Kia whakatōmuri te haere whakamua – A Māori framework for coastal climate change adaptation

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Dedication

I dedicate this thesis to my Koro, my second dad and one of my biggest cheerleaders in life, Pat Bailey. Shortly after submitting my thesis for examination, Koro's short battle with cancer came to an end and he was reunited with our late Nanny Anzio. This PhD has been one of the biggest achievements of my life and not having you here Koro with me to celebrate has been so painful. In those times of sadness, I think of the good times, the laughs, the trips, the banter and the sunny days in the garden, and I know you are there with me. Until we meet again…

Pat Bailey

5th May 1951 – 15th January 2025

"Always blooming in our hearts, his legacy of love and care will never depart"

Abstract

Current climate change adaptation frameworks do not sufficiently represent or acknowledge the intricacies and complex nature of climate adaptation for all communities. This thesis contributes a Māori (Indigenous peoples of Aotearoa New Zealand (A-NZ)) climate adaptation framework that is informed by Te Ao Māori world views, mātauranga Māori (Māori knowledge), Te Tiriti o Waitangi (Treaty of Waitangi) and research at the interface of Western knowledge and mātauranga Māori. This is needed to promote a more equitable and culturally sensitive approach to the current climate change adaptation process for hapū (sub-tribes) and iwi (tribes). To achieve this, this thesis is rooted in the whakataukī (proverb) “Kia whakatōmuri te haere whakamua – I walk backwards into the future with my eyes fixed on my past”, which exemplifies the power of acknowledging Māori history and intergenerational knowledge, while moving forward to a prosperous future. This thesis had four key aims. First, I looked to the past to understand ways Māori ancestors adapted and relocated in response to natural hazards to inform a future climate adaptation or relocation process. Second, I took stock of the contemporary risk to coastal marae (Māori meeting grounds) from sea level rise. Third, I looked internationally at other Indigenous communities' adaptation challenges and how they have overcome them as a mutual learning opportunity. And finally, I developed a conceptual Māori climate adaptation framework based on existing models and informed by a wānanga (workshop) with over 100 Māori participants. This two-part framework emphasises the importance of fostering Te Tiriti-centric relationships and partnerships that are essential for climate adaptation with hapū and iwi. In addition, it serves as a guide to support adaptation decision-making for hapū and iwi Māori. This thesis took a multidisciplinary approach to achieve these aims, incorporating historical and archival analyses, semi-structured interviews, a systematic review, coastal flooding and exposure analyses using spatial information, and wānanga. The findings highlighted that relocation due to natural hazards is not uncommon for Māori, as this thesis identified 51 examples of where relocation was completed or discussed in response to natural hazards. Furthermore, in a case study with Tūhourangi and Ngāti Rangitihi, this thesis identified vital aspects that enabled their relocation following the 1886 Tarawera eruption, the most influential being tuku whenua – the gifting of land to relocate to. This thesis also identified that by 2150, under shared socio-economic pathway (SSP) 5-8.5, 27% and 28% of coastal marae (total of 186 nationally) are exposed to a 100–year and 1000–year annual recurrence interval (ARI) extreme sea level events, respectively. Overall, this thesis contributes to our understanding of the requirements to support hapū and iwi Māori in climate adaptation, with parallels to other Indigenous communities. Requirements include resourcing, partnerships, autonomy, intergenerational planning, recognition, respect and

redress. In Chapter 8 – the discussion of this thesis, we focus on four overall contributions this thesis has made, which are: 1) Hapū and iwi Māori are at risk of climate change, 2) We've done it before we can do it again, 3) Adaptation approach cannot be one-size-fits-all, and 4) Adaptation in Aotearoa needs a Te Tiriti-centric approach. Ultimately, this thesis underscores the urgent need for inclusive climate adaptation strategies that honour Indigenous knowledge systems, ensuring that hapū and iwi Māori are not only heard but are actively supported in navigating the impacts of climate change

Preface

This PhD thesis comprises five main body chapters, each of which has been published in academic journals or is intended to be published. The following chapters were written by multiple authors, including supervisory panel members and collaborators. Co-author declaration forms are included in Appendices 3-7. There is some repetition between chapters given they are/intended to be stand-alone published papers. See pages 115–116 for Māori glossary.

Chapter 3, entitled "The Role of Coastal Marae in Natural Hazards Response and Climate Change Adaptation", was written by Bailey-Winiata, A.P., Gallop, S.L., Hikuroa, D., and White, I. and was **published** in *The New Zealand Coastal Society 2022 Special Issue* "*Coastal Adaptation: Adapting to coastal change and hazard risk in Aotearoa New Zealand*."– https://hdl.handle.net/10289/16360, pages 41-44.

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Chapter 5, entitled "Increased Exposure of Marae to Coastal Flooding with Sea Level Rise and Adaptation Learnings of Ngāi Tamawhariua and Maketū Iwi Collective", was written by Bailey-Winiata, A. P., Gallop, S. L., Wotherspoon, L., Paulik, R., Winder-Murray, H., Billing, A., Bennett, R., Conroy, E., White, I., Ellis, J & Fa'aui, T. and was **accepted** to *The New Zealand Coastal Society 2025 Special Issue "Coastal Transformation."*

Chapter 6, entitled "Climate Change Adaptation by Indigenous Peoples: Challenges and Opportunities," written by Bailey-Winiata, A.P., Gallop, S.L., & White, I. and a target journal is yet to be identified.

Chapter 7, entitled "A Māori climate adaptation framework: A waka hourua approach", was written by Bailey-Winiata, A.P., Gallop, S.L., Taylor, L., White, I., Wotherspoon, L., Ellis, J., & Fa'aui, T. and a target journal is yet to be identified.

Where possible, any citations of this work are requested to be of the published papers rather than the thesis. Chapters based on published papers are included as published with minor style changes for consistency, such as spelling conventions.

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The saying *"It takes a village to raise a child"* epitomises my PhD journey. It started as one idea with three supervisors, which quickly evolved into an inter-disciplinary and cross-institutional PhD research project supported by six supervisors, multiple collaborators/colleagues, and whānau. All orchestrated by me, a boy from "Ford block" in Rotorua. It's funny how things work out.

First, my Chief Supervisor, Shari. You have always been my biggest supporter, and over the past five and a half years, you have shown me what it takes to be a good researcher. We have grown together as strong and abled Māori researchers for our people and communities. This is not the end – only the beginning.

To my co-supervisor, Iain, your knowledge, experience, and insight have hugely influenced my thinking and helped me feel more confident as a researcher. You provided a space where I felt comfortable sharing my thoughts and ideas, ultimately making the PhD experience positive. I look forward to where our research heads in the future.

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Last, my boyfriend, best friend and partner in everything, Reynar. Thank you for everything, and I mean everything. This PhD is just as much yours as it is mine. All the moaning sessions, stressful moments, breakdowns, and successes (YES, PhDs aren't always gloomy). You are my rock. I'm glad we made the most of my flexible schedule as a PhD student to travel and see the world – something I will never regret.

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All the best…. Aku

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Chapter 1 – Introduction

1.1 General introduction

Globally, most climate change adaptation frameworks do not sufficiently represent or acknowledge the intricacies and complex nature of climate adaptation for all communities. Even so, communities are adapting to a rapidly changing environment; as extreme weather and natural hazards become more intense and frequent in some places, global ecosystems, economies, and communities are being impacted. (IPCC, 2022). Adaptation is no longer a burden that future generations will contend with, but it is an issue we must tackle in the present (Adger et al., 2009; Lawrence et al., 2024). We need clear information, data and guidance to support diverse communities to adapt effectively and avoid maladaptation (Lawrence et al., 2022), including for Indigenous communities (Schlingmann et al., 2021; Nursey-Bray et al., 2022).

Adaptation to environmental change is not unchartered territory for Indigenous communities, who have rich histories of responding to change, be it environmental, anthropogenic, or imperialistic, to survive and ensure the continuation of their culture, language, identity and peoples (Maldonado et al., 2013; Whyte et al., 2019). Adaptation histories and experiences should not be relegated to the past, as they provide critical insights and learnings that can be applied today (McAdam, 2014; Adamson et al., 2018; Pinter, 2021b). Climate change is happening now, and many Indigenous communities are already adapting, including: Indigenous Arctic communities (Ford et al., 2008; Hamilton et al., 2016; Huntington et al., 2019; Desjardins et al., 2020), Native American Tribes (Maldonado, 2014; Wildcat, 2014; Simms et al., 2021), Latin America (Felipe Pérez & Tomaselli, 2021), Pacific Islands (Farbotko & Lazrus, 2012; McNamara & Des Combes, 2015; Albert et al., 2018; Parsons & Nalau, 2019; Piggott-McKellar et al., 2019; McNamara et al., 2021), Aboriginal and Torres Strait Islanders of Australia (McNamara & Westoby, 2011; Leonard et al., 2013; Carmichael et al., 2018) and Māori, the Indigenous peoples of Aotearoa New Zealand (Bryant et al., 2017; Colliar & Blackett, 2018; Awatere et al., 2021b; Blackett et al., 2021; Smith et al., 2024).

In the context of Aotearoa New Zealand (A-NZ), in which this thesis is set, adaptation to a changing climate is complicated for all communities (McNamara et al., 2018; IPCC, 2022), let alone for Indigenous communities including Māori (King et al., 2010; King et al., 2012b; Awatere et al., 2021b; Blackett et al., 2021). Adaptation can risk perpetuating histories and contemporary experiences of colonisation by Western Imperialist countries upon Indigenous communities (Battiste, 2004; Whyte, 2016; Reibold, 2023). Colonisation was aptly described by the late Dr Moana Jackson and reiterated in Elkington et al. (2020), as the replacing of one

house with another. Houses represent societies with unique economies, politics, culture, language, and religion. In the context of A-NZ, Māori houses (and subsequently their land) were systematically and forcibly replaced by Pākehā (non-Māori) houses, with many Māori houses forced to the periphery of towns and cities on often marginal land. This brief explanation of this complex process should not distract from the gravity of such a history and its associated trauma.

The motif of replacing houses reflects the colonial and Western origins of the adaptation process (Simpson, 2020; Bronen & Cochran, 2021; Gaillard & Castree, 2021; Johnson et al., 2021) and or the intergenerational trauma and risk of colonial histories repeating in adaptation (Whyte, 2016; Marino, 2018). Researchers in the climate change adaptation discipline are calling to decolonise adaptation discourse to support Indigenous communities best to adapt by providing avenues for Indigenous self-determination, to build collective capacity and achieve community aspirations, and to build towards redress (Tuck & Yang, 2012; Cochran et al., 2013; Whyte, 2017; Bronen & Cochran, 2021; Farbotko et al., 2021; Siders & Ajibade, 2021).

Despite the growing examples of Indigenous-led climate adaptation, in A-NZ, there is a lack of clear national hapū (sub-tribe) and iwi (tribe) level guidance and process frameworks that holistically and practically address and acknowledge the complexities that exist for Māori in terms of adaptation. In A-NZ, many policymakers, community leaders and researchers are highlighting the impact climate change will have on many aspects of Te Ao Māori (Māori worldview), its communities, health, economy, and culture (Smith, 2020; Awatere et al., 2021b; Kenney et al., 2023; Reid et al., 2024; Smith et al., 2024). International and national adaptation frameworks and processes often emphasise relationships and Indigenous knowledge/values. However, in A-NZ, we lack a holistic Māori climate adaptation framework that appropriately acknowledges the historical nature of current climate change vulnerabilities of Māori communities, that outlines the importance of Te Tiriti o Waitangi – Treaty of Waitangi (founding document of A-NZ) centric partnerships between Māori and the Crown, and outlines a process that is centred in Te Ao Māori, mātauranga Māori (Māori knowledge), customs and culture to move forward.

Most existing related policies and frameworks mention the impact colonisation has and continues to have on Māori and their vulnerability to climate change impacts (Ihirangi, 2021; Ministry for the Environment, 2022b). Adaptation and relocation in response to climate change have the potential to reignite those fears and fight or flight response to ensure colonial histories are not repeated, and often relocation is discounted entirely (Whyte, 2016, 2017). However, relocation cannot be ignored in the adaptation decision-making process; it needs to be

included and given equal consideration among a suite of adaptation options (Lawrence et al., 2020; Mach & Siders, 2021). Hence, we must find ways to include relocation in adaptation discussions with Māori communities in a safe, non-threatening and non-committal way. A Māori adaptation framework is needed to flip the narrative of relocation to one of transformative opportunity rather than forced removal. The narrative of relocation for Māori needs to have foundations in Te Ao Māori and mātauranga Māori. It should aim for Indigenous empowerment and tino rangatiratanga – Māori self-determination in decision-making.

This PhD aims to develop a Māori adaptation framework that promotes a more equitable and culturally sensitive approach to the adaptation planning process. I achieve this by looking backwards to move forwards, centring the research around the whakataukī (proverb) – "Kia whakatōmuri te haere whakamua – I walk backwards into the future with my eyes fixed on my past" (Rameka, 2016), highlighting the relevance and importance of intergenerational worldviews to Māori. The chapters and objectives of this PhD follow a similar timeline from the past to the present and into the future and address the following research aims:

1. Explore and collate examples of historical relocations of pā (complexes of significant structures) in response to natural hazards.
2. Analyse the current risk of coastal pā to coastal flooding with sea level rise.
3. Understand the current challenges experienced by global Indigenous communities to adapt.
4. Develop a Māori climate adaptation framework.

1.2 Thesis outline

This thesis begins by looking to the past (Chapters 2–4), then understanding what is occurring in the present (Chapters 5–6), and finally moving forward into the future (Chapters 7–8). Every chapter contributes to answering the overall thesis aims and objectives **(Figure 1-1)**.

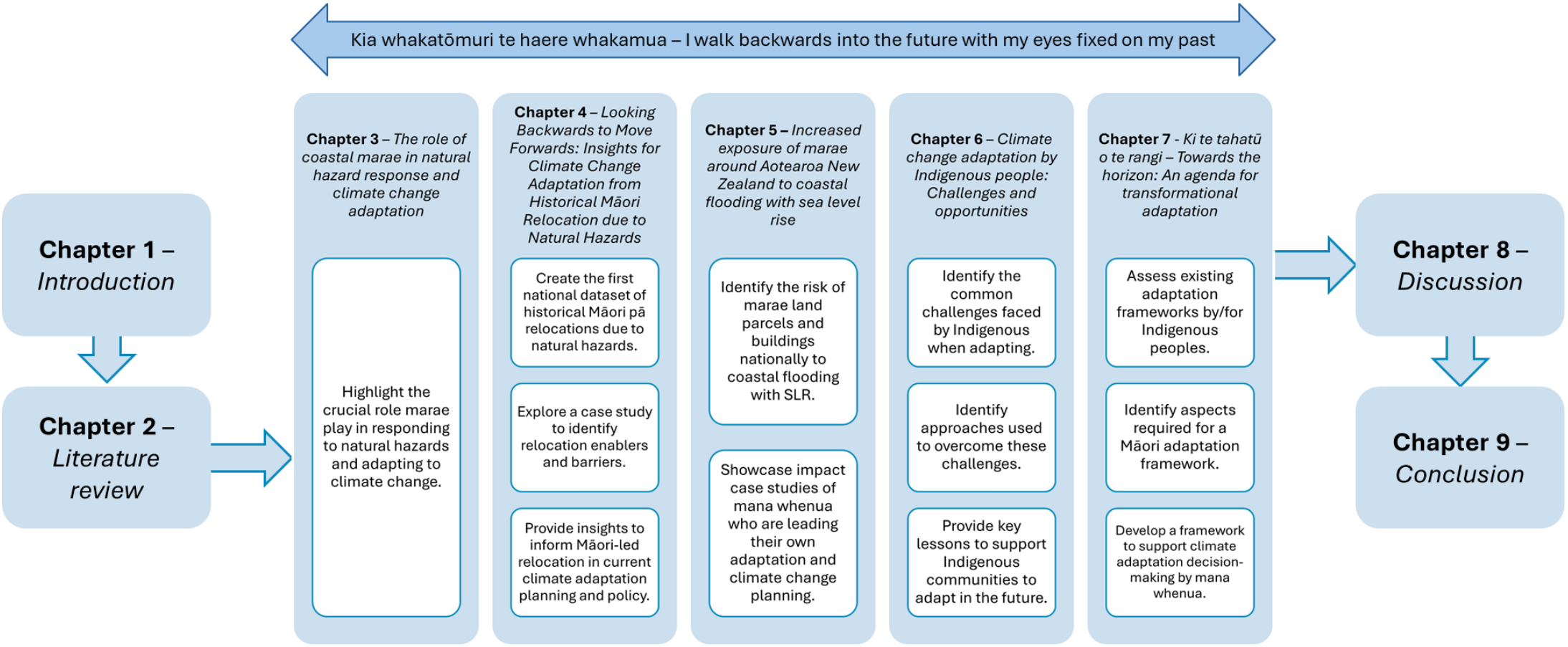

Figure 1-1: PhD thesis chapter and research objectives

1.3 Researcher positionality

Knowing about the writer behind the words is unusual in science, to the point where it is almost frowned upon. Objectivity can increase one's "academic integrity" within some circles, and the pressure to conform and remain objective is sidelining. However, when you are an Indigenous researcher, working with and for your people, utilising and learning your own people's cultural perspectives, narratives and knowledge, it is inappropriate (and impossible) to detach your true self from the research. This is what Smith (2012) describes as the "insider-outsider researcher dilemma", in that you are part of the research community and are a "researcher", but you are also one of the "researched", the community, the people, and the culture being researched. Those of us in this position understand what is at risk for our people, the challenges we face, the histories we have endured, and the intergenerational trauma we carry, both from an objective and subjective standpoint. We operate in both worlds, the Māori world and the non-Māori world, to achieve the best outcomes for our people, to make a better world for future generations, and at the same time, ensure we gain career progression and ensure our outputs and publications meet a certain level of kudos from our peers and that we have a "competitive" research profile to apply for research funding. This is the reality of many people who conduct research at the interface of science and Indigenous knowledge – how does one navigate this space? How do we find the balance? I do not think there is a straight forward answer.

Growing up as a boy from Ford Block in Rotorua, relatively disconnected from my Māori roots besides the occasional tangi (funeral) at the marae (Māori meeting grounds) or visit with my grandparents/great grandparents, my upbringing was set in the Pākehā world. I am on a journey of self-discovery that includes finding what it means to be Māori for me. University was a pivotal moment in my journey of my Māoridom. I am privileged to be exposed to many things and be given many opportunities to expand my thinking. You cannot help but notice a few things, like the impact of climate change and natural hazards on Māori communities. Marae, hapū and iwi Māori are at the coal face of climate change and when you have been given the knowledge and tools to look into the future at the impending impact many have coming, it is hard not to get emotional and depressed. I have faced this reality many times and still do, but for me, it is easier to deal with the problem by trying to find ways to change the status quo. Research and postgraduate study provided an avenue for me to try. Despite this drive to support my people and communities now and in the future with climate change and natural hazards, there is always a looming voice saying, "What makes you think you have the right to be doing this work with Māori communities", or "you are not "Māori enough" to be doing this type of research". I still feel like this sometimes, but a piece of advice I received was, "Is what I am doing/wanting to do coming from a place of aroha (love and compassion)?" If yes, then

you need to try and see if the idea floats. This is not to discount the instances of Māori being disadvantaged by those with a hidden agenda behind an empathetic outlook. However, if you want to try to make a positive difference in ways that support, enhance and give autonomy to Māori, then isn't that what we should all aspire to do? That is my outlook for my research, PhD and career.

Chapter 2 – Literature review

2.1 Introduction

The purpose of this chapter is to provide context, relevance, and an indication of the gravity of the research conducted in this thesis. Given the interdisciplinary, multiscale and multitemporal nature of climate change and adaptation, particularly concerning Māori communities, this literature review is designed to give an overview of the current state of research. These include climate change, climate change adaptation, Indigenous vulnerability to climate impacts, and lastly, setting the scene of the Aotearoa New Zealand context, where I dive into Te Ao Māori, Mātauranga Māori, Te Tiriti o Waitangi, Research at the interface and Climate change adaptation policy and guidance.

2.2 Climate change

The climate is changing, with extremes becoming more intense and frequent, fuelled by anthropogenic emissions of greenhouse gases contributing to the greenhouse effect caused by rapid global industrialisation and urbanisation (Wong et al., 2014; Eyring et al., 2021). A critical impact of rising global temperatures is the rising of global sea levels through thermal expansion of the global oceans (Gregory & Church, 2002) and the melting of glaciers and ice caps (Bindoff et al., 2007; Levy et al., 2024). On the coast, where populations are concentrated (Hallegatte et al., 2013; Neumann et al., 2015), rising sea levels have direct impacts on the frequency and intensity of coastal flooding (Jongman et al., 2012; Vousdoukas et al., 2016), coastal erosion (Leatherman et al., 2000), and on coastal groundwater levels and saline intrusion (Rotzoll & Fletcher, 2013; Bosserelle et al., 2022).

Shared Socio-economic Pathways (SSPs) are a projected set of climate pathways that envision the future based on different social, economic and environmental factors, which are then used to analyse the impacts of climate change (Riahi et al., 2017). There are five SSPs: **SSP1 – Sustainability**, which is a world that is making progress towards sustainability with low challenges to 1) mitigation, reducing the root cause of climate change (e.g., reduction of greenhouse gas emissions) (IPCC, 2013), and 2) adaptation, modify the environment and human lifestyles to withstand the changing climate (IPCC, 2022). **SSP2 – Middle of the Road**, which is a world that follows historical trends with medium challenges to mitigation and adaptation. **SSP3 – Regional Rivalry**, which is a world that is fragmented with increasing nationalism and slower economic growth with significant challenges to mitigation and adaptation. **SSP4 – Inequality**, is a world with high disparity within and between countries in terms of economies and political power, with significant challenges to adaptation but minimal

to mitigation. **SSP5 – Fossil-fuelled Development**, a world with rapid economic growth powered by intensive fossil fuels, leading to increased emissions, resulting in more significant challenges to the mitigation of greenhouse gases and fewer challenges to adaptation. Climate scientists and researchers use these different scenarios to make projections on environmental factors that will likely change with a changing climate, for instance, sea level rise predictions (Nauels et al., 2017) and drought risk (Zhou et al., 2023).

2.3 Climate change adaptation

Climate change adaptation is a rapidly evolving space in research, policy and practice that aims to reduce the risk to communities from a changing environment and climate (Sietsma et al., 2021). Adaptation approaches vary to fit local contexts, resources, and community needs (Nordgren et al., 2016; Cradock-Henry et al., 2021). Particularly at the coast, adaptation is often categorised into the PARA Framework — Protect, Accommodate, Retreat, and Avoid (Dronkers et al., 1990; Doberstein et al., 2019; Dedekorkut-Howes et al., 2020). **Protecting** involves building engineered structures or nature-based solutions to safeguard homes and infrastructure (Nicholls et al., 1995). **Accommodation** improves resilience in hazardous locations, such as by raising houses (Jamero et al., 2017). **Retreat** mitigates risk by relocating dwellings or abandoning at-risk land (Hino et al., 2017; Haasnoot et al., 2021). **Avoid** discourages further development in vulnerable areas (Doberstein et al., 2019). There are many examples of adaptation planning processes, such as Adaptation Policy Frameworks (Lim et al., 2005), Dynamic Adaptive Policy Pathways (DAPP) (Haasnoot et al., 2013) and the US Climate Resilience Toolkit (Gardiner et al., 2019), to name only a few.

Dynamic Adaptive Planning Pathways (DAPP) is an approach widely used internationally and encouraged by the A-NZ Government to local Government and communities to aid their adaptation decision-making plans (Lawrence et al., 2019; Ministry for the Environment, 2024). DAPP was developed in the Netherlands and is focused on physical drivers and impacts (Haasnoot et al., 2021). DAPP helps make adaptation decisions under deep uncertainty by creating pathways for adaptation actions that can be short and long-term under different scenarios (Haasnoot et al., 2013). Under DAPP, changes can be monitored with signals and triggers indicating the need to switch to an alternative pathway before reaching a threshold. Adaptation and various planning mechanisms struggle to consider aspects such as place attachment, economic barriers, cultural impacts, and the uncertainty of whether the adaptation will work (O'Hare et al., 2016; Hino et al., 2017; Hanna et al., 2019; Siders, 2019).

2.4 Indigenous peoples responding to the environment

Climate change compounds vulnerabilities for lower socio-economic and marginalised communities (Benevolenza & DeRigne, 2019; Ngcamu, 2023). Indigenous peoples are often at the forefront of climate change impacts (Kenney & Phibbs, 2021; Schlingmann et al., 2021), despite their generally minimal contribution to the global climate crisis (Green & Raygorodetsky, 2010). In addition, many Indigenous cultures, belief systems, economies and subsistence systems are reliant on and connected to natural ecosystems and environments (Salmón, 2000; Savo et al., 2016; Kurian et al., 2021).

Despite this contemporary vulnerability, Indigenous peoples are highly capable, and adaptation to environmental change is not unfamiliar. Many Indigenous communities have rich histories of responding to ecological, anthropogenic, and imperialistic changes to survive, thrive and continue their culture, language, identity, and peoples (Maldonado et al., 2013; Whyte et al., 2019; Phibbs & Kenney, 2022; Kitara et al., 2024). For example, Maldonado et al. (2013) discuss how Native Americans once moved from place to place depending on food and safety. This seasonal movement, known as “seasonal rounds”, has been discussed heavily in the literature (Barnett & McMichael, 2018; Kassam et al., 2021; Boas et al., 2022). However, this seasonal movement was inhibited through colonisation and restrictive boundaries (Whyte et al., 2019), such as the case of Kivalina, Alaska, which used to be a seasonal hunting ground before it became a permanent settlement. Permanent settlement in Kivalina was due to the US Bureau of Indian Affairs forcing parents to enrol their kids in school (Maldonado et al., 2013).

In a world with climate change, the previous experience and history of adaptation and relocation mentioned earlier do not play a dominant role in future climate change adaptation planning or processes. McAdam (2015) discuss historical relocation cases in the Pacific, whether for environmental or other reasons, and provide insights and analogies that may be useful for contemporary debates. McAdam (2014) investigated the relocations of two Pacific Island nations, the 1945 relocation of the Banabans from present-day Kiribati to Fiji and the 1947 relocation of Vaitupuans from Tuvalu to Fiji. The one key difference between these two examples is that the relocation of the Banabans was in response to the industrial extraction of natural phosphate minerals on their island from a British company. In contrast, the Vaitupuans relocated to lands purchased by some of the men from the Island as an insurance policy against overpopulation and land scarcity (McAdam, 2014). Both communities experience complex dual identities; some feel the identity of their homeland and their current land, while others feel connected to one and not the other. The Banabans' attitudes towards present-day Kiribati are fraught, as many Banabans feel that Kiribati wrongfully profited from the phosphate

industry, which resulted in their relocation. McAdam (2014) emphasised, following the example of the Banaban relocation, the importance of self-determination and self-governance and the right to control their narrative, which will play an essential role in future climate change relocations.

Incorporating this traditional knowledge and understanding of (im)mobilities and relocation in the context of climate change in the Pacific, Suliman et al. (2019) discuss the ancient Austronesian concept of “banua”. Banua is a complex cultural scaffold of (im)mobilities connecting people across the Pacific through their traditional voyaging ancestors who sailed double-hulled canoes following celestial and environmental indicators too far off lands. Banua has taken on many dialectical differences across Pacific Indigenous cultures; most notable and relevant is “whenua” in A-NZ, which is the Māori word that doubles in meaning for both “land” and “placenta”, connecting people to the land (Selby et al., 2010). This is reflected in the Māori tradition of burying the placenta in the whenua, creating an eternal bond between humans and the earth (Le Grice & Braun, 2016). Suliman et al. (2019) highlight the centrality of Pacific ancestors’ position in a moving cosmos, exhibiting how they never got lost during their exploration and expansion of the Pacific. Despite losing sight of the land, they were never disconnected. They posit that Banua creates an opportunity to explore the realities of climate change from a rich historical context of journeying, losing sight of land and starting over, showcasing novel and alternative ways of developing approaches to the challenges climate adaptation poses for Pacific communities. In A-NZ, while there is much to learn from stories of other Indigenous peoples for climate change adaptation, we first need to look inward to our histories, stories, values and knowledge.

Indigenous peoples around the world are adapting to climate change, including in the Arctic (Ford et al., 2008; Hamilton et al., 2016; Huntington et al., 2019; Desjardins et al., 2020), North America (Maldonado, 2014; Wildcat, 2014; Simms et al., 2021), Latin America (Felipe Pérez & Tomaselli, 2021), the Pacific Islands (Farbotko & Lazrus, 2012; McNamara & Des Combes, 2015; Albert et al., 2018; Piggott-McKellar et al., 2019; McNamara et al., 2021; Yee et al., 2024), Aboriginal and Torres Strait Islanders of Australia (McNamara & Westoby, 2011; Carmichael et al., 2018) and Aotearoa New Zealand (Bryant et al., 2017; Colliar & Blackett, 2018; Awatere et al., 2021b; Blackett et al., 2021). In these examples, similar needs are highlighted for climate change adaptation, including the need for resources (including financial and contextually specific adaptation information), meaningful engagement with Indigenous communities and the incorporation of their Indigenous knowledge into adaptation plans. While it is good to understand these challenges, it is equally important to identify the opportunities and ways to overcome them. It requires a nuanced, place-based understanding of the multifaceted reasons for these challenges.

2.4.1 Colonial roots and climate change

Climate change has deep roots in Indigenous communities, with colonisation generally seen as the root cause of historical and contemporary marginalisation and, hence, vulnerability to climate change (Whyte, 2016; Ford et al., 2020; Reibold, 2023). Historically, colonisation subjugated Indigenous people, their worldviews, knowledge and beliefs to resemble a Western worldview, part of the West's imperial expansion into resource-rich and expansive Indigenous lands (Smith, 2012; Cain & Hopkins, 2016). Industrialisation and extractive economies are linked with colonisation and expansion into Indigenous lands for resources, lands and spreading civilisation (Maldonado et al., 2013; Whyte, 2017). This results in what Whyte (2016) posits as the 'colonial déjàvu', the continued injustice to Indigenous peoples by climate change. One example is the Indian Removal Act of 1830, which resulted in the Trail of Tears, the forced relocation of tens of thousands of Native Americans off their ancestral lands in the Southeastern USA to new designated reservations West of the Mississippi River (Cave, 2003). Another poignant example is, the relocation of the people of Bikini Atoll, Marshall Islands, in 1946, initiated by the USA as Bikini Atoll was selected for nuclear weapons testing in the Pacific. The US Government relocated people from Bikini Atoll and neighbouring islands to other Pacific Islands, in addition to creating pathways for emigration to the USA (Fraser, 2024). Furthermore, in A-NZ, examples include, the Public Works Act 1864 and the Native Lands Act 1865, which enabled the British Crown to take land from Māori without compensation for public works (Bourassa & Strong, 2002).

These examples of colonially induced relocation and land confiscation imposed upon Indigenous peoples highlight some of the trauma climate adaptation could exacerbate, particularly when considering relocation in response to a colonially induced problem. Any Governmental approach to adaptation needs to acknowledge, recognise and seek to address the intergenerational trauma caused by colonisation (Veland et al., 2013; Hill et al., 2020). For example, Nursey-Bray and Palmer (2018) discuss the role of colonisation in creating climate vulnerabilities for the Arabana people of central Australia. They shared how colonisation has enhanced the resilience of the Arabana people to be able to withstand change and negative impacts. However, not to discount the trauma colonisation caused, which was reiterated in the context of a need for redress of those historical wrongs, from an economic, social loss, cultural and values perspective. Nursey-Bray and Palmer (2018) posit that first acknowledging colonisation and the impact it unleashed on Indigenous people will support innovative new ways of moving forward that achieve adaptation and redress. These could include collaborative governance and/or enhancing sustainable and economic livelihoods embedded

in adaptation. There is a need to develop more context-specific and multiscale guidance and frameworks that can navigate and address this complexity.

2.4.2 Indigenous adaptation to climate change

Adaptation is complicated for all communities, particularly when considering relocation (Agyeman et al., 2009; Felipe Pérez & Tomaselli, 2021). Two key barriers to relocation are place attachment (emotional and functional bonds between people and a place (Burley et al., 2007; Hashemnezhad et al., 2013; Dandy et al., 2019) and costs (Narain et al., 2011; Hanna, 2019). Indigenous peoples' emotional and functional bonds with their environments have existed for generations and are intertwined with Indigenous knowledge, identity and culture (Salmón, 2000). There is the potential that adaptation could jeopardise these bonds, for instance, coastal engineering (e.g., seawalls) or relocation, which reduces the risk of coastal flooding and erosion but inhibits access and connection to waterways (Gauer et al., 2021). This could have detrimental effects on the mental health and well-being of individuals and impact the intergenerational transfer of environmental knowledge and practices (Jones et al., 2014).

Adaptation, and particularly planned relocation, can have substantive associated capital costs, often addressed through Government subsidies, buyouts or insurance payouts, which makes adaptation and relocation an expensive endeavour (O'Hare et al., 2016; Hino et al., 2017; Hanna et al., 2019; Siders, 2019). The strength of place attachment and the burgeoning financial cost can inhibit decision-making. Without appropriate understanding, resourcing and supporting Indigenous communities to lead and/or be involved in adaptation, there is a substantial risk of maladaptation (an adaptation action that results in an undesirable or unintended outcome), which could exacerbate the oppression of marginalised communities (Magnan et al., 2016; Lawrence & Saunders, 2017).

Finding examples of how to reduce the impact that relocation has on place attachment is difficult. One example is "generational retreat" discussed in Piggott-McKellar et al. (2021), where a form of climate relocation is highlighted in the context of two Fijian villages, Vidawa and Karoko. This example highlighted the variation in generational attitudes towards relocation, with the older generation feeling more connected to their original areas than younger, more mobile generations who have not yet established their households and want to live away from the threat of hazards. The community of Karoko decided to build new homes on higher ground, whereas Vidawa has progressed with a village-wide directive with new houses established on a new site on higher ground. Generational retreat occurred with the younger generations leaving their parental homes and moving into the newer homes on higher lands and the older generation remaining (albeit elders were also allowed to relocate). The

new sites are 10–15 minutes away from the old site, so connection and access can be maintained. However, this does not entirely solve the issue of place attachment following relocation, given that the community fears that the separation of young and old will create a more profound disconnection. This example demonstrates that process innovation in adaptation can occur at the community level. In this case, to reduce impacts and ensure place attachment while supporting two very diverse aspirations (to stay and to go), will need a total financial commitment to support that innovation with guidance from local and central Government.

2.5 Aotearoa New Zealand (A-NZ) context

The below sections of this literature review highlight some fundamental aspects relevant to understanding climate change adaptation of Māori in A-NZ. These include Te Ao Māori – A Māori worldview, Mātauranga Māori – Māori knowledge, Te Tiriti o Waitangi – The Treaty of Waitangi, Research at the interface, and Climate change adaptation policy and guidance: A-NZ context.

2.5.1 Te Ao Māori – A Māori worldview

A Te Ao Māori worldview is similar to many other Indigenous views in that humans are part of the environment rather than being separate, and people must protect and enhance the environment for future generations, termed kaitiakitanga in A-NZ (Marsden, 1992; Kawharu, 2000). Te Ao Māori sees the environment as kin, wherein the creation story, tangata whenua (people of the land) and the world as we know it descends from Papatūānuku (Earth Mother) and Ranginui (Sky Father) (Wilkinson et al., 2020). We are children of the Earth, and as we have inherent responsibilities to care for our elders and parents, we are stewards tasked to maintain and protect the environment for future generations (Roberts et al., 1995).

This inherent responsibility and spiritual connection to the land is one of the many reasons why climate relocation is difficult for Māori, as being separated from your land, the land you connect your identity and culture to, relocation is unfathomable (Awatere et al., 2021b). This holistic and interconnected view is antithetical to some Western worldviews of the environment, which is seen as a resource to be extracted (Luetz, 2024). Crucial to Te Ao Māori is the Māori kinship hierarchy stemming from whānau (family), hapū, and iwi (Winiata, 1956; Reilly, 2004). Hapū often affiliate with marae. At the centre of the marae is typically the wharenui or whare tīpuna (meeting house), where this structure physically and symbolically is an ancestor of the hapū (Skinner, 2016). Marae are interconnected across time and grounded in whakapapa (genealogical connection), which links people to each other (past, present, and future) and the environment (Forster, 2019). Marae are often located near waterbodies and

on low-lying land, given the historical, spiritual and practical purpose of water in Māori culture and identity (Ruru, 2011), and sometimes due to colonial displacement to marginal lands (Hardy et al., 2019).

Marae are a crucial topic in current climate change and natural hazards planning (Phibbs & Kenney, 2022; Kenney et al., 2023). Bailey-Winiata (2021) highlighted that 191 marae are within 1 km of the coastline, with 71% (136) coastal marae at elevations less than 20 m above mean sea level, and a further 39% (74) coastal marae are less than 150 m from the coastline (Bailey-Winiata, 2021). This research also found that 41 coastal marae are potentially at risk of a 100–year extreme sea level event with 3 m SLR. This work identified the need for deeper analysis across varying scales and time, but also to look at the "assets" at risk through a more holistic lens that incorporates other cultural infrastructure, such as urupā (cemeteries) and wāhi tapu (sacred sites) and opportunities for adaptation and relocation. In addition, there is a growing body of literature that looks at the impact on other aspects of Māori, including archaeological sites (Bickler et al., 2013; Jones et al., 2023), and Māori primary industries (Awatere et al., 2021b). The overall risk of coastal flooding to marae, including its impact on marae buildings, land, cultural infrastructure, and community well-being, is still not fully understood.

2.5.2 Mātauranga Māori – Māori knowledge

Indigenous knowledge is accumulated through centuries of living and being of Indigenous peoples within their environments (Kelman et al., 2012; Maldonado et al., 2016), and forms the basis of many approaches to adaptation (Makondo & Thomas, 2018), conservation (Ens et al., 2021), natural resource management (Ulluwishewa et al., 2008), hazard mitigation practices (Hiwasaki et al., 2014; McKemey et al., 2020) and natural hazards (King et al., 2007), to name a few. In A-NZ, Te Ao Māori is a holistic worldview that is grounded in tikanga (Māori customs and practices) and mātauranga Māori. Mātauranga Māori is knowledge utilised by Māori to make sense of their environment over millennia through direct observation of environmental changes through often oral intergenerational transmission (Durie, 2004; Hikuroa, 2017). Mātauranga Māori is knowledge originating from Māori ancestors cemented in a Māori world view, comprising its generation and ways of knowing, and values which are central to Māori culture and identity (Hudson et al., 2016b; Hikuroa, 2017; Mercier, 2018).

There are various types of mātauranga Māori including mātauranga-taiao (knowledge of the environment), reflecting the totality of Māori occupation within the environment of A-NZ (King et al., 2007). Mātauranga can also be referred to as local place-based knowledge specific to an iwi tribal area (mātauranga-a-iwi), a hapū sub-tribal area (mātauranga-a-hapū), and a

whānau family grouping (mātauranga-a-whānau). This is informed by whakapapa to the surrounding environment, where its landmarks and resources are regarded as elders to be sustained and looked after (Ruru, 2018; Wilkinson et al., 2020). Importantly, each whānau, hapū and iwi has their own mātauranga that incorporates collective experience and the visible and invisible, past, present and future (Broughton & McBreen, 2015; Hikuroa, 2017). In many areas, particularly the natural hazard space, there is extensive mātauranga around the respect required with regards to the dangers and care that must be taken, such as around waterbodies, codified in pūrākau (ancestral stories) (e.g., Hikuroa (2017) detailed further in Chapter 3). McFadgen (2013) and King et al. (2007) identified the existence of knowledge and experience of ancestral Māori communities and natural hazard impacts. For example, King et al. (2007) identified encoded natural hazards phenomena in oral recordings such as mōteatea (laments), whakataukī and waiata (song), place names and tohu taiao (environmental indicators). These works began the conversation around adaptation and natural hazards, which can inform future climate change adaptations and relocations by Māori.

Te Ao Māori and mātauranga can support climate change adaptation in many ways, from building relationships to developing processes, incorporating values, and place-based knowledge that can inform risk assessments and adaptation plans. For example, Stephenson et al. (2024) highlighted four mana whenua (people with authority over the land) organisations leading their climate change adaptation plans and initiatives across the country. Five key themes were discussed: **Rangatiratanga**, leading climate change adaptation at different community scales (marae, hapū or iwi). **Mātauranga**, learning and drawing from all knowledge to support adaptation. **Kaitiakitanga**, a holistic approach to climate adaptation that incorporates and values people and the environment. **Manaakitanga** (kindness or generosity) which ensures disaster preparedness and initiatives to look after the whānau and the wider community. **Kotahitanga** (unity), uniting all people on shared climate adaptation kaupapa (agenda). Identifying and exploring an adaptation or relocation example at the whānau, hapū and iwi scale, informed by their mātauranga and experience, will continue to unlock and identify an example adaptation process, its nuances, enablers and barriers. This could be translated to see what aspects would be transferable for other hapū, iwi and community groups to learn and adapt from. However, adaptation in modern times is complicated, with land availability, Governance issues, resourcing, and legislation barriers. For A-NZ, there is a need to explore the opportunities in Governance and policy to achieve adaptation for hapū and iwi Māori.

2.5.3 Te Tiriti o Waitangi – The Treaty of Waitangi

Māori are navigating what climate change and adaptation look like for their people, culture, and identity (King et al., 2010; Awatere et al., 2021b). In A-NZ, the Treaty of Waitangi/ Te Tiriti o Waitangi (hereafter Te Tiriti) is an important founding constitutional document and bastion for hapū and iwi Māori with the British Crown. Te Tiriti is an addendum to He Whakaputanga o te Rangatiratanga o Nu Tireni – A Declaration of the Sovereignty of New Zealand signed in 1835 by rangatira (Māori leaders) throughout the North, Waikato and Ngāti Kahungunu areas (Waitangi Tribunal, 2014; Mutu, 2019b). On 6 February 1840, some Māori leaders signed the Māori language version of Te Tiriti, which confirmed He Whakaputanga, preserving the tino rangatiratanga of the rangatira and hapū (Mutu, 2019a). Te Tiriti gave kāwanatanga (governance) over unruly incoming British settlers to the Queen of England and outlined a partnership between those Māori leaders who signed and the British Crown (Hayward, 2004; Mutu, 2011). Te Tiriti exists in two versions, in English and a Te Reo Māori (Māori language) translated copy. A significant discrepancy between these documents is the use of kāwanatanga, which translates to governorship over land and people (Mutu, 2018). Kāwanatanga was used to translate sovereignty, authority over land and people, into te reo Māori, fuelling the debate over the legitimacy of the translation, as the English version of Te Tiriti explicitly withdraws Māori sovereignty over their lands to the British Crown (Mutu, 2019b; Burns et al., 2024). Following the signing of Te Tiriti, there has been a litany of failures to honour it, such as the failure of the British Crown to actively protect Māori lands, forests, fisheries and taonga (tangible and intangible things of significance) and numerous failures to uphold the principle tenets of Te Tiriti of partnership, active protection and consultation (Jones, 2016; Mutu, 2019a). In 1975, the Treaty of Waitangi Act was enacted, establishing the Waitangi Tribunal. This tribunal was created to provide a mechanism for Māori hapū and iwi, who have been disadvantaged by legislation or policies imposed by the Crown, to seek redress through a settlement (Ministry of Justice, 2021).

Te Tiriti principles of partnership, governance, active protection, and consultation between Māori and the Crown are critical to climate adaptation decision-making, especially given that local Governments often implement adaptation plans and process (Iorns, 2019). Te Tiriti can provide foundations to a partnership approach for community adaptation in contrast to the current adaptation process, which is often top-down, one-size-fits all, and which struggles to recognise and enable Māori (and Indigenous) voices and culture (Clar & Steurer, 2019; Conway et al., 2019). An example of a Te Tiriti-centric approach in A-NZ is the Rauora framework developed by Ihirangi, a group of Māori climate and environmental experts supported by the National Iwi Chairs Forum, an entity made up of chairpersons from 71 iwi groups in A-NZ (Ihirangi, 2021). Ihirangi was tasked with creating a national climate response

framework based on an Indigenous worldview. The Rauora framework has several key recommendations: 1) Interconnectedness. 2) Inalienable relationship of hapū and iwi Māori to their land and environment. 3) Recognition of the authority of the environment. 4) Respect for the mana of hapū and iwi Māori. 5) Uphold Te Tiriti. 6) Collective action for climate challenges. 7) Intergenerational equity, and 8) Empowering communities for climate planning. Ihirangi (2021) further recommends exploring ecological restoration, respecting mātauranga Māori, redressing historical wrongs, ensuring water security, and shifting to sustainable economies.

2.5.1 Research at the interface

This thesis is based on research at the interface of two knowledge systems, mātauranga Māori and Western science. While research at this interface is a privilege, it can be complex (Durie, 2004). Broughton and McBreen (2015) define Western science as knowledge formed from Western epistemologies into disciplines and hierarchies of knowledge (Broughton & McBreen, 2015). Western science provided a new way to make sense of the world, mainly introducing the scientific method developed in Europe, centring on observation, rationality, and objectivity (Reiss & Sprenger, 2014; Morgan & Manuel, 2020). Western science is a mainstream foundation for climate adaptation and scientific risk assessments. There has been progress in focusing on Indigenous voices, perspectives, and knowledge, with a plethora of research being conducted globally (Agrawal, 1995; Makondo & Thomas, 2018; Sloane et al., 2021).

Many exemplary frameworks provide guidance and examples of research at the interface of mātauranga Māori and Western science. Below, we discuss the Mauri Model, He Poutama Whakamana, and Braided Rivers Approach, three of the most well-known models in A-NZ. The **Mauri Model** was created by Morgan (2006) as an environmental monitoring framework that incorporates Māori values and Western science to assess the state of the environment, such as following the devastating environmental disaster of the MV Rena oil tanker running aground off the coast of Tauranga, A-NZ, resulting in the devastating oil spill in 2011 (Fa'aui & Morgan, 2014). This framework aimed to improve the water management process, including information from both knowledge systems (Morgan, 2006). Central to this framework is the concept of mauri (life force), which is a tohu (indicator) of the health and well-being of the community, people, and environment **(Figure 2-1)**. In this framework, Mauri can either be enhanced, maintained, neutral, diminished or destroyed. The ways that mauri can diminish are through pollution, over-harvesting, or environmental degradation. At the same time, mauri can be enhanced through acts of restoration, e.g., riparian planting, reduced emissions, recycling, and sustainability.

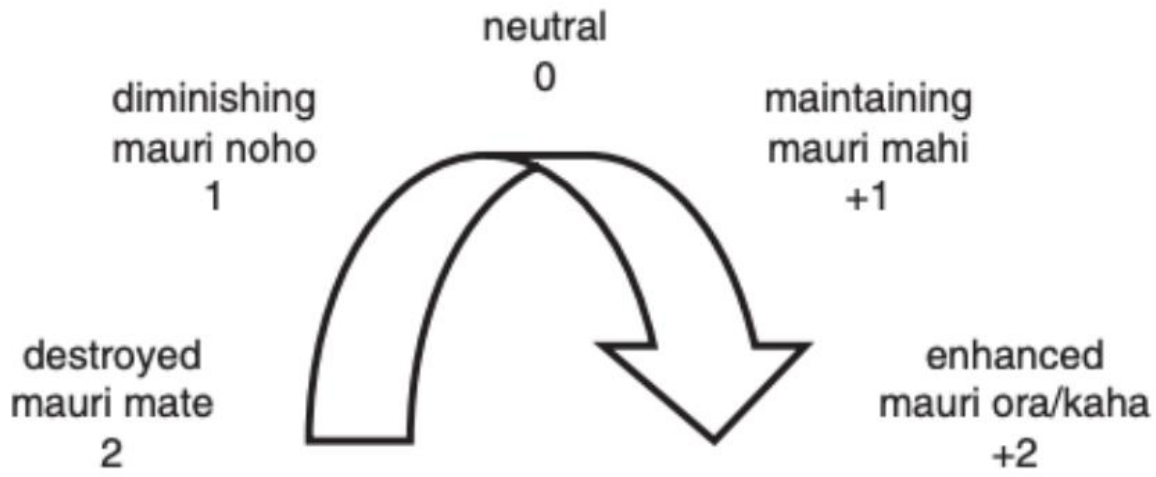

Figure 2-1: Mauri model rating (Morgan, 2006)

The **He Poutama Whakamana** framework is centred on the mirror-imaged tukutuku panels, often found within marae, which represent the ascension to higher levels of knowledge and understanding (Macfarlane & Macfarlane, 2018). He Poutama Whakamana is founded in kaupapa Māori approaches, which are research methodologies that are 'culturally safe' and can balance the nuances of social, political, and cultural aspects important to Māori whilst at the same time able to balance the contributions of non-Indigenous researchers and their research (Macfarlane & Macfarlane, 2018). This framework focuses on three main aspects/steps of the research enquiry, including Mōhiotanga (Acknowledge and respect), Mātauranga (Knowledge systems and understanding) and Māramatanga (Integration and apply) (Wilkinson et al., 2020). These three aspects occur as a mirror-image of the Western scientific method of Identifying the research question, Developing the technique to answer the research question, and producing and disseminating results. Importantly, as seen in **Figure 2-2**, the tukutuku panels move upwards together simultaneously, eventually reaching the same objective.

Figure 2-2: He Poutama Whakamana Framework (Macfarlane & Macfarlane, 2018)

A further example is the **Braided Rivers Approach** developed by Macfarlane et al. (2015). It uses the braided rivers of Te Waipounamu/ South Island of A-NZ as a metaphor and symbol for collaborative research at the interface **Figure 2-3**. Mātauranga Māori and Western science form two separate river streams flowing in the same direction. Like a braided river, the two streams cross and separate but are headed to the same destination (Macfarlane et al., 2015; Wilkinson et al., 2020). In a metaphorical sense, these two streams resemble two baskets of knowledge, giving rise to the whakataukī "Nā to rourou, nā taku rourou, ka ora ai te iwi", which means with your food basket, and my food basket, the people will thrive, highlighting the power of collective knowledge sharing (Wilkinson et al., 2020). This framework highlights the importance of collectivising knowledge systems, where appropriate, but equally important is utilising knowledge systems on their own but ensuring the same common destination. The braided rivers framework provides a foundation for climate adaptation frameworks in a way that respects all knowledge, experience, and expertise that people and communities offer in ways that build resilience and foster growth and development.

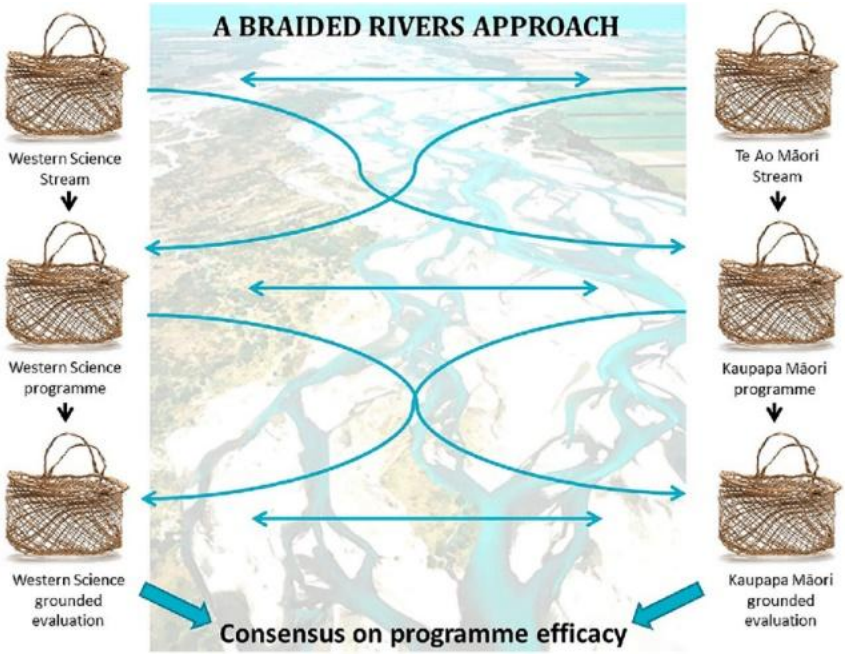

Figure 2-3: Braided rivers approach to research at the interface of Western science and mātauranga Māori (Macfarlane et al., 2015)

2.5.2 Climate change adaptation policy and guidance: A-NZ context

For some, climate change is an abstract reality for future generations. However, the impacts of climate change in A-NZ were brought to light in February of 2023 with the devastating Ex-Tropical Cyclone Gabrielle event that resulted in a National State of Emergency (Civil Defence, 2024). Gabrielle caused severe flooding across A-NZ and inflicted damage to many communities and marae, resulting in many hapū and iwi Māori discussing adaptation options and particularly relocation (NZME, 2023; Stewart, 2023). Gabrielle catalysed a resurgence of interest and demand for national and community-level adaptation planning, contributing to the rapidly developing national policy, risk assessments and funding arrangements for damaged communities and those at future risk (Department of the Prime Minister and Cabinet, 2023).

Simultaneously, this rapid policy development that occurred after Gabrielle includes changing adaptation legislation, Government inquiries, public submissions, and continual research and practice. However, there remains a lack of guidance, which results in many experiments of communities, including hapū and iwi Māori, conducting their adaptation plans without a blueprint of a potential appropriate process (White & Lawrence, 2020). In 2023–24, the Ministry for the Environment invited public submissions to their “Community-led retreat and adaptation funding” and “Climate change adaptation framework” parliamentary inquiries. The latter identified the need for national guidance as a framework to support communities and local Government in conducting adaptation, particularly regarding adaptation funding mechanisms (Finance and Expenditure Committee, 2024). It is still unknown how this

framework will deal with the multiscale, multitemporal and multistakeholder nature that adaptation requires, particularly for hapū and iwi Māori. In light of this, an analysis was conducted by Cretney et al. (2024), who reviewed 294 submissions to a previous public submission process to the draft National Adaptation Plan in April 2022, which highlighted similar calls and questions as to how national adaptation guidance will balance the multiplicities of scale, time and people. In the context of submissions made by Māori people, groups or organisations, particular attention was given to the need for local and granular approaches, the provision of data tailored to a Māori context, adaptation to be led by Māori, the prioritisation of Te Tiriti o Waitangi, that mātauranga Māori is valued in adaptation plans and process, and that the diversity in and between Māori communities is acknowledged (Cretney et al., 2024).

The intended national climate adaptation framework posited by the Ministry for the Environment must have Māori voices heard in establishing such an adaptation framework. A parallel framework for Māori is needed to incorporate cultural knowledge and address intergenerational trauma related to climate change adaptation, while also honouring Te Tiriti as a guide for partnership (Hanna et al., 2022). Currently, Te Tiriti is under the spotlight with the current Treaty of Waitangi principles bill, which the current Government has initiated to redefine the principles of Te Tiriti (Ministry of Justice, 2024). This bill has been a divisive mechanism for dismantling the rights of Indigenous Māori of A-NZ and placing their autonomy and sovereignty under question. The bill's outcome is undetermined at the stage of writing this Doctoral thesis, but there has been a collective response of Māori and Tangata Tiriti against it. This thesis will contribute to the national discussion on the relevance and importance of Te Tiriti for the safe and effective adaptation of all people of A-NZ to climate change.

Chapter 3 – The role of coastal marae in natural hazard response and climate change adaptation

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3.1 Introduction

While not included in the original paper below, here we provide a brief introduction of this paper in the context of the overall thesis. This paper highlights, at a high level, how important marae are to Māori identity and culture and the significant role they play in natural hazard response and climate change adaptation. This role was brought to the forefront in recent years following this publication, as in early 2023 with Ex-Tropical Cyclone Gabrielle, which devastated many communities of Aotearoa New Zealand (A-NZ), including many hapū (sub-tribe) and iwi (tribe) Māori. At the forefront of the response during and following Gabrielle was the collective rallying of marae (Māori meeting grounds), hapū and iwi Māori to provide shelter, food, and support to affected communities, simultaneously as many of their whānau (family) and marae were devastated by the event. Several marae and their wider communities were isolated, as roads and transport lines were cut off from floodwaters and damaged bridges, some instances lasting for weeks. Climate change exacerbates exposure and isolation to flooding of marae and their communities, making the role marae play in disaster response all the more important. In addition, marae have been and will continue to be the focus of adaptation discussion and decision-making processes, such as recent strategies like the Maketū Climate Change Adaptation Plan, which had marae as a key focus area. Hence, this paper aims to highlight the significance of, and the integral role marae have and continue to play in natural hazard response and climate change adaptation.

3.2 Significance of marae

Marae are the ancestral meeting grounds of Māori, the Indigenous peoples of A-NZ. Marae today generally consist of an ātea (courtyard) and a complex of buildings, including the wharenui (meeting house), wharekai (kitchen/dining quarters), wharepaku (bathrooms), and often also kōhanga reo (Māori preschool), wharekarakia (place of prayer) and other facilities such as housing for kaumātua (elders) **(Figure 3-1)**.

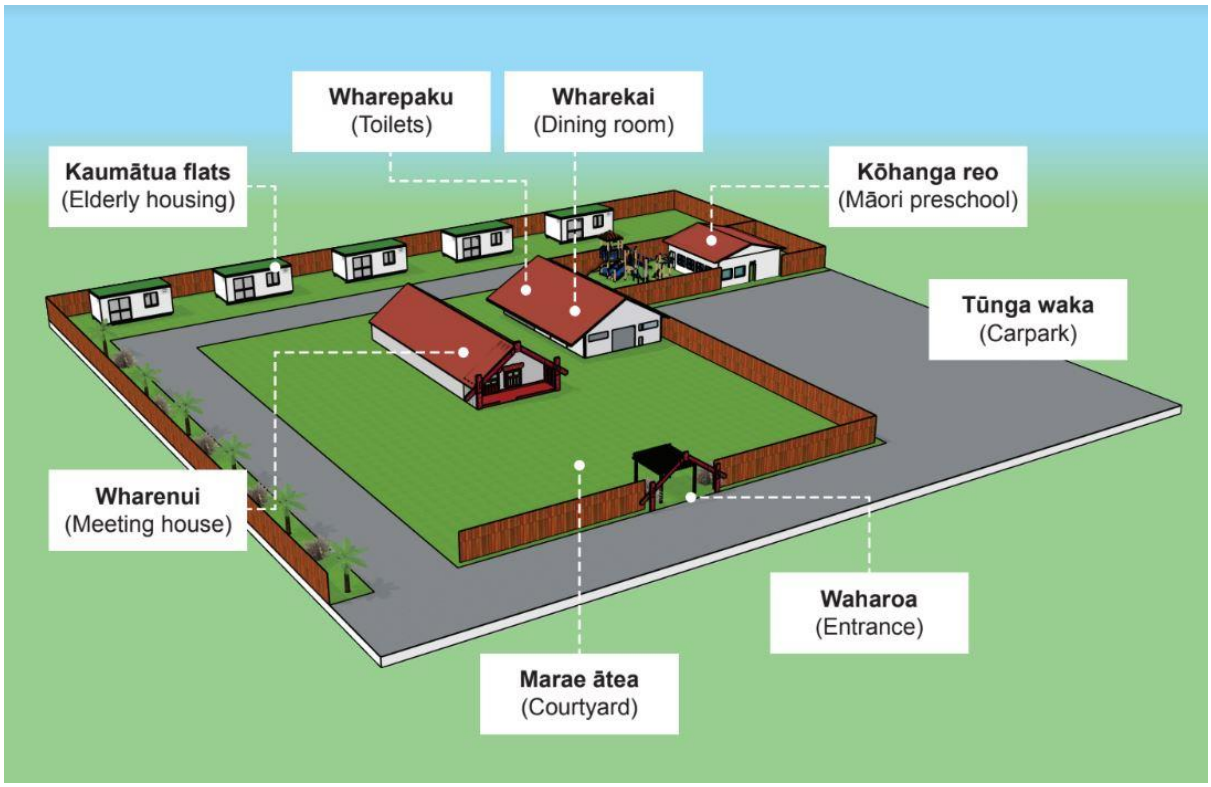

Figure 3-1: Generalised marae complex (graphic compiled by Gemma Conn)

But marae are much more than infrastructure, they are at the centre of Māori culture, identity, and spirituality (Tapsell, 2002). Marae connect Māori to our tīpuna (ancestors), and to future generations. Marae are spiritual buildings and places, symbolising the connection between the primordial parents Papatūānuku (Earth Mother) and Ranginui (Sky Father). The foundations of wharenui are secured in Papatūānuku, and the roof ascends to Ranginui, providing a space in between where Māori can connect to our primordial parents and ancestors who now reside with the atua **(Figure 3-2)** (Kawharu, 2010).

Marae have whakapapa (genealogy) to the environment, which includes tangata whenua (people of the land). Marae are tūrangawaewae (a place to stand), providing a sense of belonging through whakapapa, which is an integral concept to Māori identity. Marae are often adorned with carvings and other depictions or representations of significant ancestors to the associated hapū or iwi. These artworks often illustrate pūrākau (ancestral stories) which encode the history and philosophy of the people in traditional narratives (Hikuroa et al., 2018).

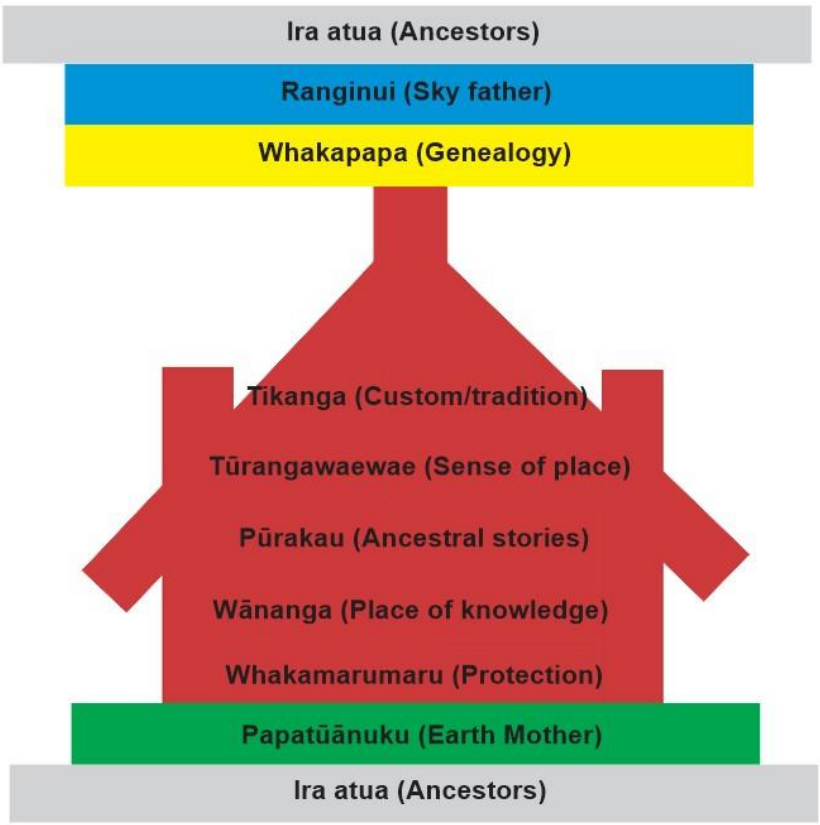

Figure 3-2: Schematic of marae showcasing key values contributing to their significance (adapted from Kawharu, 2000)

Marae are also community hubs, including as a place for celebrations such as birthdays and weddings, as well as mourning life during tangi (funeral), through to hui (meetings) and wānanga (places of learning). Marae provide shelter, food, and recently host highly effective COVID-19 community vaccination initiatives (Penetito et al., 2021; Hossain et al., 2022). Beyond COVID-19, marae are critical emergency response infrastructure for natural hazard responses, e.g., as Civil Defence sites for people to evacuate to during natural disasters (Hudson & Hughes, 2007). Central to this, is that many marae have the capability to accommodate large numbers of people with facilities such as large-scale kitchens, dining rooms and sleeping areas. At marae manaakitanga (generosity/kindness) is shown to all guests, which is common such as during hui, wānanga, tangi and celebrations. The haukāinga (home people) rally together to support the kaupapa (agenda) to manaaki (support) people seeking refuge, providing accommodation, food, medical support, and post-disaster support such as counselling (Kenney & Phibbs, 2015).

3.3 Marae at the water's edge

Marae are often located near waterbodies including rivers/streams, estuaries, and the ocean. In Te Ao Māori (Māori worldview), water has mauri (life force) and is the originator of all things,

and that it is akin to humans, giving rise to a well-known whakataukī (proverb), “Ko wai ko au, ko au ko wai” – “I am the water, and the water is me” (Stewart-Harawira, 2020). As a resource, water sustains the most basic of human needs and is used by Māori to irrigate māra (gardens), a source of kai awa (freshwater food) and kai moana (seafood). Water is also highly spiritual for Māori and is used in rituals and purification processes. Waterbodies were also a dominant transport route of Māori, connecting whānau, hapū and iwi for trade and resolution of conflicts.

Marae are often positioned in places that are known to be safe based on mātauranga a whānau/ hapū/ iwi (often more generally referred to as mātauranga Māori — Māori knowledge specific to whānau, hapū and iwi groups). Marae were often positioned in locations that were safe from attack, such as on headlands, or close to resources, such as within estuaries. Positioning of some marae is reflected in pūrākau which speak of caution. For example, in Matatā there is a taniwha in the form of a lizard where the flicking tail reflects the changing course of Waitepuru stream. The four marae are positioned well clear of the flicking tail and avoided devasting debris flows of 2005 (Hikuroa, 2017). Although there are many advantages to living nearby waterbodies, such features are prone to natural hazards such as flooding and erosion, meaning hapū and iwi Māori have had to be adaptable and resilient in response to natural hazards (King et al., 2007). Hapū and iwi have in the past and continue to adapt to the impact of natural hazards and now climate change, through a carefully considered process, informed by mātauranga Māori developed through generations of observations.

The impact of many natural hazards is being exacerbated by climate change, particularly at our coasts including via coastal flooding and erosion due to increased storm frequency and magnitude in some places, intensified by sea level rise. Focusing on coastal marae and climate change, King et al. (2012b) and King et al. (2013) found that the coastal Māori communities of Manaia, Waikato–Hauraki, and Mitimiti, Hokianga, Northland were particularly at risk of the impacts of climate change, ranging from Māori business and health to the physical impacts of damage to infrastructure and accessibility. Bailey-Winiata (2021) undertook a broad-scale national approach to understand marae exposure to SLR and found that 191 marae are within 1 km of the coastline, proximally adjacent to highly diverse coastal geomorphologies ranging from estuaries to open coast beaches. They also found that 6 marae are exposed to a 100–year extreme sea level event at current mean sea level, and 41 coastal marae are exposed to a 100–year extreme sea level event with 3m SLR **(Figure 3-3)**. These investigations highlight the extent to which coastal marae, and their associated wāhi tapu (sacred sites of significance, such as urupā (cemeteries), and mahinga kai (traditional food gathering sites) are at risk of coastal flooding due to SLR.

When establishing ancestral marae, careful consideration was given to the risks associated with natural hazards, based on careful and detailed observations through time. However,

climate change has intensified environmental hazards and impacts, and hence many marae are now at risk. Coastal adaptation is topical around the world as coastal communities are having to adapt to the impact of sea level rise.

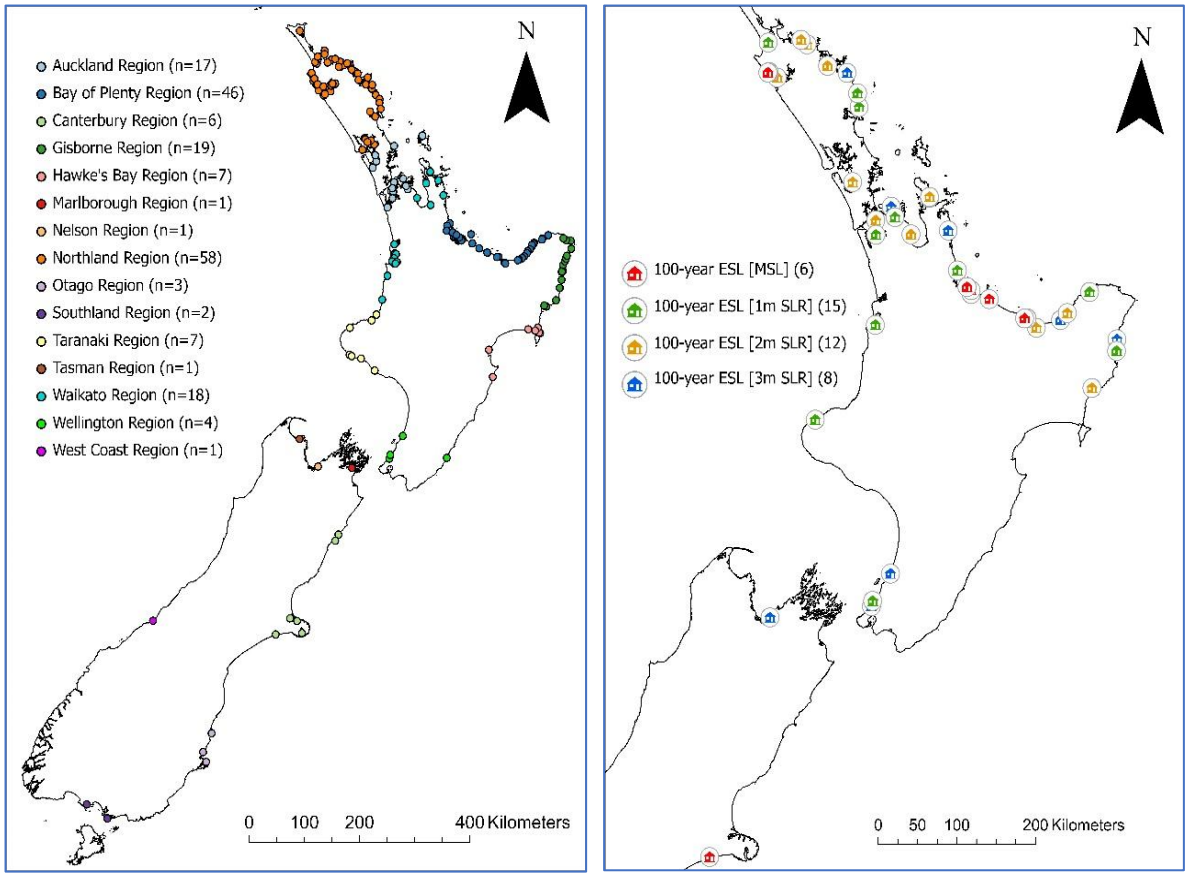

Figure 3-3: (A) National coastal marae categorised into Regional Government Boundaries; and (B) National coastal marae exposure to a 100-year extreme sea level event with +1 m increment of SLR (Source: Te Pōtiki National Trust, 2011 (maps) and Paulik et al., 2020 (dataset))

To manage the risk as we head into the future with our changing climate, hapū and iwi can and are drawing on their mātauranga-a-hapū and a-iwi Māori and are developing innovative solutions to adapt and mitigate the risk. Coastal adaptation is generally categorised into three broad types: 1) Protect, 2) Accommodate and 3) Retreat, with many coastal marae already adapting across all these responses. For example, Maketū marae in Kawhia has experienced erosion since the 1940's until the 1970's and in response the hapū, Ngāti Mahuta, constructed a seawall in 1971 and it was reinforced in 2004 (Tonkin+Taylor, 2007).

Accommodation options for sea level rise and flooding are being considered by some marae, such as at Mirumiru marae, in the Waikato region. This marae is only accessible by boat and is situated on the Marokopa River. The hapū of Mirumiru marae, Ngāti Peehi, Te Kanawa and Kinohaku and the National Institute of Water and Atmospheric Research (NIWA) discussed potential options for adaptation in response to coastal flooding and erosion with SLR in Te Ao Māori News (Day, 2018).

Retreat is often the most controversial adaptation solution and aims to reduce risk by relocating and/or abandoning infrastructure, buildings and communities away from at-risk areas (Hino et al., 2017). In the past, many marae have retreated or relocated in response to natural hazards. For instance, a landslide flowing down the Waimatai stream devastated inland Waihi village near Lake Taupō in 1846. This event killed 64 people, and another in 1910 lead to one fatality (Taig et al., 2012). These events lead to its relocation to its current position to the East of Waihi Bay, Lake Taupo.

At the coast, Waikari Marae in Tauranga Moana was relocated to higher ground by the hapū, Ngāti Tapu, in response to coastal flooding and erosion in the late 19th century (Tauranga Moana District Maori Council, 1989). In addition, Waipapa marae in Taranaki was relocated to higher ground in 1940 in response to river flooding, and again in 2009 (Waipapa Marae Trust, 2022). More recently, many other marae have begun the conversation of potentially relocating their marae. However, this is not always deemed a suitable option such as for Tangoio Marae on the East Coast of the North Island, which focused their attention on protection measures and sound evacuation procedures (Colliar & Blackett, 2018).

Heading into the future with climate change, marae are likely to play an increasingly important role for communities of A-NZ. They will continue to protect and shelter people from hazards and following disasters, and sites of community engagement about risk. Marae are also examples of mātauranga in action, such as where and how to position communities, infrastructure, and other marae to avoid hazards, if retreat is determined to be the right course of action.

3.4 Self-determination and coastal adaptation

In terms of Indigenous communities, retreat or relocation in many places around the world must be conducted carefully given the potential to perpetuate historic injustices which occurred through the process of colonisation. For example: confiscation of Indigenous land, forced removal of Indigenous peoples from traditional land, and forced assimilation into Western society (Whyte, 2017). This disconnection from ancestral lands means that Indigenous peoples have sometimes been unable to fully adapt to the natural rhythms of the environment. Current issues surrounding land ownership and availability of land to relocate to, makes adaptation more difficult compared to adaptation pre-colonisation, and if relocation is deemed appropriate, for some, lack of land precludes this option entirely.

This argument emphasises that adaptation for marae needs to be cognizant of this history and ensure Māori self-determination, as outlined in both Te Tiriti o Waitangi and the United Nations Declaration on the Rights of Indigenous Peoples. Furthermore, in the context of A-NZ, any adaptation must uphold the principles of active protection, partnership, and participation of

Māori consistent with the intent of Te Tiriti o Waitangi. This should involve Māori at every stage of the process, from knowledge collation and generation through to the selection of adaptation options. The latest Intergovernmental Panel on Climate Change Sixth Assessment report highlighted the need for Indigenous engagement and collaboration with Indigenous knowledges to the betterment of all peoples headed into a climate changed future (IPCC, 2022). The challenge now is how to put those words into practice.

Chapter 4 – Looking Backwards to Move Forwards: Insights for Climate Change Adaptation from Historical Māori Relocation due to Natural Hazards

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4.1 Abstract

Climate change relocation of Indigenous communities is increasing globally. For Māori (the Indigenous peoples of Aotearoa New Zealand), many pā (complexes of significant structures) are at risk to climate change impacts with relocation as one potential adaptation option. For Indigenous peoples this step is not taken lightly, as connection to place is imperative. The aim of this research is to highlight some histories of Māori communities relocating in response to natural hazards, providing insights from the past to help plan for future adaptation. To do this, we undertook a national-scale textual analysis and identified 51 examples of pā relocating in response to natural hazards since pre-1840. We then focused on a case study with members of two iwi (tribes), who relocated following the 1886 eruption of Mount Tarawera to identify enablers and barriers to relocation, and to draw insights to assist with Māori-led responses to climate change adaptation. We found that key enablers of relocation included whānau (family)-level decision-making, cultural norms of awhi (support), whanaungatanga (relationships), whakapapa (genealogical connection), koha (donation), tuku whenua (gifts of land) and mātauranga Māori (Māori knowledge). In summary, Māori and other Indigenous peoples have rich histories of relocations, utilizing their own Indigenous knowledge, local implementation, and adaptability to natural hazards that can be implemented in our modern context.

4.2 Introduction

Climate change is increasing the frequency and severity of many natural hazards, including wildfires, droughts, and extreme weather events, inducing erosion and flooding (Van Aalst, 2006; IPCC, 2022). Many Indigenous communities are already experiencing (and adapting to) the impacts of climate change (Wildcat, 2014; Ford et al., 2020). This includes in the North American Arctic, where Indigenous communities are losing land to melting permafrost, erosion, and flooding (Ford et al., 2008; Bronen, 2010; Maldonado et al., 2013; Bronen, 2015). The community of Isle de Jean Charles, Louisiana USA, including members of the Biloxi-Chitimacha-Choctaw tribe, face increased coastal flooding due to sea level rise (Simms et al., 2021). In the Pacific Islands, the Indigenous peoples of the Solomon Islands (Albert et al., 2018), Tuvalu (Farbotko & Lazrus, 2012), Kiribati (Storey & Hunter, 2010; Allgood &

McNamara, 2017), Fiji (McNamara & Des Combes, 2015; Piggott-McKellar et al., 2019) and Torres Strait (McNamara et al., 2017; McNamara et al., 2021) all face sea level rise induced erosion and flooding.

Indigenous communities are generally considered more vulnerable to climate change due to factors including dependence on natural subsistence systems, elevated exposure (such as due to being situated on hazardous marginal land), and reduced ability for traditional seasonal movements due to colonisation (Newton et al., 2005; McEvoy & Mitchell, 2019). Indigenous communities also have histories of marginalisation, lower socioeconomic opportunities, lack of resources, poorer health outcomes and lack of contextually specific adaptation information, alongside continuing to suffer the ongoing intergenerational impacts of colonisation (Maldonado et al., 2013; Whyte, 2017; Ford et al., 2020). Contemporary relocation is complicated by other colonial legacies including insufficient access to sustainable land (Fayazi et al., 2020), tribal land ownership (Whyte, 2016), land tenure issues (McEvoy et al., 2020), and individual property rights (Hanna et al., 2022). Lastly, relocation for Indigenous peoples can result in loss of cultural heritage, identity and Indigenous knowledges (Whyte, 2016; Bronen & Cochran, 2021).

There are, however, many lessons from the past and present highlighting the knowledge, strength, and adaptability of Indigenous peoples who have adapted to environmental changes for millennia (McNamara & Westoby, 2011; Petzold et al., 2020). There are rich histories of community-level mobility in tune with the natural world and surrounding environment (Barnett & McMichael, 2018; Whyte et al., 2019; Bronen et al., 2020). Elders tell stories of how relocations have occurred in response to natural hazards, and, if these are identified, collated, and their decision-making processes identified, these examples hold potential in informing contemporary policy on Indigenous adaptation, helping position Indigenous people as active responders rather than victims (Cochran et al., 2013).

In Aotearoa New Zealand (hereafter, A-NZ), many Māori (Indigenous peoples of A-NZ) communities are disproportionately at risk to climate change, particularly in coastal areas, as water is important as a resource and for cultural identity and traditions (Ruru, 2013). Climate change is impacting upon Māori infrastructure (Bailey-Winiata, 2021), economy (King et al., 2010; Awatere et al., 2021b), health (Jones et al., 2014) and alters traditional understandings of the environment (McMurdo Hamilton et al., 2021). New national legislation for planning for climate change is also being devised (Ministry for the Environment, 2022c), while many recent extreme flooding events continue to impact Māori communities (Desmarais, 2023). Nationally and globally, there is much more that needs to be understood (and applied) of how adaptation should consider issues surrounding land governance, land rights, legal and ethical considerations of relocated individuals and communities. For Indigenous communities

adapting to climate change and associated legislation risks perpetuating colonisation for Indigenous people, termed by Whyte (2016) as the “colonial déjà vu”. As such, it is crucial that policy development for climate change adaptation draws on Indigenous knowledge and perspectives on decision-making within its frameworks.

This research aims to look backwards to contribute to the contemporary agenda of climate change adaptation by and for Indigenous peoples. The objectives are threefold: 1) to produce the first national dataset of previous relocations of Māori pā relocating in response to natural hazards (where pā is a broad term for the complex of Māori structures, places, and people, important to Māori culture and identity); 2) to explore an example within this dataset to ascertain enablers and barriers to relocation; and 3) to highlight insights that can help inform Māori-led relocation in response to current climate change adaptation planning and policy discussions. The case study relates to the iwi (tribes) of Tūhourangi and Ngāti Rangitihi following the 1886 eruption of Mount Tarawera. This research contributes to the growing international body of work on Indigenous adaptation to climate change. A key reason for this work is to gather stories of what many Māori already know, but this dataset emphasises there are many more yet to tell. We wish to highlight the strength and resilience and bring together some ideas of ways forward to contribute to the narrative of power and self-determination of Māori and all Indigenous peoples.

4.3 National context of A-NZ

4.3.1 Natural Hazardscape

Aotearoa New Zealand is surrounded by Te Moana nui a Kiwa (Pacific Ocean), Te Moana Tāpokopoko a Tāwhaki (Southern Ocean), and Te Tai o Rehua (Tasman Sea) **(Figure 4-1)**, and is situated along an active geological plate boundary, subjecting the country to frequent natural hazards, extreme hydro-meteorological events and large-scale global climate cycles (ODESC, 2007; Glavovic et al., 2010; Godoi et al., 2018). Climate change and sea level rise will amplify many of these hazards (Bodeker et al., 2022).

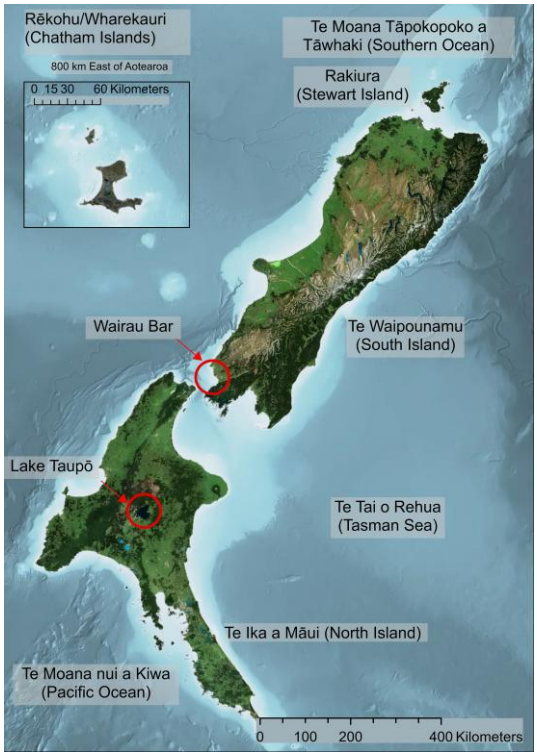

Figure 4-1: A Te Ao Māori view of Aotearoa New Zealand, which is "upside down" compared to conventional maps. Here the North Island is Te Ika a Maui (The fish of Maui). The South Island is Te Waka a Maui (the canoe of Maui) (Ka'ai & Higgins, 2004; Hikuroa, 2020) (Data source: New Zealand 10 m Satellite Imagery (2021–2022) & GEBCO Gridded Bathymetry (2020))

4.3.2 Legislative context

In February 2021 A-NZ's Ministry for the Environment (2022c) announced plans for a new Climate Change Adaptation Act (CCA) to address complex issues associated with financing managed retreat. Managed retreat involves the managed relocation of people and infrastructure away from hazardous locations and can be pre-emptive or in reaction to natural hazard events (Lawrence et al., 2020; Siders & Ajibade, 2021). In A-NZ, managed retreats have previously occurred, but without a clear legislative framework resulting in isolated policy experiments unable to respond to the diverse needs of communities (Hanna et al., 2022). The proposed CCA acknowledges the need to weave a "by-Māori-for-Māori approach" into legislation alongside typical science and Government-led processes (Dexter, 2023). This research, therefore, is timely and situated in the direct context of these debates.

4.3.3 Māori and Pā

Māori and the Moriori (of Rēkohu/Wharekauri) are the Indigenous peoples of A-NZ, arriving in the 13th and 14th centuries from Hawaiki in French Polynesia (McWethy et al., 2010; McConnell et al., 2021). Māori kinship social structures stem from whānau (family), hapū (sub-tribe), and

iwi (Winiata, 1956; Reilly, 2004). Māori hapū can be focussed in settlements termed pā, many of which are situated near water bodies as waterways provide resources, transport, and trade and the use of wai (water) in many traditional practices (Bailey-Winiata et al., 2022). The centre of pā is often a marae complex, which are ancestral Māori meeting grounds. At the centre of marae is the wharenui (meeting house) where the structure physically and metaphorically is an ancestor of the hapū (Skinner, 2016).

Pā connect past, present, and future generations in whakapapa (Rameka, 2016). Whakapapa is a grounding force and genealogical link throughout time and connects people to each other and to the environment (Forster, 2019). A kincentric connection to the natural environment is also present in many other Indigenous cultures, such as in Tahiti (Maric, 2016) and Australia (Kearney et al., 2019). However, many of these environmental relationships are at risk with climate change, and adaptation needs to provide for these connections.

4.4 Methods

4.4.1 Textual analysis

The research framework is underpinned by the whakataukī (proverb) “Kia whakatōmuri te haere whakamua—I walk backwards into the future with my eyes fixed on my past” (Rameka, 2016). A mixed methods approach incorporating a textual analysis was used to identify historical examples of pā relocating in response to natural hazards in A-NZ. This was complemented with a thematic analysis of semi-structured interviews. For the textual analysis, we draw from the methods of Grace-McCaskey et al. (2021) and Tubridy et al. (2021), and our textual analysis includes both primary (e.g., original material) and secondary sources (e.g., subsequent material created from the primary sources) (Brundage, 2017). Primary sources include Te Tiriti o Waitangi-Treaty of Waitangi Settlement documents **(Section 4.4.1.1)**, and A-NZ produced media available on Pressreader **(Section 4.4.1.2),** and secondary sources include Google search of Māori maps **(Section 4.4.1.3)**, Google search of pā relocation **(Section 4.4.1.4)**, and Oral conversations **(Section 4.4.1.5)**.

In the textual analysis, three sets of keywords were searched relating to: 1) pā, 2) natural hazards, and 3) managed retreat/relocation **(see Appendix 2)**. Pā is a collective term to describe Māori settlements, the people (hapū and iwi), and individual culturally significant sites such as marae. Furthermore, keywords regarding natural hazards were sought from “The Natural Hazardscape report” ODESC (2007), which is a non-statutory document aimed to inform hazard managers about the frequency, management, and occurrence of 17 key hazards for A-NZ. Lastly, keywords relating to managed retreat/relocation were sought from Hanna et al. (2017), where a textual analysis was conducted to understand the different terminology used in relevant policy documents in A-NZ.

4.4.1.1 Te Tiriti o Waitangi – Treaty of Waitangi Settlement documents

Te Tiriti o Waitangi – The Treaty of Waitangi (Te Tiriti) is a foundational document of A-NZ, signed in 1840, by Māori Rangatira (leaders) and British Crown (Crown) representatives (Orange, 2020). Te Tiriti outlined the relationship between Māori and the Crown, with dominant principles of partnership, participation, and protection (Orange, 2020). Te Tiriti has an English and a Māori version, however during translation, the gravity of the terms and conditions that Rangatira were agreeing to were not accurately conveyed, such as land ownership and sovereignty (Stokes, 1992). In 1975, The Treaty of Waitangi Act was passed, and the Waitangi Tribunal was established to provide a mechanism where Māori who were disadvantaged by legislation or policy imposed by the Crown were able to seek redress. This study investigated historical not contemporary claims, as the tribunal only began reviewing these claims since 2020 (Ministry of Justice, 2021). Historical claims total 87 documents. To search Te Tiriti settlement documents for pā relocations, a query in NVivo software was used to search for keywords.

4.4.1.2 Pressreader

Pressreader is a subscription-based online media platform accessing thousands of magazines and newspapers around the globe (Canuel et al., 2017). It is commonly utilised to identify articles and other written media with certain keywords (Fish, 2020). This study utilised all publications produced and published in A-NZ and only those written in English. Using the advanced search in Pressreader, all keywords were searched.

4.4.1.3 Māori maps

The keywords were searched in the Māori Maps online database of marae locations (Te Potiki National Trust, 2011). Within Māori Maps, histories of each marae were searched, which sometimes contained historical accounts of some form of relocation. Similar to research on climate change perceptions by Hayes and O'Neill (2021) and Walter et al. (2018), we utilized the Google site search, using the “site” query in the Google search engine with Māori maps as the site, then searched the website for keywords (Google Developers, 2022).

4.4.1.4 Google search engine

Drawing on the methods of Ford et al. (2015) and Mbah et al. (2021) who identified relevant grey literature for their systematic reviews regarding adaptation of Indigenous peoples to climate change. The Google search engine was used to identify further examples of pā relocation in response to natural hazards that may have been missed by the above methods. A combination of media articles (10) and grey literature (5) were found.

4.4.1.5 Oral conversations

Oral communication is a key method of knowledge transfer within many Indigenous communities (Amare & Gacheno, 2021), including Māori (Mercier et al., 2011; King et al., 2018). Only some aspects of oral information may be included in the textual analysis documents described above, such as quotes of oral accounts. Through oral conversations with other researchers, hapū and iwi members and fellow students, further examples of pā relocating in the past surfaced. These examples were searched using the name of the pā, through the Google search engine to identify documentation for all cases mentioned.

4.4.2 Process for conducting kōrero with Tūhourangi and Ngāti Rangitihi

The case study of the relocation of Tūhourangi and Ngāti Rangitihi following the 1886 Mount Tarawera eruption is one of the most well-known cases of Māori relocation to a natural hazard. The lead author of this paper has whakapapa to Tūhourangi which benefits the research by the ability to facilitate informative discussions due to understanding of cultural norms and whānau connections, which is a key aspect (albeit not essential) of kaupapa Māori research theory (Smith, 2012). This research incorporates aspects of kaupapa Māori research theory to comprehend the intergenerational memory of the Tarawera eruption. Kaupapa Māori is a philosophy that guides research by Māori for Māori, delivering on emancipatory and empowerment outcomes (Walker et al., 2006; Smith, 2012). Kaupapa Māori research has five key principles for ethical research outlined by Walker et al. (2006):

1. **Tino rangatiratanga:** self-determination over the research, with a Māori centred agenda (Henry & Pene, 2001; Pihama et al., 2002).
2. **Social justice:** redress of the power imbalance in research and build the capability and capacity of the current and next generation (Eketone, 2008; Smith, 2012).
3. **Te Ao Māori worldview:** a Māori lens shapes a research project differently to Western research, allowing for inclusion of Māori concepts (Bishop, 1999; Walsh-Tapiata, 2003).
4. **Te reo Māori:** conducting interviews or engagements in te reo Māori is beneficial to conduct kaupapa Māori research (albeit not essential) as it creates connections and enables deeper understanding to cultural concepts or texts (Powick, 2003).
5. **Whānau:** collective view of the research team and the participants as whānau. This enables whakawhanaungatanga (process of establishing relationships) as well as a shared vision of the research outcomes (Bishop, 1995).

In our research, whakawhanaungatanga and whānau were at the centre of the interview process, from the whakapapa of the main author, to whānau directing us to important people

to approach to interview, through to the interactions before, during and after the interviews. In line with positive outcomes for Māori, this research showcases the resilience and adaptability of Māori to natural hazards to help support and empower Māori to protect their pā in the face of climate change. In line with whanaungatanga (relationships or family connection) and Māori values, for each participant there was an initial, unstructured kōrero about the reasons for the work, before a formal interview took place. This occurred in a combination of in person, including sharing of kai (food), as well as over the phone or via zoom, depending on the preference of participants. Kōrero were then conducted at a later date.

Kōrero involved inverting the roles of "researcher" and "participant" leading to more open and honest dialogue (Bishop & Glynn, 1999). The kōrero were audio recorded (with permission) and transcribed, in line with human research ethics approval through the University of Waikato (HREC(HECS)2022#02). Interviews were conducted in English over the course of 1-2 hours. Participants are not named and denoted as Participant 1, 2, 3 and 4. These four knowledge holders are those we were directed to by our whānau as key knowledge holders of the history. The kōrero were guided but not limited to the interview questions with data transcribed and analysed for key themes and enablers for the relocation process, for interview questions **(see Appendix 2)**.

Given the time passed since the Tarawera eruption, the kōrero shared can be defined as oral traditions, which is information passed down to the informant regarding recent and distant past events (not to be confused with oral histories which relate to events within the lifetime of the informant) (Tau & Anderson, 2008; Mahuika, 2019). Mahuika (2019) posits that both oral traditions and histories are ongoing narratives rather than just ancient tales, which evolve and recontextualise for new environments or generations and serve as foundational narratives that embody cultural values, world views and histories.

4.4.3 Māori and Indigenous data sovereignty principles

The information identified in the national-scale textual analysis and shared by participants, is mātauranga Māori (Māori knowledge) which is a taonga (tangible and intangible things of significance) (Mead, 2003; King et al., 2020). At the national scale, because publicly available textual sources were used, there is no connection between us as "researchers" and the hapū and iwi of the pā. However, we are not exempt from being ethically aware of the issues and exploitation of Indigenous and particularly Māori data (Kukutai et al., 2020). To mitigate these impacts, we have: 1) included only previously published examples; 2) only disclosed non-identifiable information such as pā type, type of relocation, regional location not exact location; and 3) kept analysis at a national scale to avoid revealing specific locations. For the kōrero, the ownership of the mātauranga shared remains with those who shared it. This mātauranga

was treated with the upmost care, and all participants have viewed and approved this work prior to submission. We also highlight that the perspectives shared by the participants are their own and not representative of views of all hapū and iwi members or all Māori.

4.5 Results and discussion

4.5.1 National examples of Māori relocation

The textual analysis identified 51 cases of pā relocation, including seven that have relocated more than once. Twenty-four of these cases were identified from oral conversations; 15 from Google search engine; three from Te Tiriti settlement documents; five from Māori maps; and four from Pressreader. The timeline of these cases date pre-colonisation (pre–1840) to present day **(Figure 4-2A)**. There were 38 completed pā relocations, 11 pā where discussion to relocate occurred but with no imminent plans to relocate, and two pā that have planned to relocate at some stage but progress is unknown to us.

There was a wide range of natural hazards driving these pā relocations **(Figure 4-2B)**, including 17 due to flooding, 11 due to tsunami, eight due to erosion, three due to flooding and erosion combined, two due to volcanic eruptions, one from a landslide, one due to subsidence, one due to an earthquake and seven with unknown natural hazard causes **(Figure 4-2B)**. For the flooding category **(Figure 4-2C)**, seven were due to riverine flooding, four due to coastal flooding, four undefined and two due to high rainfall (with an undefined location) **(Figure 4-2C)**. Furthermore, those that were caused by erosion included three due to coastal erosion, two due to riverine erosion, one due to coastal and riverine combined, one due to high rainfall and one undefined. For examples where a combination of flooding and erosion induced relocation, there were three coastal cases **(Figure 4-2C)**. In addition, the textual analysis identified six cases of pā relocating in response to Government acquisitions of land and two relocating to be nearer to urban infrastructure, which are excluded from analysis.

Tsunami caused 11 individual pā to relocate, all prior to colonization, except for one case in 1840 – 1900. The tsunami were from local and distant sources, with some causing great devastation beyond A-NZ, such as the 1868 AD Chilean Tsunami that originated from the magnitude 9 Arica earthquake, with damaging tsunami waves throughout the Pacific region (Lomnitz, 2004). In A-NZ, the physical impacts of this tsunami were greatest on the East coast of A-NZ, and on Rēkohu (Chatham Islands) (Thomas et al., 2020; Goff, 2021). The tsunami had run-up heights of up to 10 m and was able to move boulders of up to 500 kg (Goff & Chagué-Goff, 2001). This tsunami destroyed a pā and European houses at Cape Pattison (North–West section of Rēkohu), eventuating in relocation of the whānau away from the pā (Goff & Chagué-Goff, 2001).

Another tsunami caused the relocation of a pā at Wairau Bar in the Marlborough region of Te Waipounamu **(Figure 4-1)**. This pā is referred to by some as the first in A-NZ and was occupied from 1300 AD (Higham et al., 1999; Jacomb et al., 2014). It relocated following a tsunami and was later reoccupied, evidenced by reworking of material in middens, although it is unclear how long after the tsunami this reoccupation occurred (McFadgen & Goff, 2007; King et al., 2017). The return to the pā following this devastating event reflects the strong connection of Māori to their whenua (land) (McFadgen & Goff, 2007).

While most cases of pā relocation we found are coastal, there are also cases inland. For example, two landslide events occurred in 1846 and 1910, impacting Te Rapa pā located on the shores of Lake Taupō **(Figure 4-1)**. These two events took the lives of around 50 – 70 people of Ngāti Tuwharetoa in 1846 and one more life in 1910 (New Zealand Herald, 1910). Both cases involved landslides and debris flows from the Waimatai Stream above the pā (Massey et al., 2009). There is also evidence of an earlier event at a nearby pā at the mouth of the Omoho Stream that was buried by another landslide in 1780 (Massey et al., 2009).

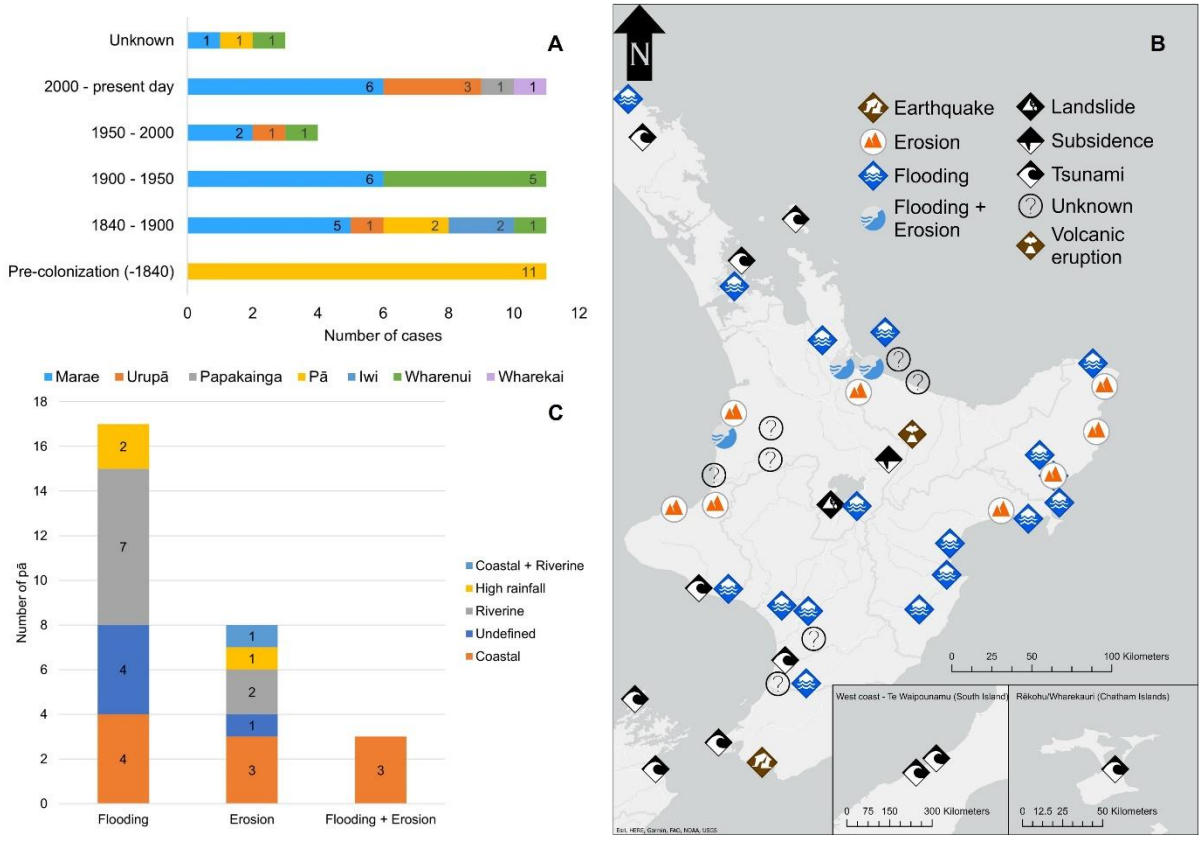

Figure 4-2: (A) Timeline of pā relocating (completed or not); (B) National map of pā that have relocated (completed or not) in response to natural hazards; and (C) Causes of pā relocation based on the origin of flooding, erosion, or both

4.5.2 1886 Mount Tarawera Eruption – Relocation of Tūhourangi and Ngāti Rangitihi pā

The hapū and iwi of Tūhourangi and Ngāti Rangitihi relocated following the 1886 eruption of Mount Tarawera. Tūhourangi and Ngāti Rangitihi are iwi of Te Arawa that arrived to A-NZ on Te Arawa waka (canoe) around 1350 from Hawaiki (Tapsell, 2005; Stafford, 2016). After initially settling at Maketū in the Bay of Plenty **(Figure 4-3A)**, Te Arawa spread throughout the region, particularly around the 18 lakes surrounding Rotorua (Stafford, 2016). The second largest of these lakes is Lake Tarawera, 14 km South–East of the city of Rotorua, 45 km South of Maketū **(Figure 4-3A & B)**. In the early hours of the 10th of June 1886, a sudden basaltic eruption of Mount Tarawera occurred, burying the famous silica terraces Ōtūkapuarangi and Te Tarata (Pink and White terraces), which were deemed by some as the eighth natural wonder of the world **(Figure 4-3C & D)** (Keam, 2016). The eruption killed many Māori and non-Māori families, leading to ~150 fatalities (Keam, 1988; Pene, 2015). The Māori survivors evacuated the area and headed to Ōhinemutu at Rotorua, seeking refuge and shelter. Many of the displaced hapū and iwi were now landless, without kai, and without income because the prosperous tourist economy built around the now buried pink and white terraces was in disarray. Tūhourangi were offered lands by hapū and iwi near and far, such as in the Coromandel, at Ngāpuna, Whakarewarewa, and Matatā where Ngāti Rangitihi moved to live with their whānau that were already there (Pene, 2015).

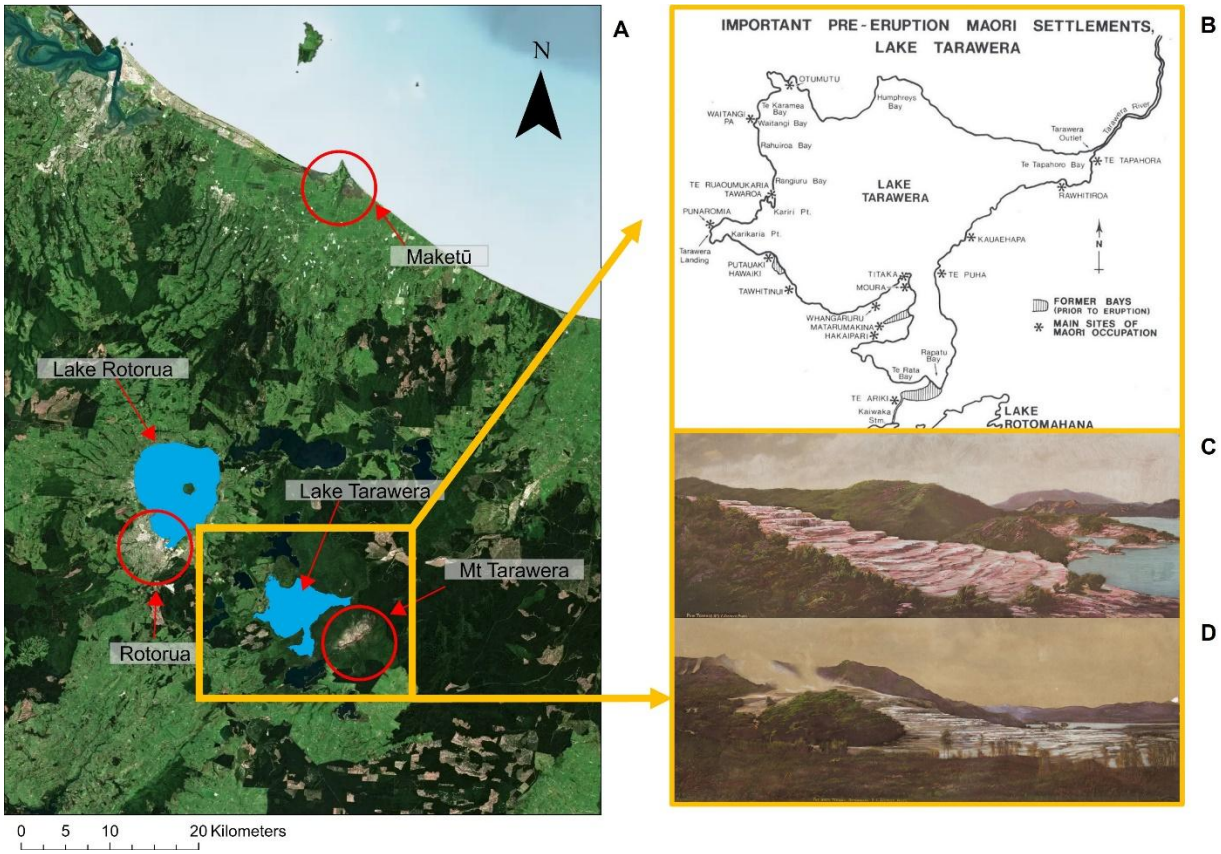

Figure 4-3: (A) Geographical sites of importance to Te Arawa in the Bay of Plenty in the context of Tūhourangi and Ngāti Rangitihi. (Data source: New Zealand 10 m Satellite Imagery (2021–2022) & GEBCO Gridded Bathymetry (2020)); (B) Locations of pre-eruption Māori settlements surrounding Lake Tarawera. Acknowledgement to the Don Stafford Collection. (C) Painting of Ōtūkapuarangi (fountain of the clouded sky) or Pink Terrace, circa 1900, New Zealand, by Charles Spencer, Charles Spencer. Purchased 2013. Te Papa (O.041083); (D) Te Tarata (the tattooed rock) or The White Terrace, Rotomahana, circa 1900, New Zealand, by Charles Spencer, Charles Spencer. Purchased 2013. Te Papa (O.041082)

Through kōrero, four key themes of a relocation process arose including tuku whenua – land gifting; autonomy and decision-making; perspective on lands and infrastructure; and the relocation site.

4.5.2.1 Tuku whenua – land gifting

In the wake of the devastating 1886 Tarawera eruption, survivors were dispossessed of their whānau, lands and thriving tourist economy. These survivors were predominantly from the hapū of Tūhourangi and Ngāti Rangitihi. Participant 1 noted:

"As far as Tarawera was concerned, that was such a traumatic event… there was nothing to go back to."

Returning to live at the site wasn't deemed favourable, as Participant 2 noted:

"the land would have been treated like land where blood was shed during battle, the land was tapu to them."

Tapu is a complex topic that can be defined as an object or a place being sacred, prohibited or restricted (Moorfield, 2023). The prominence of the trauma of the Tarawera eruption in intergenerational memory is reiterated by Participant 1, who said:

"From as long as I can remember we all knew we came from Tarawera, but as kids we never knew where Tarawera was…, I'm talking about the 1950's … That event was so traumatic that we were never going to go back."

Soon after the eruption, whānau, hapū and iwi with whakapapa to Ngāti Wāhiao, Ngāti Hurungaterangi, Tapuika, Ngāti Maru and Ngāti Rangitihi offered the hapū to either come and settle with them (in the case of Ngāti Rangitihi) or provided land to re-establish (in the case of Tūhourangi), often based on whakapapa. Tuku whenua is the customary process of gifting land between whānau, hapū, iwi, but it also occurred between Māori and Pākehā (non-Māori) in the 19th century (Healy, 2009). Based on kōrero for this research and examples given in Pene (2015), there were at least 15 offers of land from around the country, from as far North as Hokianga (580 km away) and as far South as Taranaki (390 km away). Surviving hapū members settled in a range of places including:

- Whakarewarewa offered by Ngāti Wāhiao.
- Ngāpuna offered by Ngāti Hurungaterangi.
- Ōtūkawa (East of Te Puke) offered by Tapuika.
- Hauraki(Coromandel) offered by Ngāti Māru; and
- Matatā offered by Ngāti Rangitihi.

Ngāti Rangitihi also relocated post-eruption, by moving with whānau at the coast of Matatā, as mentioned by Participant 3 who shared:

"Matatā would have been the place to be, trade and resources. Tarawera as it is now the mountains, pre-eruption, the focal point would have been the pink and white terraces, after the eruption they were destroyed, hence there wasn't a significant pull towards living at Tarawera."

4.5.2.2 Autonomy and decision-making

During the interviews, strong leadership and whānau-level decision-making shone through as powerful mechanisms of the relocation process. Decisions were made by whānau, for whānau, which ensured their best interests were protected. As Participant 1 shared:

"At the time the event was so traumatic that perhaps thinking/processing the options that were given wasn't a high priority, we're lucky we survived… The other thing is that they had really

strong leadership right from the word go. We are the ones that are left, and we must carry on… Anyone of that era would have been very pragmatic about it."

Participant 3 discussed how leadership at the whānau level helped decision-making:

"Whānau were able to deal with the issues at hand, they dealt with them at the whānau level."

Accompanying sound leadership, whanaungatanga and awhi (support) played an important role. Whanaungatanga is related to whakawhanaungatanga and whānau and which is a collective affiliation with roles and responsibilities to work together and support each other (Moeke-Pickering, 1996; McCarthy, 1997). Whanaungatanga accompanies awhi. Following the Tarawera eruption, these concepts were central to the post-relief effort for the survivors, Participant 1 shared that:

"We had some whānau come to Ngāpuna at Ngāti Hinemihi and to Ngāti Tarāwhai. All our relations came to awhi us… even our whanaunga at Coromandel, they also came and showed awhi."

Koha (donation or contribution) was a key enabler of successful relocation, where koha in a general sense is part of tikanga Māori (Māori customs and practices) in formal ceremonies and informally in everyday life such as hui (meetings) as a symbol of reciprocity. Koha can be in the form of food, a taonga such as a valuable cloak, ornament, or weapon, and today often money. Koha is traditionally offered with no expectations from those giving it, both the donor and the recipient recognise this gesture while both maintaining their respective mana (authority) and self-determination (Bishop & Glynn, 1999). Participant 1 reflects:

"Koha was a mixture of things, there were offers of land, but also resources, kai or even a place to sleep. Everybody moved over and made room for you."

One of the many gifts of land to Tūhourangi was from Ngāti Maru of the Hauraki and Coromandel regions. These offers are embedded in whakapapa, as Tamatekapua (Captain of Te Arawa waka) is buried at Moehau, a prominent mountain peak of the Coromandel Peninsula. This is reflected in kōrero from Participant 1, who shared:

"Some of us went to Coromandel with Ngāti Maru … that's where Tamatekapua is buried as well as Hei. People from our canoe are buried there, we've got connections there, they are whānau."

In addition, whakapapa included that Uenukukopako (Son of Tūhourangi-Ancestor of Tūhourangi iwi) married Taoitekura (Daughter of Marutūāhu-Ancestor of Ngāti Maru) (Pene, 2015).

We can learn from these concepts and collective response heading into the future with increased climate change impacts, as Participant 1 mentioned:

"The past is really how you deal with the future… I know that if we had something as bad as that again, we know that people would come offering bread, kai etc. different way of doing it now but the same support is there."

Reciprocity was important in relocation as it translated to generosity in the future as Participant 3 mentioned:

"If we have to do that again I think it would lead to reciprocity, we would repay the favour. That happened with Tūhourangi with Coromandel… Generosity often leads to reciprocity. This cements relationships and people remember this stuff."

It is clear from the relocations following the Tarawera eruption that mātauranga Māori influenced actions and decision-making, as it still does today. For example, tohu which are defined as signals or indicators, are important cues utilized by kaitiaki (guardians) and local people, varying from environmental changes, events, or processes, which are an aspect of mātauranga Māori (Paul-Burke et al., 2022). Regarding the Tarawera eruption, tohu were a key indicator of the impetus of an eruption occurring, for instance that shared by Participant 1:

"Rūaumoko (God of Earthquakes) is shaking, and we have to pay the price of not putting the baby to sleep properly… Te Pāea and some of the people of Tūhourangi saw a ghost waka, those were all tohu, so they knew something was up."

Being aware of these tohu can help with disaster preparedness and hazard management, which in a changing climate, is incredibly valuable.

Interviews highlighted that the A-frame marae near the eruption was a more resilient design compared to the lower pitched roofs of the European settler buildings. The A-frame roof allowed ash to runoff, reducing ash build-up, whereas the lower pitched roofs crumbled under the weight of the accumulated ash, as shared by Participant 2 with regards to the marae Hinemihi:

"It was one of two marae that survived the eruption due to the A-frame engineering compared to the flatter European houses and hotels."

The extra protection offered by the A-frame aligns with the concept of making buildings and infrastructure more resilient to natural hazards and is a poignant example of how Māori developed extensive mātauranga in engineering and construction (Treadwell, 2017), and how it can be influential to the decision-making process of adaptation to climate change.

4.5.2.3 Perspective on lands and infrastructure

Following the Tarawera eruption, a key way other hapū and iwi offered support to the displaced hapū was by gifting land. Land is highly valued in Te Ao Māori, where land is Papatūānuku (Earth mother) to which Māori are linked by whakapapa, not an asset as in Western discourse (Moewaka Barnes & McCreanor, 2019). Thus, land wasn't (and isn't) given lightly. However, following the Tarawera eruption, the tikanga was to support Tūhourangi and Ngāti Rangitihi in recovering from the tremendous loss they suffered. Tikanga was also followed when Tūhourangi returned the land at Coromandel back to Ngāti Maru in 1986, the centenary of the Tarawera eruption. Participant 4 describes this event:

"I remember also when Tūhourangi gave the land back at Coromandel, that was 1986 as a 100-year celebration. The reasoning behind the gifting back of that land was that we weren't there. And they would never presume to take back ownership, it was under the understanding that they have given it to us, they would never have objected. But it was the right thing to do. It also keeps everyone happy and strengthens the ties as well."

Land governance structures of the late 19th century meant no one person owned the land, as Participant 1 shares:

"We never had a little spot that says that this naught .0000 [sic] belongs to this person or that person and his whānau".

Today, land governance, land availability and top-down approaches to adaptation are barriers that many communities face when trying to adapt to environmental changes, including by relocation. As Fayazi et al. (2020) noted in their case study of the Mohawk community of Kanesatake, Canada, the historical loss of land created tensions which still exist today between community and Government. They posit a settlement is required to resolve these disputes, otherwise they risk returning to the status quo with no advancement in adaptation. This is a common story globally and as Participant 2 shared, a bittersweet reality:

"Inevitably, some whānau will have to give up some land as in history whānau have agreed to gift some land to establish a marae, land will have to be sacrificed."

In addition, as Participant 3 posed the question about how relocation of a pā would work, they shared the concept of mauri (life force) that pā have, and that the physical relocation is the easy part, but maintaining or re-creating the mauri is the challenge, they share:

"There is an obligation of the crown to assist us in restoring the mauri. Now it's almost like someone needs to be responsible if people have to be moved, for retaining/maintaining the mauri. It would be easier if you had a prior connection to the land you are moving to, but I don't think that would be the case for many people, therefore, how to establish and create one. It's

all of those intangible values, I don't think the physical relocation is much of a challenge at all, it's the values".

The challenges faced during the relocation process by the survivors of Tūhourangi and Ngāti Rangitihi were many. Relocating away from ancestral lands comes at a cost to physical and cultural well-being, which is still highly understudied in the literature (Felipe Pérez & Tomaselli, 2021). This is noted by Participant 1 regarding sea level rise:

"*Relocation will be sad. They will always regret having to leave their papakāinga, papa is the earth and that's our mother. We will always mourn the loss of it."*

The decision was made to relocate to the Coromandel region, taking up the offer of land from Ngāti Maru. In the early 20th century, those at Coromandel were invited back by Ngāti Wāhiao chief Mita Taupopoki to live at Whakarewarewa. In doing so, the koiwi (human remains) of Tūhourangi who died while living at Coromandel were exhumed and returned to Whakarewarewa where they were reinterred in the local urupā (cemeteries) (Waaka, 1982). Whakarewarewa is now identified as the kāinga (home) of Tūhourangi alongside their whānau and original occupiers, Ngāti Wāhiao, where they both remain to this day. However, as Participant 2 commented:

"For the whole of both tribes, Tūhourangi and Ngāti Rangitihi there has been no resettlement back at Tarawera after the eruption. I only know of three Tūhourangi people who are living in houses up there."

When relocation was contextualised with climate change, Participant 2 shared:

"Until you're faced with the fact that your marae is impacted by climate change, you'll put the relocation off as long as you can, for sentimental reasons... Until they can be shown the evidence that this is going to happen in the future, there is no impetus to start to do something revolutionary such as moving their marae."

4.5.2.4 Relocation site

Having a relocation site that provides similar and plentiful resources, whakapapa, or opportunities for transformation supported Tūhourangi to relocate in the past and is relevant for future relocation. The awhi from whānau and the importance of keeping whānau together was an important objective of the relocation, as Participant 1 mentioned:

"Had [sic] whānau at Rotorua at Whakarewarewa and they said come and stay…they also knew we could make a living, keep our families together."

In addition, resources and having a sense of place is an important factor when relocation occurred for Tūhourangi, being able to call a place their own and to stand and belong is

integral. This emphasises the move away from risk is not the end goal, for Indigenous people it is just a step on a journey of forging a new relationship with whenua. For instance, Participant 2 shared:

"What's clear for me is that we all yearn for a sense of place (Tūrangawaewae) which is a driving force for Ngāti Hinemihi. Ngāpuna where they settled is a stone's throw from Whakarewarewa… However, we wanted our own place to stand."

A key theme that also arose out of the kōrero was the concept of transformation and post-relocation relationships with land. Transformation is the dominant ideal in climate change adaptation discourse in that any form of adaptation should change the status quo and address social injustice (Siders et al., 2021). Transformative potential arose post-eruption for Tūhourangi at Coromandel, particularly gold mining and the thriving industry of the 19th century, kauri gum digging, as emphasised by Participant 4:

"economic prosperity could possibly have helped determine where they moved to and what offer to take up on."

Conversely, Participant 1 stated:

"I actually think that it was whakapapa that drew them to the Coromandel, economics came second. I think at that time the push was so great to get away from Tarawera that they didn't have time to think about the economic prospects."

Kōrero shared by Participant 2 speaks about the similarity/replication of the relocation destination compared to the original site. Specifically, they mentioned:

"When we came to Ngāpuna they had the puna (water source) to bathe, what they were used to having before, having jobs and that sort of business, it made sense to come here."

4.5.2.5 Comparison of Māori relocations with contemporary managed retreat discourse

The national textual analysis and the case study contrasted the enablers and key considerations of a Māori relocation process of the past with the current focus in policy discourse. Some of these contrasts are highlighted in **Table 4-1**, such as maintaining connection and keeping whānau together, this should also be evident in the selection of the relocation site. This in comparison to Western notions of removing people, disrupting social cohesion, and relocating assets away from risk (Bronen, 2010; Maldonado et al., 2013; Siders et al., 2019). Decision-making for Māori was and should be at the whānau and hapū level, supported by iwi and made for the collective. These decisions should also be conducted in a reciprocal manner ensuring all people included in the process are supported. This is in contrast

to the typical Western practice of decisions being made by local, regional, and central Governments with community consultation (McNamara & Des Combes, 2015; Farbotko & McMichael, 2019), however issues remain around resourcing and effective engagement. Furthermore, the view of buildings, infrastructure, and lands as ancestors rather than assets or commodities will impact how such entities are treated in a relocation process. This comparison calls attention for a parallel relocation process by Māori for Māori which ensures autonomy and incorporates Māori worldviews and values.

Table 4-1: Points of difference between a Māori relocation process of the past with the current managed retreat discourse

	Enablers	***Key considerations for a Māori relocation process***	***Current relocation process policy***
Tuku Whenua – Land Gifting	Availability of land	Protect and keep whānau together + Opportunities and resources for the collective	Remove people + assets from at risk locations
Autonomy / Decision-making	Whānau level decision-making	Decisions made for the collective by whānau, hapū and iwi – High level of reciprocity – Influenced by mātauranga Māori	Decisions made for the individual by local, regional, and central Government – Low reciprocity – Influenced by Western Science and processes
Perspective on Infrastructure and Lands at Risk	Holistic interconnectedness	Ancestor rather than assets – More than bricks and mortar	Asset and infrastructure – Bricks and mortar
Relocation Site	Keep together + maintain connection to place	End goal = Maintain and create connection and tūrangawaewae to whenua + transformation	End goal = Move away from risk

4.6 Looking back to move forwards

This paper identified 51 cases of Māori pā relocation in response to a range of physical natural hazards since pre-colonization (pre–1840) to present time. The case study of Tūhourangi and

Ngāti Rangitihi gave a deeper insight into a historical relocation process and that the decision-making power sat at the whānau and hapū level and was for the collective. The whānau and hapū were supported by whānau and implemented traditional mechanisms of dealing with natural hazards and adversity, such as whanaungatanga (relationships), awhi (support) whakapapa (genealogical connection), tuku whenua (gifts of land), koha (donation) and the utilisation of mātauranga Māori (Māori knowledge) were at the forefront of every decision. The research highlights the rich learnings from kaupapa Māori-based methods focused on understanding Māori process, enablers and barriers that provide insight into how we can respond to climate change. We have focused on only one example in depth after the 1886 Tarawera eruption, there is a wealth of potential further learnings from other examples.

Regarding the current dialogue on relocation as an option to adapt to climate change, for Māori it is important for Government to acknowledge that pā and land, are not just a building or an asset with a monetary value, they are living, breathing ancestors. Interview results reveal that relocating the physical aspects is the easy part, but the intangible aspects of pā and the land present a difficult challenge to relocation. Establishing or maintaining the connection between the present generation and the past is complicated, and there is no one right solution. However, if relocation is autonomous, by Māori for Māori, perhaps drawing from decision-making processes from the past, then innovation can occur as to how this connection is maintained in a relocation process.

A view to the past has strongly highlighted the need for an autonomous approach to climate change relocation by Māori for Māori. This process should avoid a “one size fits all” notion. Whānau and hapū have the authority and the capacity to lead in this space and with their rich histories of relocation, local implementation, and adaptability. Notwithstanding this wealth of experience and knowledge, we cannot negate that society as a whole has a role to support Indigenous adaptation. In the context of Māori, given Te Tiriti o Waitangi, regardless of its debated intention, the Crown has an obligation to actively protect Māori lands and cultural sites and to support kaitiakitanga over their lands. If these principles are not ensured, adaptation risks breaching Te Tiriti.

Despite all of the aforementioned legality, an opportunity exists for substantial change. In establishing a parallel autonomous relocation process for Māori by Māori, we begin the process of redress, as autonomy initiates redress. If the Crown enables a parallel autonomous whānau and hapū-led relocation process and provides lands or resources for relocation, this is the first step in rebuilding the relationship between Māori and the Crown. This alone is a worthwhile endeavour. While this research concerns the Indigenous peoples of A-NZ, we hope that it will also stimulate discussion within Indigenous communities globally.

Acknowledgements

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Chapter 5 – Increased exposure of marae to coastal flooding with sea level rise and adaptation learnings of Ngāi Tamawhariua and Maketū Iwi Collective

To be Published in New Zealand Coastal Society – Coastal Transformation – Co-authorship form: Appendix 5

5.1 Abstract

Sea level rise driven by anthropogenic climate change is disproportionately affecting Indigenous communities globally. In Aotearoa New Zealand, Māori communities and cultural infrastructure are often located at the coast, including marae (Māori meeting grounds). Marae are critical to Māori culture and identity, past, present, and future. Here, we assess the national exposure of marae buildings and land to coastal flooding with sea level rise. By 2150, under shared socio-economic pathway (SSP) 5–8.5, 27% and 28% of coastal marae (total of 186 nationally) are exposed to a 100–year and 1000–year annual recurrence interval (ARI) extreme sea level events, respectively. Furthermore, 13% of coastal marae land parcels have more than 50% of their land area exposed under a 100 ARI & SSP5–8.5. This highlights the vulnerability of coastal marae to increased coastal flooding and their ability to operate as civil defence centres and to host important cultural events. This work also identifies that there may be potential for relocation within some existing marae sites, rather than planned relocation elsewhere. We share two empowering stories of the whānau (family), hapū (sub-tribe) and iwi (tribe) of Ngāi Tamawhariua and the Maketū Iwi Collective who are planning to adapt to climate change and sea level rise. Their innovative approaches focus on identifying internal expertise, collaboration with experts, maintaining decision-making autonomy, and sharing experiences in implementing their adaptation plans. These examples of mana whenua-led adaptation provide key learnings for Māori communities, Governments, practitioners and the wider research community about how to support future climate adaptation planning for Māori communities.

5.2 Introduction

Culturally significant places are a legacy left by our tīpuna (ancestors) that lend a sense of place, identity and connection to the past (Phillips, 2015; Sesana et al., 2021). These sites have important social, ecological, historical, educational and economic value (Pearson et al., 2021). Globally, there are many cultural heritage sites that are situated on low-lying coastal land (Reimann et al., 2018; García Sánchez et al., 2020). This includes in Aotearoa New Zealand (A-NZ), where many low-lying Māori and non-Māori heritage sites are at risk to

increased intensity and recurrence of coastal hazards with climate change (Bickler et al., 2013; Jones et al., 2023).

Sea level rise is affecting peoples, assets, and cultures of flood-prone coastal communities around the world (Hallegatte et al., 2013). It compounds colonial injustices and can contribute to continued marginalisation of Indigenous communities, who despite their generally minimal contribution to anthropogenic climate change, are some of the highest impacted communities (Bronen & Cochran, 2021). However, in response to the climate crisis, Indigenous peoples are reasserting their right to self-determination to be active agents of understanding and managing risks, and safeguarding their land, communities, and environments for future generations (Cochran et al., 2013).

Whānau (family), hapū (sub-tribe) and iwi (tribe), and their marae (Māori meeting grounds), are often located at the coast and/or waterways, some because of their historic proximity to resources, for trade and transport, while others were forcibly relocated by Crown land purchases and/or land confiscations onto what are now hazardous locations (Iorns, 2019; Parsons & Fisher, 2022). Marae are a complex of buildings, each with a role in the functioning of the marae, such as the wharenui or whare tīpuna (meeting house) which is the main building used for hui (meetings), wānanga (workshops), and sleeping, and which also provides a connection to ancestors through whakapapa (genealogy) (Kawharu, 2010; Skinner, 2016). Marae typically have a wharekai (kitchen/dining) and wharepaku (ablution facilities). Marae are one of the last places where Māori lore or tikanga (Māori customs and practices) still govern, upholding rangatiratanga (authority) of hapū and iwi (Tapsell, 2002). The role and function that the marae buildings and land play, particularly during large events is very important, with the ability to host, cater and house large numbers of people often at short notice, both within the buildings and surrounding land, such as to store vehicles and equipment. Marae land can provide space for māra kai (gardens), kōhanga reo (early childhood centres) and kaumatua (elder) housing for example (Bailey-Winiata et al., 2022). In recent times and particularly during Ex-Tropical Cyclone Gabrielle in early 2023, many marae in the Gisborne and Hawke's Bay regions were directly impacted by river flooding and landslide damage, and indirectly by road closures disturbing access to communities (Desmarais, 2023). Climate change will compound these impacts, endangering the heritage, connections, and functionality marae have for tangata whenua (people of the land) and the broader communities they serve.

This research has two objectives. The first objective is to identify the risk of marae land parcels and buildings nationally to coastal flooding with SLR, focused on coastal marae (hereafter marae) within 1 km of the coastline. Building on previous work (Bailey-Winiata, 2021; Bailey-

Winiata et al., 2024), we 1) ascertain the potential exposure of the various marae buildings and land parcels to coastal flooding; 2) apply shared socio-economic pathways (SSP) scenarios; 3) identify the impact of sea level rise by using the exposure to extreme sea level events (ESLs); and 4) incorporate higher resolution LiDAR elevation data. The scenarios investigated included SSP2–4.5 (moderate emissions–current trajectory) and SSP5–8.5 (very high emissions >4°C warmer world).

Hapū and iwi around the country are planning to adapt, however current policy frameworks support council-led adaptation, and there is a need for policy, processes and practices that enable hapū and iwi to plan to adapt (Bailey-Winiata et al., 2022; Stephenson et al., 2024). Thus, the second objective is to showcase impact case studies of the adaptation planning process of two hapū and iwi to share learnings. These case studies are located in the Bay of Plenty from the hapū of Ngāi Tamawhariua near Katikati who are leading their own adaptation planning for their papakāinga (communal Māori housing), and the Maketū Iwi Collective who developed a multi-award-winning community climate change adaptation plan. Together, these examples of Indigenous-led adaptation provide important lessons, for other Māori communities, Governments and researchers.

5.3 Identification of marae land parcels and buildings

A national marae location dataset originally from Te Potiki National Trust (2011) was used as a starting point, and although some marae chose to not be recorded in this dataset, this is currently the best available national information. This was then limited to marae that were within 1 km of the coastline as in the work of Bailey-Winiata (2021) **(Figure 5-1)**. Following this, these marae locations were manually checked using Google Street View, Google Earth Imagery and Māori Maps. These were also used to include marae that weren't part of the initial dataset. Two marae were identified in an ad hoc manner based on the author's identification of additional marae not included in the dataset. These locations were used to create two new data layers: 1) marae land parcels using the NZ Primary Land Parcels polygon dataset (LINZ, 2024b), and 2) marae buildings from the NZ Building Outlines dataset (LINZ, 2024a). Google Earth aerial imagery was used to manually verify marae buildings and adjust land parcels. The boundaries of larger land parcels were reduced to focus on the core marae functions, such as car parks, food gardens, and maintained grass areas, to prevent the skewing of exposure results. In total, there were 186 marae, 186 marae land parcels and 874 marae buildings that were used in the exposure analysis.

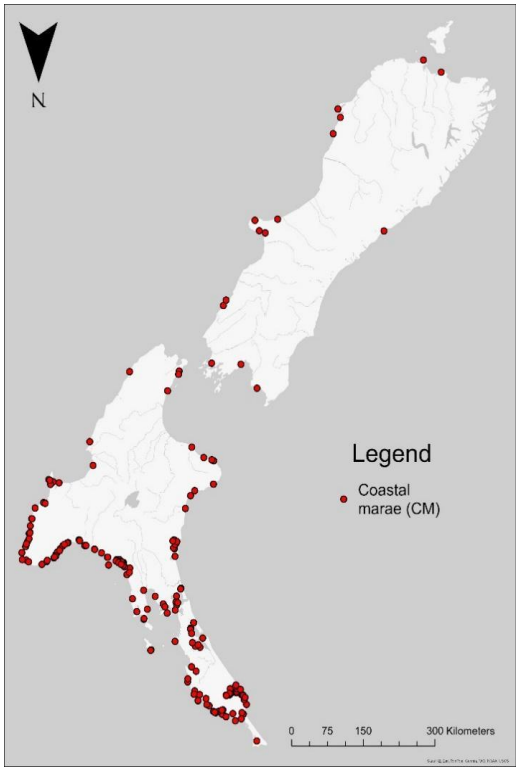

Figure 5-1: National coastal marae shown on a Te Ao Māori view of Aotearoa New Zealand which is "upside down" compared to conventional maps. The North Island is Te Ika a Maui (The fish of Maui). The South Island is Te Waka a Maui (the canoe of Maui) (Ka'ai & Higgins, 2004; Hikuroa, 2020)

5.4 Exposure of marae land and buildings to coastal flooding with sea level rise

To model potential exposure of marae land and buildings to coastal flooding with sea level rise, we utilised ESL data from Paulik et al. (2023b) who quantified A-NZ land area exposure to coastal flooding from extreme sea levels and relative sea level rise which includes vertical land movement (VLM) (Kopp et al., 2014; Naish et al., 2024). Paulik et al. (2023b) produced 1) water levels along the coast for 2–to–1000–year ARI ESL with increasing relative sea level rise increments, and 2) potential land coastal flooding extents and depths using a static model (bathtub approach). This dataset does not account for river flooding, only coastal flooding with sea level rise. Here we focus on the commonly used 100–year ARI, as well as an extreme scenario of a 1000–year ARI event under the SSP2–4.5 and SSP5–8.5 p50 scenarios inclusive of vertical land movement (Ministry for the Environment, 2024). We used RiskScape to calculate the maximum water depth intersecting the marae land and individual building polygons and the percentage of the land or building polygon exposed to coastal flooding in each scenario (Paulik et al., 2023a). Due to the presence of multiple marae buildings inside marae land parcels, and the intersection of these buildings with the modelled flood exposure metrics, there is a possibility that only some of the marae buildings are exposed to SLR, whilst

others are not. In these scenarios, the data/model is able to represent individual exposure of these buildings, providing a more accurate representation of building exposure.

5.5 Marae adaptation case study interviews

Ngāi Tamawhariua and the Maketū Iwi Collective (consisting of multiple hapū), are leaders in hapū-led climate adaptation planning. Information for these two case studies was shared through four interviews and written questions with two leaders of the adaptation strategies from each case study. These interviews were centred on the five key questions below to share learnings, as well as to share empowering messages of hope and resilience for other whānau, hapū, and iwi who are considering adaptation. These case studies were chosen due to the exceptional leadership of these hapū in national Māori climate adaptation planning. This information was collected in line with human research ethics approval through the University of Waikato (HRECS(HECS)2022#02 and **Appendix 1**). All interview data is used with permission of those involved, who are also co-authors of this paper.

The open-ended questions were designed to provide guidance for other Indigenous communities at risk from the experiences of the two case study hapū (Brinkmann & Kvale, 2018). This is also a culturally congruent method aligned with kaupapa Māori research methodologies for open and honest discussions (Bishop & Glynn, 1999).

1. Do you feel like you have/had enough relevant information and data to support your planning?
2. What additional support do you think would have helped?
3. Are you already experiencing flooding at your marae and/or wāhi tapu?
4. Do you have any plans for implementation?
5. Do you have any messages for whānau who are beginning to think about climate change planning for their marae?

5.6 Marae exposure to extreme sea levels

By 2050, 14.5% and 17% of a total of 186 marae may be exposed to coastal flooding with 100–year ARI and 1000–year ARI ESLs respectively under SSP5–8.5. By 2150, under SSP5–8.5, 27% and 28% of the 186 marae are exposed to 100–year ARI and 1000–year ARI ESLs respectively. However, it is the timing that is most concerning as 14.5% and 17% of a total of 186 marae are likely to be impacted by 2050. We further identified the exposure of marae buildings under both 100–year ARI and 1000–year ARI under SSP2–4.5 and SSP5–8.5 **(Figure 5-2)**, which shows similar trends of increasing over time.

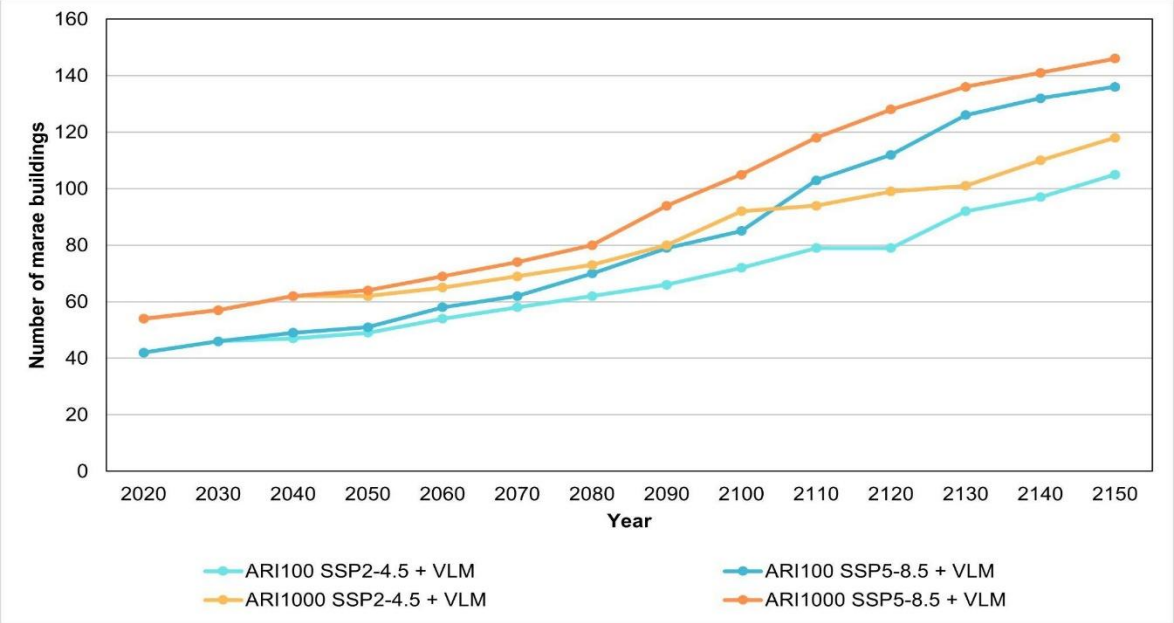

Figure 5-2: National exposure of marae buildings to coastal flooding with sea level rise for different ARI extreme sea levels and SSPs

We identified the percentage exposure of marae land and buildings exposed to 100–year ARI ESL under SSP5–8.5 to 2150 **(Figure 5-3)**. For marae buildings with 75–100% of their building area exposed, a total of 13% of the 874 marae buildings would be exposed to coastal flooding under the 100–year ARI and SSP5–8.5 scenario at 2150 **(Figure 5-3A)**. In terms of marae land parcels with more than 50% of their land parcel area exposed, a total of 13% of the 186 marae land would be exposed to coastal flooding under the 100–year ARI and SSP5–8.5 scenario **(Figure 5-3B)**. The largest numbers of marae are at both extremes of percent land exposure, i.e. 0–25% and 75–100% exposure through time. For example, under a 100–year ARI and SSP5–8.5 at 2150, 10% of the total 186 marae land have <25% (not including those with 0%) of their land exposed. This highlights an opportunity for these marae to potentially relocate buildings within their existing land parcels, noting that more comprehensive investigations would be required such as identifying any accessibility issues, suitability of the terrain and other potential hazards. Lastly, 10% of the total 186 marae land have 75–100% of their land parcel exposed. These marae have less opportunity to relocate within their marae land parcel, hence either they can relocate within their wider land parcel (given we reduced some of the larger parcels), or to another land parcel elsewhere or other approaches to adapt such as hard engineering or nature-based solutions.

A **B**

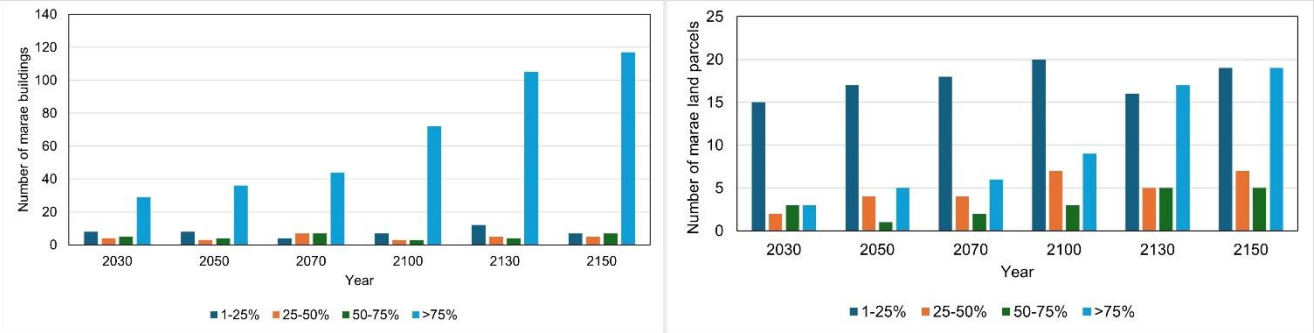

Figure 5-3: Percentage exposure of (A) Marae buildings; and (B) Marae land to 2150 under ARI–year 100 & SSP5-8.5. *These graphs do not include those with 0% exposure

Predicted water levels at the location of the marae buildings and within land parcels exceeded 5.5m in some locations. There is a large proportion of marae buildings and land exposed at flood heights between 0–1.5m by 2150 **(Figure 5-4)**. In terms of marae buildings **(Figure 5-4A)**, there is a lack of detailed information on marae building elevations. However, in general, marae buildings are either on concrete slabs with heights of around 0.15 m or on piles with heights of around 0.45 m (Paulik et al., 2024). The majority of coastal flood heights

of marae buildings is less than 1 m **(Figure 5-4A)**, so not only will there be direct flood damage of marae buildings, but other subsequent impacts, such as increased moisture under piled marae buildings, potentially resulting in mold and rot. Marae land also followed similar trends to marae buildings, with more represented at lower water depths, however, is more variable in terms of depth through to 2150 as compared to marae buildings **(Figure 5-4B)**.

A **B**

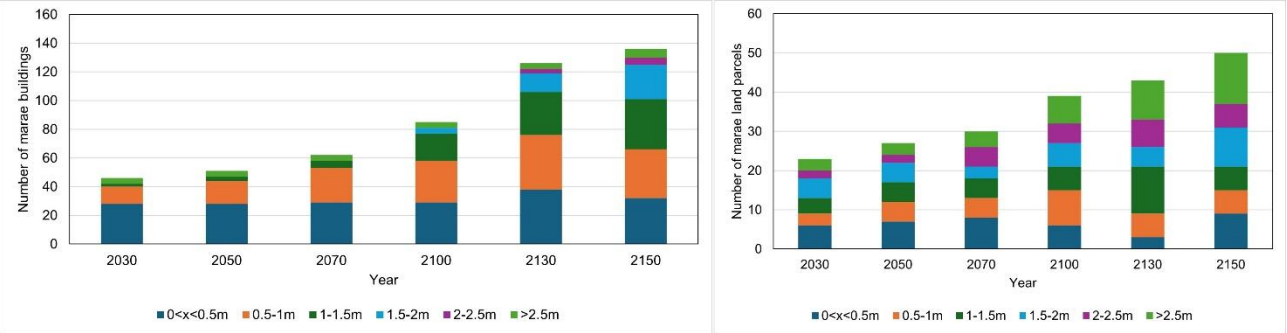

Figure 5-4: Maximum flood water depth for (A) Marae buildings; and (B) Marae land parcel to 2150 under 100–year ARI & SSP5–8.5. *These graphs do not include those with 0 m water depth

5.7 Marae vulnerability – Moving forwards

From our discussions with the hapū and iwi who are looking to plan for climate change, accessible and relevant data is important to aid decision-making and to guide processes such as adaptation. Importantly, given the absence of consideration for other hazards in this paper, such as river flooding, the full picture of risk to marae may be higher. We therefore identify multi-hazard assessments as a critical future research need. However, data is only part of the equation. For the hapū and iwi we interviewed, a number have lived experience of flooding events in recent times, and data confirming what they already know/have seen, sometimes can be seen as superfluous in contrast to enhanced support to adapt. Although, it is also acknowledged that such information can help add more detail to the current understanding and provide added impetus to act.

We now showcase two examples of where hapū and iwi are leading their own adaptation and climate change discussions. Both introduce the risk context, discuss the processes and partnerships developed, and share key lessons to feed into discussions on mainstreaming Indigenous climate adaptation.

5.7.1 Ngāi Tamawhariua – Adaptation planning supported by research

Te Rereatukāhia Marae of Ngāi Tamawhariua is situated in the Northern reaches of Tauranga Harbor near Katikati, alongside Te Rereatukāhia Awa in the Bay of Plenty. Tamawhariua whare tīpuna is elevated more than 15 m above sea level and is not directly impacted by coastal flooding now, or in future based on our analysis **(Figure 5-5A)**. However, large areas of the papakāinga of Ngāi Tamawhariua is situated below the marae on low-lying land between the awa and the estuary and in places less than 1.5 m above sea level **(Figure 5-5B)**. The area has been exposed to riverine flooding, and parts of the papakāinga were evacuated three times in 2023 including during Ex-Tropical Cyclone Gabrielle. Ngāi Tamawhariua also have an urupā (cemeteries) in the estuary on the island Tūtaetaka, which is experiencing coastal erosion on its North–Western side, unearthing historical kōiwi (human remains) following large storm events **(Figure 5-5C)**.

Ngāi Tamawhariua are forging a pathway forward to plan and respond to natural hazards and climate change in a way that is led and informed by their whānau, for their whānau. The Chair of Ngāi Tamawhariua, Hone Winder-Murray, shared the importance of being connected to skilled people who have connections within the research and industry spaces, such as with research groups like Project Kāinga – a Ministry of Business, Innovation and Employment Endeavour funded project around Māori climate change resilience with whom they have been working with. Hone shared:

"*We are lucky to have some seriously skilled people working with us and for us. Those skilled personnel have been fortunate enough to tap into places and people who have provided the funding required to seek out relevant data needed for the kaupapa. Beneficiaries of the hapū were equally important as they provided the insights into what future they want/wanted. Without their survey data – we could not determine the shaping of a safe, healthy and thriving kāinga for the future."* – Hone Winder-Murray

As Hone mentioned, equally as important is to have the whānau of the hapū onboard to ensure that whatever decisions are made, are in the best interests of the people and achieve the futures they desire. Ngāi Tamawhariua held a series of wānanga as part of Project Kāinga, centred around hapū and kāinga (housing) resilience in the face of climate change **(Figure 5-5D)**. These were attended by whānau of Ngāi Tamawhariua and researchers including social scientists, anthropologists and coastal scientists. This community input was echoed further by Anne Billing, project manager for community projects with Ngāi Tamawhariua. Anne shared:

"Bring whānau on board who have a background in the climate change space. This will save a lot of time if the right person/people are available and willing to share… We also undertook a capacity and capability survey of all whānau including those who live away, what skills, knowledge, capacity, capability already exists in house." – Anne Billing

Figure 5-5: (A) Tamawhariua Whare Tīpuna; (B) Te Rereatukāhia papakāinga looking from Marae, Tauranga Harbour to the left and Te Rereatukāhia River to the right of image; (C) Tūtaetaka Island - Urupā experiencing coastal erosion; and (D) Whānau climate change wānanga (Image source: A/D - H. Winder-Murray, B/C - A. Bailey-Winiata)

Moving forward, Ngāi Tamawhariua are in the process of publishing their Kāinga Plan, a 100–year road map to climate adaptation and resilience for Ngāi Tamawhariua, which is the result of five years of research with Project Kāinga. This identifies a 100–year vision outlining key priorities moving forward for their hapū that can be used for informing climate change discussions as well as other decisions. In response to the question, *Do you have any messages for whānau who are beginning to think about climate change planning for their marae?* Anne responded:

"Get the tamariki (children) and rangatahi (young people) onboard, the future is theirs… create a long-term vision and use docs such as hapū management plans to identify what the current generation can do to start building the foundation for future generations to build on." – Anne Billing

5.7.2 The Maketū Iwi Collective – A community climate change plan embedded in Te Ao Māori

The Maketū Iwi Collective is a combined working group with representatives from Te Rūnanga o Ngāti Whakaue ki Maketū, Whakaue Marae Trustees and Ngāti Pikiao Environmental Society, in the coastal town of Maketū, in the Bay of Plenty. Maketū is situated between two estuaries, Te Awa o Ngātoroirangi fed by the Kaituna River to the North–West of Maketū town and Waihī estuary to the East. In April 2023, the Maketū Iwi Collective published He Toka Tū Moana Mō Maketū – Maketū Climate Change Adaptation Plan, which was supported and developed by the broader Maketū community with support from Bay of Plenty Regional Council (Maketu Iwi Collective, 2023). Their plan encapsulates their collective approach to tackling climate change issues, specifically forging their own pathway forward with climate adaptation for their whānau, hapū and wider community. This plan was informed by a series of wānanga to gather kōrero (discussions) and aspirations for their future as a collective. These were then illustrated in the plans five key priorities: 1) Haumarumaru (Security and self-sufficiency); 2) Te Puna Mātauranga (Collective knowledge and wisdom); 3) Manaaki Kāinga (Caring for our home); 4) Manaaki Whenua (Caring for our lands); and 5) Manaaki Wai (Caring for our waters) see **(Figure 5-6A)**. Roana Bennett, one of the plans facilitators mentioned:

"We led our own process. Our facilitators are all from Maketū, and the people came when we put out the call. It was important to centre the wānanga inside our own world view, and our community respected and appreciated that approach" **–** Roana Bennett

Whakaue (Tapiti) Marae, belonging to the hapū of Ngāti Whakaue ki Maketū is situated on the shores of Te Awa o Ngātoroirangi. It has experienced coastal flooding in recent years and was identified in our analysis as being exposed to coastal flooding with sea level rise in all scenarios modelled. This is no surprise to the iwi collective who are pragmatic in the face of this risk for their marae and have included it as one of their key priorities, "caring for our home", in their plan. Roana Bennett, shared a kōrero of rangatiratanga (self-determination):

"We are not a vulnerable community. We don't need outsiders to determine our future. We are capable. We can respond to climate change as a community. We can help ourselves in an emergency. We expect councils and Government to do their share of the work. But when you come into our community, we will lead the conversations, we will advise the priorities" – Roana Bennett

Following on from their successful adaptation plan, implementing their key actions and achieving their key priorities is currently underway. However, implementation is slow due to lack of resourcing, but it is still happening, such as the recent Maketū Climate Change

Community Day, see **(Figure 5-6B)**, bringing together hapū, community, community projects and groups, and researchers and scientists to showcase their local and regional work. Elva Conroy, one of the writers of the plan, shared kōrero around implementation:

"Plan development is easy. But plan implementation is hard, additional support could include resourcing for project coordination, community engagement… Small grants enable communities to collectivize and plan – and to connect with councils to ensure that the big investments are done right and are well supported by the community." – Elva Conroy

Moving forward, the Maketū Iwi Collective and broader Maketū community are forging their pathway for implementation of their plan, receiving well deserved accolades such as awards at the New Zealand Planning Institute Conference **(Figure 5-6C)** and continuing to be role models for other whānau embarking on their adaptation journey. When asked, "*Do you have any messages for whānau who are beginning to think about climate change planning for their marae?"* Roana shared:

"Working as an iwi collective with a clear focus on climate change has provided us with a sound foundation upon which to build our climate change whare… Inviting the community into our space, into our climate change whare, has meant that the plan is embedded in Te Ao Māori – and that all members of the community see the plan as relevant to them… We will NOT retreat from the estuaries and rivers where we have been kaitiaki for 800 years… We may build new papakāinga, but we will always be kaitiaki of the rivers and estuaries." – Roana Bennett

Figure 5-6: (A) Maketū Climate Adaptation Plan; (B) Maketū Community Day with Rangatahi playing an adaptation serious games with the National Institute of Water and Atmospheric Sciences (NIWA); and (C) Maketū community photo at Whakaue Marae (Image sources: R. Bennett)

5.8 Lessons moving forward

Beyond technical data, these two case studies share rich, practical examples demonstrating how adaptation is already occurring despite considerable scientific and policy uncertainty. Both examples emphasise key messages to empower other hapū and iwi who are at the beginning of their adaptation journeys. There are key messages for three core audiences: tangata whenua, Government and the scientific/ research community.

The case studies share an empowering perspective, but we acknowledge the intergenerational struggle and mamae (pain) that has been endured by those past and present of these two hapū, and others around the nation, to get to this position. While progress has been made, a challenge is how to effectively mainstream these lessons, so other marae can build on tested processes and practices. The goal is to formulate fit-for-purpose policy responses for Indigenous communities by working together to outline a process that centres Māori knowledge, skills, and values, and which can draw from more explicit policy support, similar to other works such as Makondo and Thomas (2018) and Drake et al. (2023). We also

emphasise the value of resourcing communities to act, as well as the provision of more multi-hazard data that can stimulate difficult conversations.

For tangata whenua a key lesson from these stories of hope and resilience is that rangatiratanga (self-determination) can still be pursued and future generations can be protected. There is great value in reaffirming hapū and iwi rangatiratanga in the adaptation process, that allows adaptation to unfold in a way that the state could not achieve alone. Interviewees also emphasised the importance of ensuring multi generations are represented at the decision-making table and to take a multi-generational perspective that prioritizes future generations.

Lastly, for researchers and practitioners, to align and co-develop their projects in a partnership with hapū and iwi to help protect cultural heritage and share knowledge and expertise in future climate adaptation plans and practice. These partnerships need to be collaborative and go beyond only providing technical data on climate change and hazards, to generate new community and scientific capacities and capabilities. To provide a resource for hapū and iwi to guide conversations around sea level rise and adaptation, we have summarised some of the key findings in an infographic in

Figure 5-7.

5.9 Conclusion

Coastal marae around Aotearoa New Zealand are at risk of coastal flooding with sea level rise. By 2150, under SSP5–8.5, 27% and 28% of coastal marae are projected to be exposed to extreme sea levels from a 100–year ARI and 1000–year ARI respectively. Looking deeper at the risk of individual marae buildings and their land parcels paints a similar picture. 13% of coastal marae land parcels have more than 50% of their land area exposed under 100–year ARI & SSP5–8.5. After Cyclone Gabrielle in 2023, many communities, particularly hapū and iwi, are beyond the need for data to tell them what they already know, with many having lived experience of the hazard, and who are unable to wait for new data, policies or equitable resourcing to protect their marae. The case studies shared from Ngāi Tamawhariua and the Maketū Iwi Collective highlight opportunities around resourcing, partnerships, hapū and iwi autonomy, and the central importance of those who have gone before and those that are yet to come. To quote Roana Bennett, “We don’t need outsiders to determine our future, we are capable, we can respond to climate change as a community”.

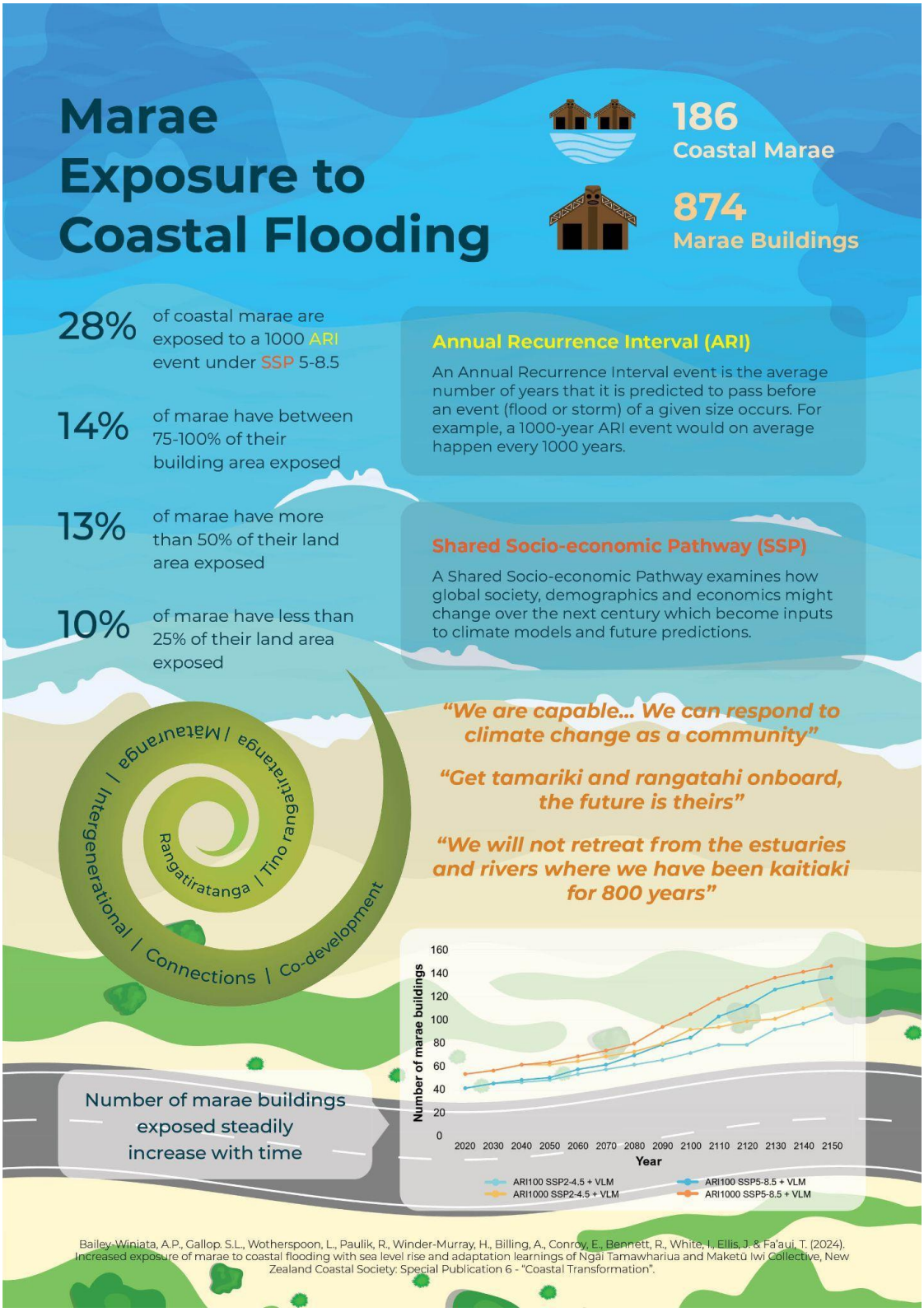

Figure 5-7: Infographic highlighting key statistics of marae exposure to sea level rise and some messages of empowerment from Ngāi Tamawhariua and the Maketū Iwi Collective

Chapter 6 – Climate Change Adaptation by Indigenous Peoples: Challenges and Opportunities

A target journal is yet to be identified - Co-authorship form: Appendix 6

6.1 Abstract

Indigenous peoples have responded to environmental changes for centuries. However, climate change is rapidly causing unprecedented challenges for many communities worldwide, particularly on the coast. There is burgeoning literature by Indigenous and non-Indigenous scholars regarding adaptation decision-making and implementation for coastal Indigenous communities, with a strong focus on local and national barriers that inhibit adaptation. We aim to identify and synthesise adaptation challenges faced by Indigenous communities globally and highlight opportunities to overcome these challenges. We undertook a systematic review of 73 peer-reviewed publications, identifying four broad challenges coastal Indigenous communities face during climate change adaptation: recognition, resourcing, respect, and redress. By bringing these challenges to the forefront and compiling and discussing the opportunities to break down these barriers, this research aims to foster new connections, knowledge and agendas. Looking across these studies provides the possibility of new perspectives to inform national policy or international collaboration, in particular, the basis for centring and engaging Indigenous knowledge in adaptation plans and the potential for enhanced solidarity, learning, and advocacy between global Indigenous communities. We identified four broad challenges that Indigenous communities appear to face continuously. These challenges include recognizing and allowing space for Indigenous knowledge and methodologies, securing adequate resources, fostering respectful and meaningful engagement, and seeking redress for past injustices. The common experiences highlighted by this research suggest that, although these issues are acknowledged in adaptation research and practice, there needs to be a greater political focus on addressing them.

6.2 Introduction

Coastal environments are highly valued by many Indigenous peoples, including for their rich resources such as food, water, and transport pathways, as well as the spiritual significance water and the ocean play in many cultures (Vierros et al., 2020; Fischer et al., 2021). The coast is a complex interface of multiple environments (terrestrial and marine), uses, stakeholders, and investments that can generate “wicked problems” that are complex and challenging, with various feedbacks with high uncertainty (Brown et al., 2014). In many

locations, the coast is under increasing risk of natural hazards, including flooding and erosion that are exacerbated by climate change (Nicholls & Cazenave, 2010; Cazenave & Cozannet, 2014) and anthropogenic activities such as housing and infrastructure intensification (Salmond et al., 2022; Smith et al., 2022).

Adaptation to climate change involves actions that actively reduce the risk and vulnerability of communities to climate impacts and pursue opportunities that build the capacity and resilience of communities to withstand those impacts (Tompkins et al., 2010; Noble et al., 2014). The key types of adaptation actions are commonly referred to as the PARA framework (Doberstein et al., 2019; Shaieree et al., 2021): **P**rotect with hard engineering (Nicholls et al., 1995) and/or soft (nature-based) solutions (Adger et al., 2005; Morris et al., 2018). **A**ccommodate — the continual utilisation of the area at risk involving engineering techniques such as raising buildings on stilts (Jamero et al., 2017). **R**etreat — reduces risk by relocating or abandoning at-risk coastal communities and land (Hino et al., 2017; Haasnoot et al., 2021). Lastly, **A**void — to actively discourage future development in at-risk locations (Doberstein et al., 2019).

While the PARA framework is a modern construct, adaptation to environmental and climatic changes is not new. Indigenous peoples have adapted to environmental change for centuries, incorporating knowledge and methods that seek to maintain relationships with the natural world (Kelman et al., 2012; Wilkinson et al., 2022). This relationship with the natural world is significant to many Indigenous peoples, cultures, and identities (Whyte et al., 2016; Reed et al., 2021). However, also common to Indigenous peoples is the ongoing pressure placed on this relationship and their ability to respond to changing environments due to colonisation (Maldonado et al., 2013; Bronen & Cochran, 2021). The marginalisation of Indigenous peoples due to colonisation has led to increased vulnerabilities to the impacts of climate change, such as being forced onto hazardous marginal land, lower socio-economic opportunities, and restrictions of individual land tenure preventing mobility (McEvoy & Mitchell, 2019; Johnson et al., 2021).

For Indigenous communities, climate change is just one of the many social, economic, cultural, and environmental issues they face, and other priorities often take precedence (such as health and safe homes) due to lack of resourcing and capacity (Kettle et al., 2018; van der Ploeg et al., 2020). However, many Indigenous communities are planning to, or being forced to adapt to, natural hazards and climate change, including Inupiat and Yupik of Alaska, USA (Bronen, 2015; Bronen et al., 2020), Biloxi-Chitimacha-Choctaw and Pointe-au-Chien of Coastal Louisiana, USA (Maldonado, 2014; Bethel et al., 2022), Aboriginal and Torres Strait Islanders of Australia (Green et al., 2010; McNamara & Westoby, 2011; Reid et al., 2014), and Māori in Aotearoa New Zealand (Manning et al., 2015; Colliar & Blackett, 2018; Blackett et al., 2021).

The aim of this research is twofold. First, to identify and synthesise the common challenges that Indigenous communities around the world have encountered when planning/implementing adaptation to climate change. Second, to highlight how Indigenous communities have made progress and distil these examples into potential pathways forward. To achieve this, we systematically review the literature on Indigenous community adaptation around three key questions: 1) What are the common challenges to adaptation? 2) What approaches were used to overcome the challenges? 3) What are the key lessons of what works and what doesn't work to support Indigenous communities in adapting?

Taking this global focus is imperative, not just because climate change is a global issue, but also because it provides the necessary foundation for solidarity and action amongst us as global Indigenous peoples, fostering mutual learning and knowledge exchange and potentially helping mainstream Indigenous approaches to climate change adaptation.

6.3 Methodology

A systematic review is a structured/systematic process of reviewing literature that originated in the health sciences and has become widely used in climate adaptation research (Berrang-Ford et al., 2015; Flynn et al., 2018; Ford et al., 2021; McNamara et al., 2021; Schlingmann et al., 2021; Hagen et al., 2022). We used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) approach to search and select the literature (Moher et al., 2009; Page et al., 2021).

This review identified literature indexed in Web of Science, Scopus, and EBSCO hosts Greenfile databases, in line with other similar systematic reviews (Flynn et al., 2018; Mbah et al., 2021; Schlingmann et al., 2021). Search strategies were created using Boolean operators and keywords, which were searched in the three databases mentioned earlier **(Table 6-1)**.

Table 6-1: Search strings used to search in Web of Science, Scopus and Greenfile

Database	***Search string***
Web of Science (277 records)	TS (Indigen* OR native OR Aborigi* OR tribal OR "first nation" OR Māori) AND TS ("climate change" OR "climate adapt*") AND TS (adaptation) AND TS (coast* OR "sea level*")
Scopus (186 records)	TITLE-ABS KEY (Indigen* OR native OR Aborigi* OR tribal OR "first nation" OR Māori) AND TITLE-ABS-KEY ("climate change" OR "climate adapt*") AND TITLE-ABS-KEY (adaptation) AND TITLE-ABS-KEY (coast* OR "sea level*")

Greenfile (81 records)	TX (Indigen* OR native OR Aborigi* OR tribal OR "first nation" OR Māori) AND TX ("climate change" OR "climate adapt*") AND TX (adaptation) AND TX (coast* OR “sea level*”)

The database filters limited the literature identified to only peer-reviewed and published articles and reviews in English from all time frames. We recognise the limitation of using only published, peer-reviewed research from these platforms in English, meaning that we are not capturing information in other languages, nor oral information (a common method of Indigenous knowledge transfer), unless it was captured within the peer-reviewed literature (King et al., 2018; Amare & Gacheno, 2021). This approach may also result in some geographic areas being underrepresented in this review. The systematic review was split into three stages: identification, screening and inclusion.

6.3.1 Identification

The searches were conducted in May 2022 and identified 544 records dating from 1991 to 2022, with most papers published post–2010. Following this, duplicates were removed using the Endnote software “Find duplicates” function (*n*=126), and some were manually removed (*n=39*) **(Figure 6-1)**.

6.3.2 Screening

The remaining records (n=379) were screened by title and abstract against the below inclusion and exclusion factors (IEF), where the record had to include any relation to Indigenous knowledge in adapting to climate change at the coast and/or be related to case studies of coastal Indigenous peoples/communities in adapting to climate change-related hazards. In addition, we excluded literature that was unrelated to Indigenous peoples, communities, culture and knowledge, anything that was related to adaptation to anything other than climate change-related events by coastal Indigenous communities and lastly, anything related to adaptation of Indigenous peoples/communities deemed as not from or within a coastal environment.

Following the title/abstract screening, (*n=233*) were excluded, and (*n=146*) were included and assessed for eligibility following the IEF. These reports were evaluated against the IEF, with some reports excluded for reasons **(Figure 6-1)** such as:

1. Has no relevance to Indigenous communities and their adaptation to the impacts of climate change at the coast.

2. Has no relevance to coastal hazards or sea level rise.
3. Text in another language.
4. Duplicate; and
5. Has no relevance to adaptation.

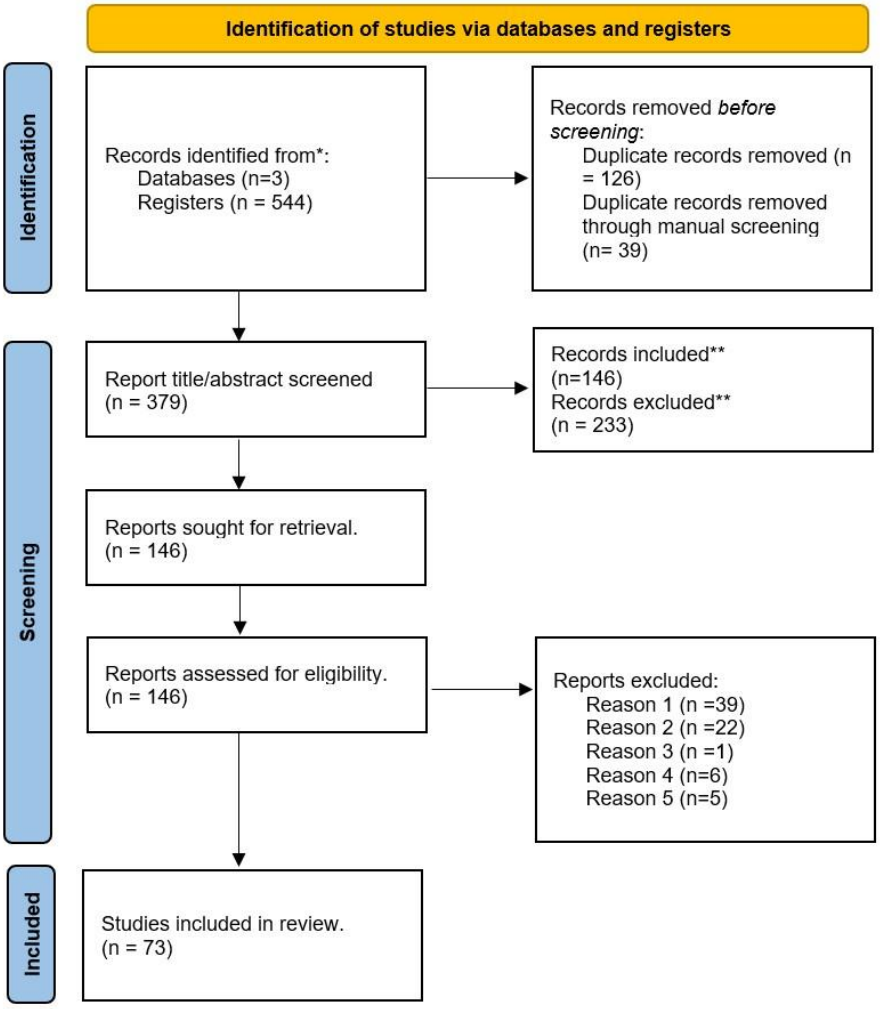

Figure 6-1: PRISMA flow diagram outlining the steps taken during the systematic review (including total numbers of records included or excluded)

6.3.3 Included

This resulted in *n=73* records for inclusion in the systematic review. Each record was manually read, and adaptation challenges and approaches to overcome those challenges were recorded. The data extraction used NVIVO software to keep track of each aspect relating to our focus to identify the key themes centred around the challenges Indigenous communities encounter when planning or implementing adaptation. Themes are patterns of shared ideas or concepts identified through the systematic review and regularly discussed through the literature (Braun & Clarke, 2022). The themes highlighted in the literature can be categorised

into four broad categories: 1) Recognition, 2) Resourcing, 3) Respect and 4) Redress. These four categories will be discussed in detail below.

6.4 Results and discussion

This section combines results and discussion. We combine data on identifying the challenges with the approaches used to overcome these issues.

6.4.1 Recognition: Give space for Indigenous knowledge and methodologies

Indigenous knowledge is intrinsic to each Indigenous culture, community and peoples around the globe, formulated from intergenerational experiences of living within local environments (David-Chavez & Gavin, 2018). Indigenous knowledge provides a wealth of information, including for climate change and adaptation, ranging from an understanding of the changes that have occurred within the environment (McNamara & Westoby, 2011; Maldonado, 2015), to the types of adaptation responses (Zander et al., 2013; Wyllie de Echeverria & Thornton, 2019). However, this review highlights some of the missed opportunities and ongoing struggles for the recognition, autonomy, relevance, and value of Indigenous knowledge to be realised in adaptation planning and practice (O'Neill et al., 2012; Green et al., 2021; Leonard, 2021; Maldonado et al., 2021; Piggott-McKellar et al., 2021). Two of the critical recurring challenges related to Indigenous knowledge that we identified were: 1) contrasting epistemologies between Indigenous knowledge and science and 2) the incorporation and integration of Indigenous knowledge and science into adaptation planning frameworks.

Indigenous knowledge and science have contrasting epistemologies, reflected in the history of the use of science as a method of colonising Indigenous peoples, which makes integrating the two challenging and sometimes not appropriate (O'Neill et al., 2012). This relationship has resulted in a perceived superiority of science and the institutions which conduct it (Dutra et al., 2018), invoking the dismissal and devaluation of other knowledge systems, including Indigenous knowledge (Mercer et al., 2012; Hopkins et al., 2015; de Scally & Doberstein, 2021; Loch & Riechers, 2021; Thompson & Ban, 2022). Many papers highlight the necessity of Indigenous knowledge to benefit adaptation plans and the missed opportunities where it was not utilised (O'Neill et al., 2012; Maldonado, 2015; Christie et al., 2018; Brady & Leichenko, 2020; Leonard, 2021; Bethel et al., 2022; Sultana & Luetz, 2022). One such example was identified by Nunn and Campbell (2020), where the omission of Indigenous knowledge led to the increased exposure and vulnerability of coastal communities situated on land deemed hazardous by local Indigenous people at the time of the development (Nunn & Campbell, 2020). Furthermore, they noted that if Indigenous knowledge was factored into

initial planning, it would have substantially reduced the cost for those coastal communities they identify as currently at risk.

The second related challenge for Indigenous adaptation is the lack of frameworks that integrate Indigenous knowledge and science meaningfully and respectfully. For instance, several papers discuss incorporating Indigenous knowledge and science for adaptation policy and planning. Many use terms such as “incorporation”, “integration”, “co-creation” or “co-production” of knowledge (Mercer et al., 2012; Hiwasaki et al., 2014; Hiwasaki et al., 2015; Dutra et al., 2018; Manrique et al., 2018; Bronen et al., 2020; de Scally & Doberstein, 2021). Various terms exist, each with different meanings and frameworks for inclusion or power sharing. For example, Hiwasaki et al. (2015) posit that Indigenous knowledge must be integrated with science before it can be utilised by disaster risk reduction, climate change policy, or research. They developed a process with small coastal communities in Indonesia, the Philippines and Timor-Leste, which integrated their Indigenous knowledge of hydro-meteorological hazards and climate change with science. This process involved observation, documentation, validation, and categorisation of their Indigenous knowledge. Validation consists of the community assessing whether 1) the knowledge is widely practised in the study area, 2) it is older than one generation, 3) it is still being used, and 4) it is effective in preventing or mitigating the hazard. Furthermore, they categorise what they call Local Indigenous Knowledge (LINK) into four categories: 1) LINK which can be scientifically explained/validated and is related to disaster risk reduction (DRR) and climate change adaptation (CCA); 2) LINK which cannot be scientifically explained/validated but is related to DRR and CCA, 3) LINK which can be scientifically explained/validated but is not related to DRR and CCA, and 4) LINK which cannot be scientifically explained/validated and is not related to DRR and CCA. They identify specifically for Indigenous knowledge in Category 2, which is that some Indigenous knowledge cannot be scientifically explained/validated but is still relevant and should be considered for DRR and CCA. However, the process of evaluating and integrating Indigenous knowledge in Category 2 with science has yet to be defined.

In contrast, some papers opposed making Indigenous knowledge conform to a known Western scientific process, as Thompson and Ban (2022) discuss that we must move beyond including Indigenous knowledge or perspectives and instead centre Indigenous self-determination, sovereignty, and anti-colonial methods into adaptation planning and processes. The development of the WAMPUM framework of Leonard (2021) exemplifies this. **W**itness: witness warnings from human and non-human relations and follow natural environmental rhythms; **A**cknowledge: acknowledge and restore traditional teachings and stewardship practices; **M**end: heal the coastline and practice environmental sovereignty; **P**rotect: protect future generations, cultural sites and connection to ancestors; **U**nite: build capacity and capability

with other communities; and **M**ove: move to new places with cultural connections and rebuild community (Leonard, 2021). This framework embraces Indigenous knowledge and resilience among Eastern coastal tribal nations of the USA. It has similar sentiments to Thompson and Ban (2022) that the continued use of adaptation frameworks not created by and for Indigenous Peoples in response to sea level rise only furthers adaptation oppression (Marino, 2018). Furthermore, Leonard (2021) highlights the issue with current popular adaptation frameworks such as PARA (protect, accommodate, retreat, and avoid) (Doberstein et al., 2019) and AAN (armouring, acquisition, and renourishment) (Siders & Keenan, 2020), whose terminology and foundations are combative and militaristic, creating a divide between humans and nature, which is antithetical to Indigenous world views of kinship, relationality and ecocentric connections between humans and our non-human counterparts. Others shared similar sentiments about language, such as Maldonado et al. (2021), who wrote about Government-developed adaptation aid created to support adaptation by the Isle de Jean Charles Biloxi-Chitimacha-Choctaw tribe in Louisiana, USA. The aid was full of political and institutional jargon with confusing and unclear language and lacked community input, ultimately acting against its intended purpose. These two papers allude to the need for a more robust system of engaging with the community in the first instance and a review of the adaptation process, options, language, and dissemination of aid documents. Ford et al. (2021) go further and argue that prioritisation of Indigenous knowledge in future research would be a first step for redress of historical marginalisation and impacts of colonialism on Indigenous communities and should actively be encouraged.

Leading with or incorporating Indigenous knowledge into adaptation is nothing new; many examples of adaptation founded on Indigenous knowledge and led by Indigenous communities include historical mobility or community relocation (Zander et al., 2013; Petheram et al., 2015; Wyllie de Echeverria & Thornton, 2019; Nunn & Campbell, 2020; van der Ploeg et al., 2020; Pearson et al., 2021; Piggott-McKellar et al., 2021), Indigenous adaptation protection structures or processes, (McNamara & Westoby, 2011; McNamara et al., 2021), and Indigenous understandings of land, place, and context to support response (Eicken, 2010; Whyte, 2014; Rosales & Chapman, 2015; McNamara et al., 2017). An approach can be seen in Maldonado (2015) who showcased the use of local multigenerational knowledge that Indigenous Native American tribes of Biloxi-Chitimacha-Choctaw and Pointe-au-Chien of coastal Louisiana, USA, used to adapt to coastal inundation. Their extensive expertise and long-standing habitation of their surrounding environment gave them deep insights into environmental changes, including coastal flooding/erosion and saltwater intrusion. In response to these observed changes, some have planted vegetable crops in raised beds to

avoid saltwater intrusion, while others have raised houses and created mounds of rocks, oyster shells and dirt around homes and heritage sites (Maldonado, 2015).

Furthermore, McNamara and Westoby (2011) discuss the importance of Indigenous knowledge in building communities' adaptive capacity in identifying and implementing adaptation options for the Indigenous peoples of Erub Island, Torres Strait, Northern Queensland, Australia. Elders and Aunties (terms of respect) of Erub Island were interviewed about the environmental changes they are currently experiencing and the adaptation options they've implemented. Coastal erosion was identified as an issue, compounded by the proximity of houses to the coastline. The Elders and Aunties shared their use of local materials to build rock walls, their traditional methods of using upright logs as windbreaks, and planting native vegetation to reduce current erosion and encourage accretion (McNamara & Westoby, 2011). A common thread of the challenge to Indigenous knowledge for climate adaptation is the ongoing literature that seeks to make the case of recognising the value of Indigenous perspectives, whether regarding their application in practice or, more fundamentally, their value (de Scally & Doberstein, 2021; Green et al., 2021). While there are excellent examples of adaptation in practice, this theme highlights how much time Indigenous scholars and communities are still spending on creating space and voice for their knowledge or the necessity of culturally appropriate adaptation processes rather than using that time and resources to work on adaptation solutions that can protect their communities.

6.4.2 Resourcing: Invest in people and projects

Resourcing adaptation is an issue for all communities, for planning through to implementation, as well as the maintenance and monitoring of adaptation options once created; both monetary and information resources are needed (Boston & Lawrence, 2018; Hanna, 2019). Resourcing was highlighted as a significant issue in many of the papers reviewed, with dominant themes including 1) a lack of Government support or resources, 2) reduced capacity of community members, including due to lack of payment for their time and expertise, 3) access to and application requirements of available funds.

First, there were instances where no Government support was available and bottom-up approaches to adaptation planning, and implementation were instigated, requiring a level of community leadership, time, and local scale support structures (Albert et al., 2018; Bronen, 2018; Asugeni et al., 2019). Asugeni et al. (2019) give the example of the community of Abitona and Wyfolonga of East Kwaio, Solomon Islands, which had a lack of support from the Government to implement a raised walkway to connect their low-lying coastal villages that are flooded during storm events and are set to get worse with climate change. The Abitona and Wyfolonga communities' approach was enabled by strong community leadership and inter-

community relationships, which enabled the completion of their adaptation response, in this case, the construction of a raised walkway (Asugeni et al., 2019). This example highlights the community's resilience and adaptability despite needing more support from governing bodies.

Resource to support Indigenous people's time/expertise to engage in adaptation planning was another challenge that was highlighted in the systematic review (Manning et al., 2015; Petheram et al., 2015; Whitney & Ban, 2019). Furthermore, some reported a lack of desire to build the capacity of younger generations to assist in Indigenous knowledge development and transfer (McNamara & Westoby, 2011; Schmidt et al., 2021), nor was any support available to use relevant tools and information to support their adaptation planning or implementation (Dulal et al., 2009; McLeod et al., 2019; Bethel et al., 2022). Whitney and Ban (2019) discussed the need for more capacity, this study surveyed 26 people who work in the coastal British Columbia region, specifically with First Nations, Provincial, or Federal Government organisations related to coastal management and planning. Their study highlighted gaps, particularly regarding people’s capacity to engage with climate-related work and funding, stemming from broader funding gaps in the research space in Canada, specifically adaptation research in British Columbia. However, they identified an approach that involves the downscaling of adaptation planning to the local and regional scale. It reduces the cost burden on Governments and contributes to positive community buy-in to adaptation strategies (Whitney & Ban, 2019). This includes fundamental resources enabling access to more substantial support and removing barriers. For instance, Kettle et al. (2018) mention that certain adaptation funds that coastal Indigenous Alaskans are eligible for require the community to have supplementary hazard mitigation plans, which take resources to develop and for some communities, these resources are not available (McNamara et al., 2017; Leonard, 2021).

The allocation of adaptation resources was highly variable. For example, Maldonado et al. (2021) mention the exclusion of the Borikè Tribe in Puerto Rico from insurance and permit processes due to many communities not holding legal land tenure for their occupied lands, as is the traditional practice of continued occupation on the same location for generations (Maldonado et al., 2021). In the context of the USA, Maldonado et al. (2013) and Marlow and Sancken (2017) discuss the disadvantages that definitions within the policy can have. They discuss that the Stafford Act, which provides and orchestrates disaster relief and emergency response in the US, does not account for slow-onset hazards such as climate change. Hence, this legislation does not support communities that want to pre-emptively adapt. Marlow and Sancken (2017) discuss that grants for disaster preparedness, mitigation and response disqualify many Indigenous communities in the USA due to their small size and relative isolation, making prerequisite environmental monitoring and cost-benefit analysis expensive.

Several papers also mentioned the directing of funds to those most vulnerable to climate impacts, which allocates funds away from communities that are not immediately vulnerable but want to adapt pre-emptively (Donatuto et al., 2014; Korovulavula et al., 2020). Furthermore, Bronen (2015) discuss the disparity in priorities, such as projects that repair or rebuild public infrastructure, which could be better directed to longer-term sustainable options like relocation. Many papers also highlighted relocation resourcing as a barrier (Maldonado, 2015; Bronen, 2018; Nunn & Campbell, 2020). For instance, Bronen (2018) argues that relocated communities need support not only before and during relocation but also after to re-create their lives and livelihoods. Bronen (2015) and Bronen et al. (2020) highlight the inconsistencies of policy, plans and risk assessments in the context of Indigenous Alaskans. Assessments and plans recommend monitoring environmental change to provide more data to inform decision-making but do not provide funding to monitor or support building capacity and capability within the community to conduct the monitoring.

Highlighted in this review was the presence of smaller funds that can be utilised for adaptation, which some cases identified had specific and sometimes limiting criteria (Dulal et al., 2009; Wolsko & Marino, 2016; Kettle et al., 2018; Dannenberg et al., 2019; Ford et al., 2021; Piggott-McKellar et al., 2021). For instance, Kettle et al. (2018) discussed how many native Alaskan communities identified acquiring funding as the largest barrier to implementing more anticipatory climate initiatives. They highlight that in the case of relocation, some communities were hesitant even to mention the term as it could reduce their competitiveness for funds to supplement immediate needs. A few papers mentioned that because of funding limitations, the efficient targeting of available funds to priority projects could create further problems (Bronen, 2018; Korovulavula et al., 2020; Hagen et al., 2022). Here, Domingue (2021) mentions that through 74 in-depth interviews with members of coastal Louisianan communities, they identify that because of the constrained funding, getting “bang for your buck” was a priority for Government support of any adaptation option, which may rule out the long-term benefits of potentially more significant, more expensive projects. Funding limitations were a key theme, demonstrated to disadvantage Indigenous communities and was linked to climate justice by some scholars. For example, many of these communities have minor greenhouse gas contributions yet are most vulnerable to the impacts. As such, those larger emitting countries and corporations need to be part of the conversation on how best they support the communities they are ultimately impacting (Ford et al., 2015; Korovulavula et al., 2020; Nunn & Campbell, 2020; Piggott-McKellar et al., 2021).

Common themes to this systematic review are that resourcing, be it monetary, expertise or information, are widely reported in the literature as a critical challenge with many opportunities for improvement. Despite the recurrent lessons of what went wrong and what needs to change,

this review serves to highlight how Indigenous communities are continuing to be disadvantaged and discriminated against when trying to adapt to climate change. A broader conversation from all stakeholders and partners needs to occur to outline how best resources can be marshalled and allocated. As Huntington et al. (2012) argue, continued inaction reduces the possibility of future adaptation.

6.4.3 Respect: The need for meaningful engagement

Effective and respectful community engagement is a hallmark of many qualitative and quantitative research studies about or of importance to communities or peoples. This review included articles that included and discussed community engagement and ranged from co-development with the Indigenous community to more mainstream engagement processes. A core theme identified was the lack of meaningful and respectful engagement with Indigenous knowledge (Hiwasaki et al., 2015; Flynn et al., 2018; Manrique et al., 2018; de Scally & Doberstein, 2021; Thompson & Ban, 2022). This was pertinently summarised by Thompson and Ban (2022) who argued that Indigenous knowledge needs to be engaged initially, not as a commodity to be drawn upon at the last minute. Several studies highlight the problems of Indigenous communities being engaged in the later stages, notably how often adaptation plans are misaligned with their aspirations as Indigenous communities, with piecemeal engagement, creating further distrust in institutions and policymakers. (Dulal et al., 2009; Green et al., 2010; McNamara & Westoby, 2011; Cochran et al., 2013; Reid et al., 2014; Whyte, 2014; Manning et al., 2015; Rouse et al., 2017; Whitney & Ban, 2019; Westoby et al., 2020; Maldonado et al., 2021).

Westoby et al. (2020) conducted research with four communities of Vanuatu, which were involved in four different projects intent on assisting climate adaptation. A critical insight was the limited involvement of community members in project design and implementation that resulted in one project overriding the community's expressed need, which the project leads developed themselves based on their determination of the community’s needs. The community felt disempowered and eventually dismayed by the project’s failure. Had they been involved in the implementation more substantively, they reported that the outcome would have been different (Westoby et al., 2020). In this regard, literature routinely outlines an approach that engages early with Indigenous communities has multiple benefits, such as local values, knowledge and capacity being reflected in solutions and planning (Maldonado, 2014; Dewan, 2015; Maldonado, 2015; Petheram et al., 2015; Schneider et al., 2017; Carmichael et al., 2018; Hutton & Allen, 2020; Lam et al., 2020; Whitney et al., 2020), ensuring Indigenous empowerment and self-determination (Maldonado et al., 2013; Hiwasaki et al., 2015; McNamara et al., 2017; Bronen, 2018; Orlove et al., 2020; Felipe Pérez & Tomaselli, 2021;

Maldonado et al., 2021), and helping build the capacity and capability of the Indigenous community (Hiwasaki et al., 2014; Leonard, 2021).

Furthermore, many papers discuss the importance of cross-cultural work between scientists/researchers and Indigenous partners (Cochran et al., 2013; Maldonado, 2014; Reid et al., 2014; Marlow & Sancken, 2017; Hutton & Allen, 2020; Lam et al., 2020; Domingue, 2021), as Reid et al. (2014) discuss, practical adaptation planning benefits from enhanced citizen and researcher collaboration. For example, studies mention the importance of engagement across multiple levels of Government, local, regional, national, and international (Green et al., 2010; Brubaker et al., 2011; Maldonado, 2014; Bronen, 2015; Manning et al., 2015; Flynn et al., 2018; Kettle et al., 2018; Asugeni et al., 2019; McLeod et al., 2019; Brady & Leichenko, 2020; Bronen et al., 2020; Bethel et al., 2022). An approach from McLeod et al. (2019) showcased that engagement between local, state, and national Governments is a crucial mechanism for discussing and refining adaptation policies and plans in the context of Pacific Island nations. Furthermore, researchers emphasise that multi-stakeholder engagement across all aspects of adaptation, from the planning process across all institutions (Bronen, 2018; Hutton & Allen, 2020), requires respectful, transparent communication and cross-cultural collaboration (Hiwasaki et al., 2014; Bronen, 2015; Bryant et al., 2017; Hagen et al., 2022). Maldonado (2014) further says that a partnership approach isn't just crucial for incorporating policy and decision-makers at all levels for adaptation purposes; it is essential to address those social, political and economic structures that have shaped the experience of many Indigenous communities.

6.4.4 Redress: Acknowledge the burden of history

Common to many Indigenous communities is the complex history and influence that colonisation has imposed upon their society, culture, knowledge systems, and vulnerability/exposure to climate change (Maldonado et al., 2013; Bethel et al., 2022). Maldonado et al. (2013) describe, in the context of the USA, that those facing complex relocation decisions as an adaptation response are also those who have faced systemic impoverishment and injustice. They further posit that global contributors of greenhouse gases have a responsibility to support these vulnerable communities who have contributed minimally and suggest that a failure to do so may eventuate in a breach of human rights law. Several papers argued that we cannot ignore these complex and contested histories when planning for adaptation, as to do so will result in naïve adaptation and risks increasing vulnerability (Bronen, 2015; Whitney & Ban, 2019; Blackett et al., 2021). Thompson and Ban (2022) note that ignoring colonialism and the resilience of Indigenous ways of knowing perpetuates and dismisses Indigenous knowledge and different perspectives that have informed Indigenous

longevity and persistence in their environments. Whitney and Ban (2019) go further in the context of Inuit communities, saying that if their values and views are not addressed in adaptation planning, any adaptation effort risks perpetuating inequality and will increase the vulnerability of the people.

Researchers highlight that the historical marginalisation of Indigenous communities often involved forced Government-mandated relocations, and many note that future climate-driven relocation of Indigenous communities needs to distance itself from those histories (Maldonado et al., 2013; Marlow & Sancken, 2017; Bronen, 2018; Felipe Pérez & Tomaselli, 2021). A few papers also recognised that because of colonisation, some Indigenous groups have varying degrees of Indigenous knowledge. For example, de Scally and Doberstein (2021) discuss in the context of Cook Island participants who related environmental change to God and religion, suggesting religion plays a significant role in relation to the environment, which will impact adaptation planning and policy. Moving forward, Whitney et al. (2020) suggest that reconciliation is a prerequisite to implementing effective adaptation action. Through reconciliation, accepting the intergenerational trauma of Indigenous peoples (Schneider et al., 2017; Maldonado et al., 2021) and to shape future adaptation away from an ethos of ethnocentrism, power, colonial institutions or privilege to more autonomous and inclusive Indigenous-led adaptation (Ford et al., 2021; Leonard, 2021).

So far, we have discussed a combination of challenges from the literature, focusing on the four challenges: 1) Recognition, 2) Resourcing, 3) Respect and 4) Redress, as shown in **Table 6-2.** In addition to highlighting aspects of an ongoing, recurring challenge, the review suggests that these are integrated and that measures to address one element may also contribute to another. For example, recognition of Indigenous knowledge is an element that can foster respectful engagement. However, much of the literature provided approaches and opportunities to overcome these challenges, which give a positive outlook for future adaptation planning and pathways **(Table 6-2)**. We need to look at these approaches to instigate positive action for Indigenous communities to adapt sustainably, but more importantly, that is with and for them.

Table 6-2: Approaches highlighted as mechanisms to overcome the adaptation challenges

Challenge	***Approach to Overcome Challenge***
Recognition	Centre Indigenous knowledge within adaptation planning and implementation (McNamara & Westoby, 2011; Maldonado, 2015) Utilisation and creation of frameworks that are centred on Indigenous knowledge and integrate with Science (Hiwasaki et al., 2015; Leonard, 2021)

Resourcing	Community leadership and strong inter-community relationships (Asugeni et al., 2019) Downscaling to and support of local scale adaptation initiatives (Whitney & Ban, 2019)
Respect	Engaging early at the start of adaptation discussions (Maldonado, 2014; Schneider et al., 2017) Multi-level engagement across Governments, research, industry and Indigenous communities (McLeod et al., 2019)
Redress	Acknowledge the colonialism that has impacted Indigenous peoples (Thompson & Ban, 2022) Reconciliation before adaptation (Whitney et al., 2020)

6.5 Conclusion – An agenda for action?

This research aimed to analyse and synthesise project-based and context-specific research concerning the adaptation of global Indigenous coastal communities to climate change to develop new insights for future adaptation planning. In doing so, the study has highlighted four key themes that together hold the potential to inform a joint and concerted agenda for action. While there were examples of good practice, it was noticeable how much research still discussed Indigenous adaptation in terms of a struggle. We categorised these themes into four broad challenges Indigenous communities are continuously experiencing. These focused on Recognising and giving space for Indigenous knowledge and methodologies, struggles for Resourcing, creating Respectful and meaningful engagement, and struggles for Redress. The commonality of experience revealed by this research suggests that while these issues may be recognised within adaptation research and practice, more political focus still needs to be on addressing these issues. If we proceed with climate adaptation that addresses these themes, we not only redefine the current adaptation planning and decision-making process, but we also open possibilities to redress historical wrongs that colonisation has imposed and continues to impose upon Indigenous communities. More generally, in seeking to integrate adaptation knowledge and consider it with differing global Indigenous communities, we can also see recurring lessons, challenges and claims, as well as opportunities for solidarity and knowledge exchange. Each of these identifies possible areas of mutual learning, both in terms of the adaptation process and solutions, and provides insights into how to exert better influence within scientific and political domains.

Chapter 7 – A Māori climate adaptation framework: A waka hourua approach

A target journal is yet to be identified – Co-authorship form: Appendix 7

7.1 Abstract

Indigenous communities around the globe are reasserting their right to self-determination in climate change adaptation. Frameworks can guide and influence adaptation planning, process, relationships and implementation. This paper develops a Māori climate change adaptation framework. To do this, we reviewed common adaptation frameworks used internationally by Indigenous peoples and those developed by/with Māori communities in Aotearoa New Zealand. These frameworks stress the importance of relationships, partnerships, Indigenous knowledge, intergenerational vision, and adaptation guidance. To position a climate change adaptation framework for Māori, we held a Māori-led wānanga (workshop) that explored the needs and aspirations of hapū (sub-tribe) and iwi (tribe) Māori. The wānanga emphasised the importance of Te Tiriti o Waitangi (foundational document of Aotearoa New Zealand), historical experiences, and autonomous adaptation. We develop a Māori climate change adaptation framework that has two complementary focuses: 1) a waka hourua (double-hulled sailing vessel) representing partnerships and collaboration with communities, knowledge systems, and the Government; and 2) an adaptation process decision-making wheel that acknowledges intergenerational trauma and existing adaptation knowledge, as well as the identification of hapū and iwi capacity and capability. This framework honours Māori perspectives and empowers communities to navigate climate change challenges collaboratively while fostering resilience and sustainable futures.

7.2 Introduction

Indigenous knowledge, perspectives, and experiences of the natural environment hold a plethora of information on how we can adapt to climate change (Green & Raygorodetsky, 2010; Hiwasaki et al., 2015; Bronen et al., 2020; Petzold et al., 2020). Indigenous peoples are often among those most vulnerable and at risk of climate change impacts (Wildcat, 2014; Ford et al., 2020). Many Indigenous communities are exposed to rapid changes in temperature and extreme weather impacting natural subsistence sources (Savo et al., 2016) and sites of cultural significance (Reimann et al., 2018; Bailey-Winiata et al., 2022). Climate change, and adaptation to climate change, is altering the relationships Indigenous peoples have with their environments.

Adaptation to climate change is already occurring in many communities around the globe (Maldonado et al., 2013; Maldonado, 2014; Johnson et al., 2021). Coastal adaptation (generally focused on coastal flooding and erosion) often takes the form of PARA: **P**rotect: complex engineering to act as a barrier, **A**ccommodate: ways to live with the hazard, **R**etreat: relocate away from the hazard, more recognisable as 'managed retreat', and **A**void: refrain from development in hazardous locations (Doberstein et al., 2019). Each option has pros and cons, and an adaptation framework or plan/strategy helps identify the most appropriate option(s) for the given location, community and resources.

Māori in Aotearoa New Zealand (hereafter A-NZ) are vulnerable to climate change, with many important places such as marae (Māori meeting grounds) and urupā (cemeteries) situated on low-lying marginal lands where hazard, intensity and recurrence are expected to increase with climate change. Moreover, the predominance of natural resources/environments in the Māori economy, such as natural assets (Awatere et al., 2021a) and tourism (Kurian et al., 2021), creates additional economic uncertainty moving forward with climate change (Bailey-Winiata et al., 2022). Māori have a rich historical and contemporary experience of mātauranga Māori (Māori traditional knowledge) around adaptation and resilience in the face of environmental and anthropogenic-induced change, such as by relocation to natural hazards and through land confiscations and forced removals through colonisation (Boast & Hill, 2010; Bailey-Winiata et al., 2024). The ongoing intergenerational trauma of colonisation can make it challenging to have adaptation discussions, particularly regarding relocating as an option and when Government authorities lead these conversations. Frameworks and guidance that acknowledge this trauma and identify adaptation frameworks that resonate with Māori is an area requiring further exploration.

Many hapū (sub-tribes) and iwi (tribes) around A-NZ are reclaiming their autonomy by leading their adaptation plans that reflect their aspirations as a collective, empowering them as hapū and iwi Māori that are centred in their mātauranga and tikanga (Māori customs and practices) (Stephenson et al., 2024). These plans sit within the context of rapidly evolving legislation and terminology in national adaptation policy and research. For instance, the terms "community-led retreat" and "planned retreat" are becoming more popular, replacing the unfavourable term 'managed retreat' which carries negative connotations for many communities of forced relocations (Expert Working Group on Managed Retreat, 2023; Ministry for the Environment, 2023). A one-size-fits national adaptation framework will struggle to acknowledge and address the intricacies and complexities hapū and iwi Māori have with the Government (Kawharu, 2001) and the adaptation process itself (Bierbaum et al., 2013; Jones et al., 2018).

Many adaptation frameworks exist around the world that suggest fundamental elements required to support adaptation. Likewise, A-NZ has several adaptation frameworks and a growing body of related guidance. A recent review of a decade of adaptation practice in A-NZ by Lawrence et al. (In review) focuses on Dynamic Adaptation Pathways Planning (DAPP), which is currently the recommended approach from the national Ministry for the Environment (MfE). DAPP outlines an approach for making adaptation decisions under deep uncertainty, when the probabilities and consequences of change is unknown or imprecise (Haasnoot et al., 2013). This review found that partnerships between hapū and iwi Māori, local Government, and the Crown are generally poorly developed for adaptation decision-making. Māori are generally participants rather than directing or significantly influencing the adaptation process. Furthermore, they note that a key barrier to adaptation is explicit engagement with Te Ao Māori (Māori worldview) and mātauranga Māori in a Te Tiriti-centric partnership and that there is a need to build capability and capacity in a Te Ao Māori approach to adaptation (Lawrence et al., In review). To do this, there is a lack of frameworks specifically targeted to supporting the relationships and process of climate change adaptation for hapū and iwi Māori. Therefore, this contribution provides a two-part Māori climate change adaptation framework that embodies the core principles of well-known existing adaptation frameworks but which is founded on the voices, knowledge and experiences of more than 100 Māori adaptation experts through a wānanga (workshop). This paper has three key research objectives. First, to assess existing climate adaptation frameworks by/for Indigenous peoples from national and international literature. Second, to identify aspects required for a Māori adaptation framework. Third, to develop a framework of key partnerships and adaptation guidance to support climate adaptation decision-making by hapū and iwi Māori.

7.3 Evolving climate adaptation planning and legislation

Here, we summarise the current state of climate adaptation in A-NZ. A-NZ is a dynamic land mass of islands with a plethora of geologic natural hazards, such as earthquakes, tsunamis and volcanoes, alongside those that may be exacerbated by climate change, such as flooding, erosion and extreme weather events. In early 2023, Ex-Tropical Cyclone Gabrielle brought to the forefront the potential impacts of climate change, with flooding and rainfall-induced landslides devastating multiple regions. Areas impacted included multiple Māori communities, marae and wāhi tapu (sacred sites) at the coast and near rivers, resulting in many hapū and iwi Māori discussing and planning for adaptation. Adaptation is a contentious topic among some Māori communities, including stemming from the potential disruption to the deep connection to the natural environment and the intergenerational impacts and injustices of colonisation, involving the forced removal and confiscation of ancestral lands and continued marginalisation (Whyte, 2016; Expert Working Group on Managed Retreat, 2023).

Since 1991, A-NZ has developed legislation and guidance around climate change, from its initial mention for consideration of climate change in the Resource Management Act (1991), followed by many others such as the National Climate Change Risk Assessment (2020), National Adaptation Plan (2022), Expert Working Group on Managed Retreat, and Ministry for the Environment Coastal Hazards and Climate Change Guidance (Resource Management Act, 1991; Ministry for the Environment, 2020, 2022a; Expert Working Group on Managed Retreat, 2023; Ministry for the Environment, 2024). There is ample and rapidly developing adaptation legislation and examples of communities creating adaptation plans, but in general, there remains a lack of guidance to support implementation (White & Lawrence, 2020). Ministry for the Environment recently invited public submissions to their 'Community-led retreat and adaptation funding' and 'Climate change adaptation framework' parliamentary inquiries. The latter, a national adaptation framework, is highlighted by the Ministry for the Environment as needed "to strengthen how New Zealand prepares for the effects of climate change". What this framework looks like, particularly how it can canvas all communities, particularly for hapū and iwi Māori, is still unknown. Herein lies an opportunity to explore what a Māori climate change adaptation framework could look like.

7.4 Existing climate adaptation frameworks

Here, we focus on understanding existing adaptation frameworks, focusing on opportunities to support a Māori climate adaptation framework. The 10 frameworks to review were identified by their prevalence in the adaptation research and through discussions with experts in the field. These frameworks focussed on multiple factors, described in detail below; these include the importance of relationships and partnerships, the relevance of Indigenous knowledge and values, the importance of an intergenerational vision and adaptation guidance that can support adaptation plans and implementation.

7.4.1 Relationships and Partnerships

Strong relationships and partnerships are necessary for adaptation. This was reiterated in the "Justice Forward" framework by Whyte (2013) developed in the USA, which signifies the importance of "collective continuance", which focuses on communities' capacity to adapt for a flourishing future. This framework emphasises relationships and responsibilities beyond human interactions, including with and between flora, fauna, and natural landscapes. Whyte (2013) discusses the importance of relationships more broadly, such as honouring tribal sovereignty through meaningful partnerships and collaborations between Government and Indigenous groups. This will ensure that the federal Government of the US protects tribal lands and heritage and integrates Indigenous and non-Indigenous knowledge into adaptation planning (Whyte, 2013). The importance of the relationships with flora and fauna was also

highlighted in the Rauora framework of Ihirangi (2021) developed in A-NZ, where a central theme is the interconnectedness of all things, focussing on the inalienable relationship of Māori to their lands and the recognition of the authority of the environment. Ihirangi (2021) further recommends that ecological restoration, respecting Māori knowledge, redressing historical wrongs, ensuring water security, and shifting to sustainable economies should be factored into an Indigenous adaptation framework.

The importance of partnerships between the Government and Indigenous communities, focused on Māori, was highlighted in Te Kete Kaitiakitanga. Te Kete Kaitiakitanga is a toolkit for practitioners, policymakers and tribal partners that re-enforces kaitiakitanga (stewardship) roles within A-NZ's ecosystem-based management approach to marine governance (Taylor et al., 2024). They posited "e toru nga mea" which means "three things", rangatiratanga (authority), mātauranga Māori, and tikanga which are needed to activate and enable kaitiakitanga. Furthermore, a dominant focus of this tool is the identification of who has rights and interests, categorised into three groups **(Figure 7-1)**: 1) Tino rangatiratanga (self-determination), where Māori have control and their interests are prioritised; 2) Rangatiratanga (authority) on an equal basis, shared control where kaitiaki (stewards) have a say in the decision-making but other voices should be included, and 3) Rangatiratanga on an equitable basis, equitable control in decision-making and transparent and accountable system to kaitiaki and wider community for delivery of outcomes (Taylor et al., 2024).

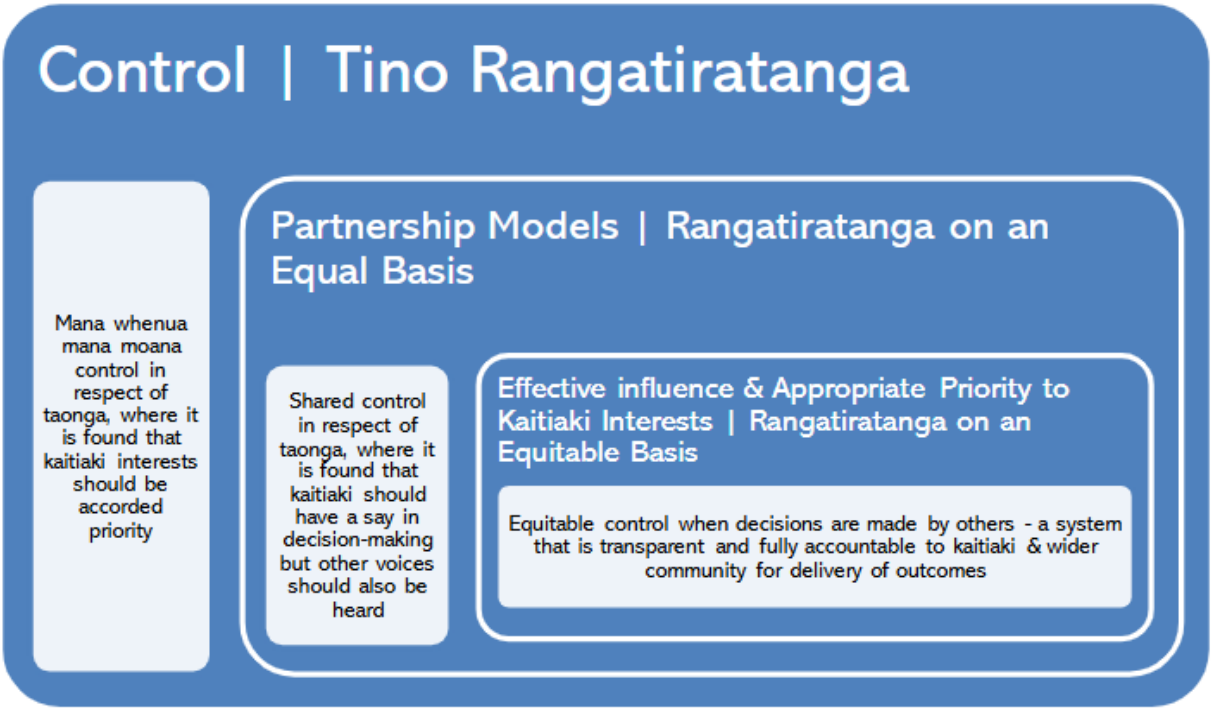

Figure 7-1: Rights and Interests Model (Taylor et al., 2024)

Furthering relationships and strengthening partnerships was further emphasised in the spheres of influence discussion in the Matike Mai report from Matike Mai Aotearoa, which is an independent working group on constitutional transformation who have focussed on the development of a model for an inclusive constitution for A-NZ (Matike Mai Aotearoa, 2016). This extensive report centred heavily on Te Tiriti o Waitangi – The Treaty of Waitangi (hereafter Te Tiriti). Te Tiriti is the foundational document of A-NZ that outlines the partnership between the British Crown and Māori of A-NZ, who signed Te Tiriti on the 6th of February 1840. Te Tiriti is an addendum to He Whakaputanga o te Rangatiratanga o Nu Tireni, which was a declaration of the sovereignty of New Zealand signed by some rangatira (Māori leaders) in 1835 (Mutu, 2011). Te Tiriti has critical principles of partnership, participation, and protection (Orange, 2020). Unfortunately, following the signing of Te Tiriti by some rangatira of A-NZ, the obligations of the Crown were not upheld, resulting in the colonisation and assimilation of Māori into British society and the extensive confiscation and purchase (sometimes forced) of Māori land. In 1975, The Treaty of Waitangi Act was passed, and the Waitangi Tribunal was established as a platform for Māori who were disadvantaged by legislation or policy imposed by the Crown the ability to seek redress (Ministry of Justice, 2021). Te Tiriti is an approach to partnership between Māori and the Crown that should be applied in climate change adaptation. A Te Tiriti-centric governance approach that could be considered in adaptation is exemplified in the spheres of influence model **(Figure 7-2)**, which provides for the independent exercise of rangatiratanga, kāwanatanga (Crown governance) and a sphere where the first two spheres work together, ōritetanga (equal approach) (Matike Mai Aotearoa, 2016).

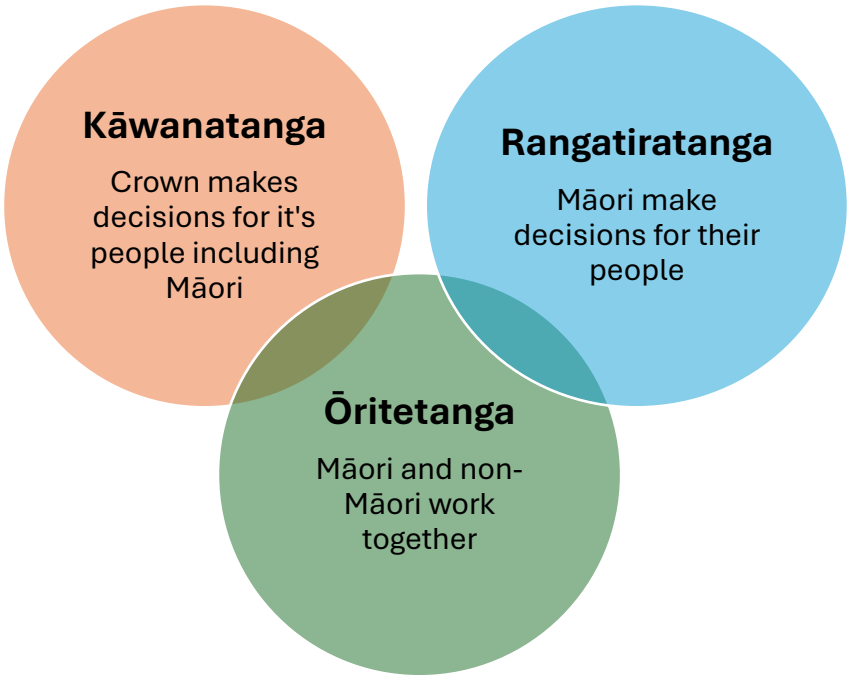

Figure 7-2: Spheres of Influence in a Te Tiriti-centric approach, with Kāwanatanga (Crown governance), Rangatiratanga (Māori) and Ōritetanga (Equal approach) (Matike Mai Aotearoa, 2016)

7.4.2 Indigenous knowledge and cultural values

The importance and relevance of Indigenous knowledge, world views, and cultural values in adaptation have been highlighted in many frameworks. For instance, the WAMPUM framework developed by Leonard (2021) is an Indigenous sea level rise adaptation framework informed by the knowledge and experience of North–Eastern and mid-Atlantic coastal tribal nations of North America. Wampum refers to carved quahog (clams) and whelk shells traditionally gathered along the Atlantic coast, which were used as currency, artistry, politics and knowledge transmission in Native American culture and tradition (Leonard, 2021). WAMPUM is also an acronym for **W**itness: Observe changes within the environment, **A**cknowledge: Integrate traditional teachings and cultural practices, **M**end: Heal the coastline through adaptation, **P**rotect: Ensure the environment and cultural heritage are protected for future generations, **U**nite: Collaborate with others to build capacity and unity, and **M**ove: Relocate to areas with prior connection (Leonard, 2021). This framework uses local Indigenous knowledge to develop culturally and locally relevant sea level rise risk assessments and provides adaptation planning/options. Leonard (2021) goes further to say that the continued use of adaptation frameworks that are not created by or for Indigenous peoples only furthers adaptation oppression, reflected in the Western cultural biases in Western adaptation frameworks.

Incorporating cultural values was at the centre of a Te Ao Māori disaster risk reduction framework developed by Rout et al. (2024) which guides non-Māori decision-makers in A-NZ to understand disaster risk reduction from a Te Ao Māori perspective. This holistic and cyclical framework emphasises interconnectedness across space and time with four essential foundations: 1) **Whakapapa** – all things living and non-living are related. 2) **Mauri** – everything has a life essence. 3) **Mana** – authority or power. 4) **Atua** – progenitors and personifications of natural hazard phenomena. Rout et al. (2024) highlight that the difficulty of incorporating Te Ao Māori into disaster risk reduction is partly due to the deep resistance and exclusivity of a Western worldview, and they note that more profound changes within institutions and disaster risk reduction processes are needed. Although the disaster risk reduction framework mentions a changing climate and the impacts on the interconnectedness and balance of the system, it does not discuss adaptation specifically.

A Māori approach to adaptation should exercise hapū and iwi rights to self-determination and sovereignty over all of their domains, including environmental, cultural and social. This is shown in the Rauora framework by Ihirangi (2021), which emphasises respecting Indigenous rights to self-determination and the international standard of free, prior, and informed consent for developing adaptation policies and plans. In addition, the Rauora framework discusses the importance of hapū and iwi Māori as partners, not stakeholders, at policy decision-making tables. Furthermore, Colliar and Blackett (2018) discussed the nuance of decision-making for Māori in their Te Huringa ki te Rangi – He Rautaki Tāwariwari framework (discussed in more detail in the following paragraph), in that hapū and iwi Māori around the country have their own decision-making structures and processes informed by their tikanga and whakapapa (genealogy), highlighting the need for adaptation planning to start at the hapū and iwi Māori level.

7.4.3 Intergenerational vision

An intergenerational vision that aspires to achieve adaptation and risk reduction whilst accomplishing bigger-picture opportunities for Indigenous communities through adaptation is important. A clear vision was critical to Te Huringa ki te Rangi – He Rautaki Tāwariwari framework. This translates to “the changes within the heavens” and reflects the continual battle between Tāwhirimātea (God of wind and storms) and Tūmatauenga (God of war and humanity) instigated by the separation of their parents – Ranginui (Sky father) and Papatūānuku (Earth mother) as part of the Māori creation story (Colliar & Blackett, 2018). This framework is an 8-step cycle to support adaptation decision-making, and the first step is to centre all adaptation thinking and decision-making around a clear vision, community aspirations and understanding of the past. This framework continues with options to achieve

that vision identified (Steps 3–4), which then need to be chosen, implemented, monitored and reviewed (Steps 5–8) (Colliar & Blackett, 2018).

The importance of aligning adaptation plans and options with community aspirations was also mentioned in the “Te Huringa ki te Rangi – He Rautaki Tāwariwari framework” by Colliar and Blackett (2018). The Climigration framework of Bronen (2021) presented seven key recommendations that need to be addressed in a climate relocation governance framework based on human rights in the United States of America. These recommendations include: 1) **What is a ‘threatened’ community,** which communities are at risk, and to what? This will ensure that available resources are targeted to higher-priority communities. 2) **Federal Climigration organisational structure**: This encompasses all governance mechanisms and a unity of federal organisations to support community adaptation. 3) **Collaborative governance**: this allows for collective action and takes advantage of various expertise from different agencies, industries and communities, as well as from different funding sources. 4) **Ensure self-determination is upheld for all communities**, including Indigenous. 5) **Integrated hazard mitigation planning** involving protection in place and community monitoring programmes. 6) **Review of funding opportunities**; and 7) **Land use policies** consistent across ecosystems and jurisdictions. Bronen (2021) emphasises the importance and requirement for any relocation governance framework to have foundation principles of human rights. The Climigration framework prioritises communities, governance structures and relationships, with broader recommendations for adaptation funding and policy rather than details about the adaptation decision-making.

7.4.4 Adaptation guidance

Some frameworks focus on more practical aspects of the climate adaptation process. For instance, the He Huringa Āhuarangi, He Huringa Ao developed by Awatere et al. (2021b) is a Māori climate change risk assessment tool to support climate change decision-making. This tool was developed by leading Māori academics who assessed the risk of whānau (family), hapū, iwi and Māori business to climate change using a kaupapa Māori approach (Māori research methodology) in tandem with a hazards, vulnerability and exposure perspective emphasised in the National Adaptation Plan 2022 (Ministry for the Environment, 2022a). Part of this approach was the holistic emphasis on four key areas of concern: 1) He Kura Taiao—Living treasures, 2) Whakatipu Rawa—Māori enterprise, 3) He Oranga Tāngata—Healthy people, and 4) Ahurea Māori, Tikanga Māori—Māori culture, Māori values and principles (Awatere et al., 2021b). For each of these critical areas of concern, there was an initial review of potential adaptation options from relevant literature related to each hazard. Awatere et al. (2021b) identified the need to investigate the role and responsibility of Te Tiriti in adaptation

decision-making as well as to identify methods of including multiple different types of information into risk assessments and decision-making analyses for Māori communities.

Implementation guidance was identified by MfE based on a 10-step decision-making framework and Te Huringa ki te Rangi – He Rautaki Tāwariwari by Colliar and Blackett (2018), who built their framework off the MfE framework. The Ministry for the Environment (2017 and 2024) Coastal Hazards Guidance is structured around an iterative 10-step framework intended to guide and implement a long-term strategy and decision-making process for coastal areas affected by coastal hazards and in the future with sea level rise **(Figure 7-3)**. This framework is widely used in A-NZ, mainly by territorial authorities (such as district and regional councils) and local communities. While developed for the coast, this framework is used in various other environments. This framework has five key questions, each with two key steps; these include:

A) What is happening? – 1. Set the context and prepare, and 2. Assess sea-level rise and coastal hazards. **B) What matters most?** – 3. Establish values and objectives, and 4. Assess vulnerability and risk. **C) What can we do about it?** – 5. Identify options and pathways, and 6. Evaluate options and pathways. **D) How can we implement the strategy?** – 7. Develop the adaptive planning strategy with signals and triggers, and 8. Implement. **E) How is it working?** – 9. Monitor, and 10. Review and adjust.

While not explicit in the wheel diagram itself, in the supporting guidance, this process-based framework outlines the importance of engagement with hapū and iwi Māori in adaptation planning, process and integration of mātauranga Māori into adaptation. It seeks to draw attention to the complexity that exists for Māori in terms of connection to land and place, as well as land tenure and resource constraints. However, this framework does not provide a separate process for conducting such adaptation with Māori but refers to the Rauora framework and opportunities to achieve this (Ministry for the Environment, 2024).

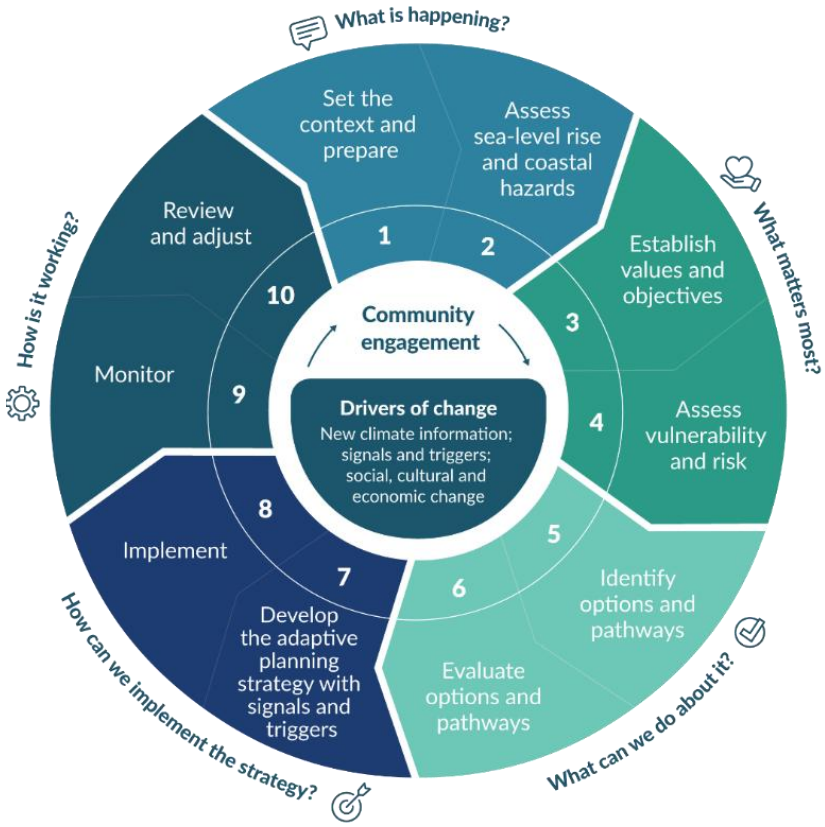

Figure 7-3: Ministry for the Environment 10-step decision-making wheel for climate change adaptation (MfE, 2024)

7.4.5 Summary

In summary, the frameworks reviewed highlighted are diverse and share common themes that can provide a foundation for our Māori climate adaptation framework. In A-NZ, we lack a clear, process-based Māori adaptation framework that incorporates the fundamental elements that resonate with hapū and iwi Māori. This is echoed by the Expert Working Group on Managed Retreat (2023) in A-NZ, who posited that an adaptation framework for Māori needs to centre Māori as the decision-makers, and any adaptation needs to be decided by them and for them (Expert Working Group on Managed Retreat, 2023).

7.5 Methodology

To identify what a Māori climate adaptation framework that is aligned with Tikanga Māori could look like, a Māori led, and Māoricentric wānanga (workshop) was held focused on climate change adaptation and retreat. A group of kairangahau Māori (Māori researchers), including the lead author and one of the co-authors, led this wānanga on the 2nd of October 2023 at Whakaue Marae in Maketū (Eastern Bay of Plenty, North Island) hosted by the local iwi and hapū of Ngāti Whakaue ki Maketū. This was attended by a collective of over 100 (mostly Māori) people from research, local Government and mana whenua (people with authority over

the land) perspectives. The timing of this wānanga was aligned with the New Zealand Parliament Environment Select Committee's inquiry into 'community-led retreat and adaptation funding' in August 2023, of which a collective submission was put forth to the select committee following this wānanga (Taylor et al., 2023).

Wānanga is a traditional method of knowledge transmission and is often utilised as a culturally appropriate and safe research methodology that is centred on Māori values and mātauranga Māori (Mahuika & Mahuika, 2020; Matamua et al., 2023). The opening of the wānanga followed tikanga, including pōwhiri (formal welcome ceremony) with the exchange of whaikōrero (speeches) and of koha (gift) to the hosts, followed by harirū (shaking of hands) and hongi (exchanging of breath through the pressing of noses). Once the formalities were concluded we shared kai (food) to lift the tapu (sacredness) of the formalities.

For the first of two sessions of the wānanga, our hosts, Ngāti Whakaue ki Maketū, shared their award-winning, iwi-led climate adaptation plan, "He Toka Tū Moana mō Maketū – Maketū Climate Change Adaptation Plan" (Maketu Iwi Collective, 2023). Following this, attendees shared experiences from their whenua (lands) and hapori (community) in an open discussion on climate change. We also used Mentimeter to help drive these discussions. Mentimeter is a web-based audience response system that is used mainly in the education space to increase student participation during lectures and lessons by building word clouds in response to participants' answers to questions or topics (Mohin et al., 2022). Mentimeter was used to easily collect participants' thoughts on some key questions. The Mentimeter results presented here are not an extensive survey but do provide a valuable picture of the thoughts of those present at the wānanga. The questions asked in Mentimeter included:

1. Which iwi/hapū/organisation do you whakapapa to?
2. How are you engaged in climate change kaupapa (topic)?
3. What do you think when you hear "community-led retreat"?
4. What brings you to this hui – what are you hoping to get out of it?
5. What is another word/term that describes the adaptation required?
6. Which term do you prefer? [when showing options of "community-led retreat", "managed retreat" or "other"]

The second session involved a workshop focussed on sharing thoughts and aspirations around a Māori community-led retreat process and its outcomes. The attendees separated into groups of around 8–10 with large sheets of paper and were asked two key questions:

1. What does a Māori community-led retreat process look like?
2. What outcomes do we want from a parallel Māori community-led retreat process?

Participants provided their thoughts regarding these two questions on their sheets of paper, and at the end of the session, each group presented key themes and thoughts. Following the wānanga, these results were analysed using a thematic analysis methodology to identify the key themes shared by each group (Braun & Clarke, 2012). The results from this workshop were obtained in line with human research ethics approval through the University of Waikato (HREC(HECS)2022#2). This wānanga was undertaken following tikanga Māori in terms of ethics, where for Māori, ethics is tikanga, which reflects our values, our beliefs and the way we view the world as Māori (Hudson et al., 2016a). It was made clear both in the wānanga invite via social media and again at the start of the wānanga that attendance was considered as consent for being involved in the process and a “circle of trust” existed between researchers and attendees (Smith, 2015).

7.6 Māori climate adaptation wānanga – Results

The results from the wānanga that were influential to the framework highlight three key themes: Te Tiriti o Waitangi's importance, historical experiences, and the importance of autonomous adaptation.

7.6.1 Te Tiriti o Waitangi – A partnership approach to adaptation

We acknowledge the complexity that exists for many hapū and iwi Māori in terms of historical and present breaches of Te Tiriti, which has created intergenerational tensions between hapū and iwi Māori with the Crown and the broader A-NZ Government. We therefore need an approach that gives effect to Te Tiriti and any existing and pending settlements that hapū and iwi Māori have with the Crown (to redress breaches of Te Tiriti), and how they may or may not alter concerning climate change and adaptation. As was mentioned at the wānanga

“A Te Tiriti-centric approach to climate adaptation is the necessary foundation for the relationship between Tangata Whenua and Tangata Tiriti in Aotearoa.”

A Te Tiriti-centric climate adaptation framework will provide empowerment and rangatiratanga of hapū and iwi Māori to lead their adaptation planning and process in partnership with central and local Government. In the process and outcomes workshop at the wānanga, it was highlighted that adaptation requires involvement by all partners, Government, Tangata Whenua, and Tangata Tiriti (Non-Māori Treaty partners – non-Māori people). This was likened to a “waka hourua approach”. A waka hourua is a traditional doubled-hulled sailing vessel (Waiti & Wheaton, 2022). Waka hourua have seen a revitalisation around the Pacific including

in A-NZ (McDonald, 2022). The waka hourua has been used extensively as a motif for research frameworks and projects, ethical approaches, social initiatives, and engagement strategies in A-NZ (Rata et al., 2012; Maxwell et al., 2020; Mullane et al., 2022). The waka hourua was highlighted at the wānanga as a potential method to engage and plan for hapū and iwi Māori adaptation. A Māori climate adaptation framework needs to reaffirm the rangatiratanga of hapū and iwi Māori through a Te Tiriti led approach that engenders Māori autonomy as active decision-makers. It also needs to identify pathways forward that are enabled by innovative, co-developed, and locally viable adaptation funding models that provide resources for items not identified within Western adaptation frameworks, such as resourcing time to deal with historical mamae (grief) of colonial injustices.

7.6.2 Importance and relevance of historical experience and Indigenous knowledge

Mātauranga Māori is intergenerational knowledge passed down from our ancestors, and its importance and relevance supersedes the present and is intended to ensure the flourishing of future generations and the surrounding environment (Hikuroa, 2017). Today, mātauranga Māori encompasses the thinking and doing of present generations, tamariki (children), rangatahi (young people), pakeke (adults) and kaumatua (elders) who collectively have deep intergenerational knowledge that stems from their strong connection with their natural surrounding environments (Cowie et al., 2016). In addition, Māori communities have vast historical experience with environmental change, climatic shifts, and non-environmental change, such as ancestral migration pathways, as well as colonial injustices of land confiscations (Bailey-Winiata et al., 2024). However, incorporating mātauranga Māori into climate adaptation plans takes time, resources and careful/meaningful consideration. As was mentioned at the wānanga:

“We as Māori have rich histories of adaptation and responding to changes…we need space and resources to bring our whakapapa and mātauranga to the forefront heading into the future with climate change”

The examples from the past are more complicated to replicate today due to several factors. For example, there is often a lack of available, sustainable land for relocation, and for some, the skills and knowledge necessary to maintain traditional ways of living are unavailable. This is due, in part, to the commodification of land and the establishment of property rights. An example of the relocation of Tūhourangi and Ngāti Rangitihi hapū and iwi following the Tarawera eruption in 1886 (Bailey-Winiata et al., 2024), where they overcame land availability barriers through gifts of land based on whakapapa. As was mentioned at the wānanga:

“Finding solutions such as those used in the post-Tarawera recovery in the previous point, show our capacity for putting matters such as property rights (whether that be through law or lore) aside when the bigger picture concerns human and Indigenous rights.”

At the wānanga, the current mainstream adaptation planning and decision-making process was discussed. An emphasis was placed on DAPP which is underpinned by a European worldview as it was developed in the Netherlands and its application has been dominated by physical drivers and impacts (Haasnoot et al., 2021). However, DAPP was designed to be flexible to suit local contexts and vulnerabilities through time (Haasnoot et al., 2013; Lawrence et al., 2019; Haasnoot et al., 2024). For example, at the wānanga, there were discussions on the necessity for risk assessments and planning documents and processes that resonate and reflect Māori values as well as a platform to be able to share and incorporate mātauranga-a-iwi and a-hapū (knowledge specific to the iwi and hapū levels) into adaptation plans alongside Western knowledge:

“We need to utilise OR create climate/hazard risk assessments that are centred on our mātauranga with us for us.” AND “Risk assessments could be adopted and adapted by mana whenua for their respective whenua and whānau.”

The tikanga of the wānanga were outlined before the event and led by and for Māori, which enabled open and honest discussions. Participants shared negative, angered and traumatic stories concerning the reality of many hapū and iwi Māori to the extent of mamae either through colonial injustices of land confiscations (Bourassa & Strong, 2002), lack of consultation from Government with hapū and iwi Māori (Elkington et al., 2020), and the negative impacts of the Treaty settlement process (Birdling, 2004; Mutu, 2019b). This has resulted in contention and fear from hapū and iwi Māori when local councils are conducting regional and local adaptation planning with hapū and iwi based on this foundation of mamae. However, Māori are practical and pragmatic communities. Adaptation needs to be on their terms, with resourcing and time devoted to addressing the mamae and fostering positive relationships of trust between the Government and hapū and iwi Māori. As was mentioned at the wānanga:

“It is important that the link of climate change to colonisation is recognised and that it is acknowledged.”

7.6.3 Autonomous adaptation

Adaptation to a changing climate isn’t a clear cut process, and for Māori there is a much broader and deeper focus around power and connection to places and lands which need to be considered. For instance, whakapapa ties people to particular rohe (district or area) and

taonga (tangible and intangible things of significance, e.g., possessions, ecological species, and healthy environments), and the responsibilities for those domains will continue regardless. However, adaptation language and processes were identified as barriers. In particular, the framing and terminology of “retreat” and specifically “community-led retreat” was a particular point of contention. This is a global issue, with adaptation experts and academics calling for a reframing of adaptation terminology, specifically ‘retreat’ (Mach & Siders, 2021). During the wānanga, three Mentimeter questions were focused on identifying participants' thoughts on terminology. There was an overall negative response of participants to “What do you think when you hear the words “community-led retreat”? with responses in **Figure 7-4.**

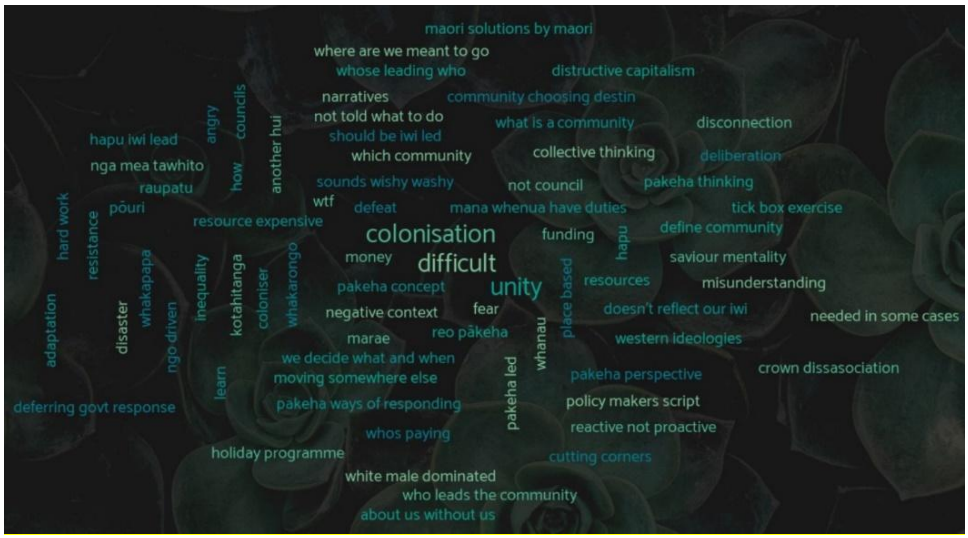

Figure 7-4: Mentimeter participant responses to "What do you think when you hear the words "community-led retreat"?” at the wānanga on 02/10/2024 at Whakaue Marae Maketū

At the wānanga, participants discussed the need for a shift in the framing and terminology of retreat as it still privileges non-Māori language and ideas. However, we do not have the answer as to what term should be used; communities need to decide on a term that resonates with them. As discussed at the wānanga:

“Community-led retreat” still privileges non-Māori language and framing. We still do not see ourselves in it. It continues to feel colonial, and suitably vague.”

In addition to reframing language, the wānanga highlighted that adaptation implementation needs to incorporate Te Ao Māori. For example, kōrero was shared about the importance of ensuring land is ready and healthy to become part of the ocean following a relocation process, supporting kaitiakitanga even though the whenua may be covered in water. In typical relocation discussions in local Government-led adaptation, the question of what happens to the land relocated from is often centred on the land value or potential future land use. Making sure no pollutants or hazardous substances remain as part of a relocation process that

supports kaitiakitanga needs to be considered. Key recommendations from the global and national adaptation frameworks and our wānanga are highlighted in **Figure 7-5**. These recommendations form the foundations of a new Māori climate adaptation framework presented in the following section.

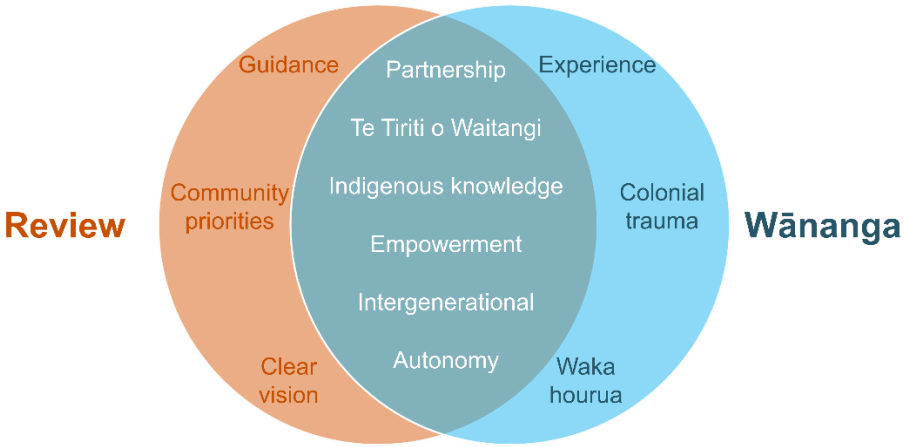

Figure 7-5: Key points and recommendations from the wānanga and global and national adaptation frameworks to incorporate into a Māori climate adaptation framework

7.7 A Māori Adaptation Framework – A pathway forward

Here, we posit a two-part Māori adaptation framework that is informed by the foundational principles from global and national adaptation frameworks for/by Indigenous peoples **(Figure 7-5)** and identified aspects of importance from the wānanga. The two parts that work together are: 1) A waka hourua approach focused on fostering the necessary partnerships for climate change adaptation, and 2) A Māori adaptation decision-making wheel supported and propelled by the waka hourua.

7.7.1 A waka hourua approach – The partnerships for climate change adaptation

Here we build on the proposed waka hourua approach suggested at the wānanga **(Section 7.6.1)** representing a process for a partnership with whānau, hapū and iwi Māori with the Crown and Tangata Tiriti in adaptation discussions and planning, while looking forward to a collective destination of adaptation. The components of the waka that allow it to sail have been used as metaphors for a Te Tiriti-centric partnership, based on the three spheres of influence mentioned in **Section 7.4.1**. These are described below in terms of what the waka component is, its role and its metaphoric counterpart. In addition, as seen in **Figure 7-6**, to the left of the waka hourua, are six stages of development of the waka hourua itself, representing the

importance and the mana (authority or integrity) of the relationship-building process that is going to be required for climate change adaptation.

7.7.1.1 Waka components

The waka components, as illustrated in **Figure 7-6**, highlight the different components of a waka hourua and their relation to the fostering of Te Tiriti-centric partnerships that hold mana that are necessary for climate change adaptation by hapū and iwi Māori, as seen in **Table 7-1.**

Table 7-1: Waka components and their relationship to fostering of Te Tiriti-centric adaptation partnerships

Waka components	***Description***
Raa matua / Main sail – ***Rangatiratanga***	The raa matua is the largest sail on the waka, designed to catch the wind and propel the vessel. It symbolizes Rangatiratanga, representing Māori communities' right to self-determination and autonomy in climate adaptation planning and implementation.
Raa kei / Mizzen – ***Kāwanatanga***	The raa kei is the secondary sail on the waka that supports the primary sail, raa matua. It symbolizes Kāwanatanga, or Crown governance. The partnership between Rangatiratanga and Kāwanatanga in a Te Tiriti-focused approach is called Ōritetanga, meaning equality. This illustrates how both governance systems, represented by different sails, can collaborate and add value to adaptation.
Pou manawa / Mast – ***Decision makers***	The two masts hold the sails that catch the wind. Pou manawa symbolize decision–makers like whānau, hapū, iwi, tohunga (experts), and rangatira who hold up the rangatiratanga sail, and local and central Government representatives who hold up the kāwanatanga sail. These experts possess the mana to advance adaptation efforts. When appropriate, both groups collaborate to support decision-makers in a Te Tiriti-centric approach, achieving ōritetanga.
Papa noho / Deck – ***Broader communities and stakeholders***	The papa noho is the deck that supports the masts, sails and the people on board the waka. The papa noho represents broader communities and stakeholders and requires representation across all stakeholders and partners.
Hiwi / Hull – ***Tangata Whenua and Tangata Tiriti***	The waka hourua features two hulls on either side of the papa noho, keeping it afloat. The hiwi symbolize adapting communities under a Te Tiriti partnership model: one representing Tangata Whenua and the other Tangata Tiriti, both affected by climate change. These hiwi are linked by the papa noho and work collaboratively toward a shared vision of adaptation, utilizing co-governance and expert guidance.
Hoe tere / Steering paddle	Tino rangatiratanga or autonomy is the steering paddle which guides the waka. Autonomy should be upheld in all adaptation decision-making and

– ***Autonomy in decision-making***	that a Te Tiriti-centric partnership and relationship is crucial in navigating the pathway forward with climate adaptation.
Aku / Crossbeams – ***Researchers at the interface***	These crossbeams connect the two hiwi and support the papa noho. The aku represent those engaging communities, whānau, hapū, or iwi alongside researchers and mātauranga Māori experts for adaptation outcomes.
Huarere / Weather – ***Challenges and adversity***	Huarere (weather) presents challenges and opportunities for sailing the waka. It signifies the unpredictable factors affecting adaptation planning and implementation, including financial, political, societal, and historical issues. Nonetheless, with a strong waka and a united crew, we can navigate and even leverage these challenges to move forward.

7.7.1.2 Building the partnership – Towards Ōritetanga

Beyond the individual parts of the waka, the process of building the waka (i.e. partnerships) is an essential part of the adaptation process. We explain below the numbered sections which are to the left of **Figure 7-6** which correspond to different stages of the waka building process.

1. **Source the waka pieces:** This includes identifying what is needed? And Who can lead? Particularly, who has rights and interests in climate adaptation of hapū and iwi Māori, with a focus on the differing models of partnerships described in **Section 7.4**. Understanding pathways to address and acknowledge the past, be it colonial traumas or positive examples of autonomous adaptation, can help to inform future adaptation.
2. **Piecing together the waka:** involves building the structure. This will take careful consideration to ensure a strong waka is built to be able to achieve adaptation with particular emphasis on the relationships that currently exist and the fostering of new relationships and partnerships. Key points are knowing who the knowledge holders are? As well as understanding ways in which capacity and capability of the whānau, hapū or iwi is enhanced **Figure 7-6**.
3. **Waka is built:** now we need to plan where we are sailing to: Where is our destination? What is our objective of adaptation? This is where the 7-stage decision-making wheel comes in **(see Section 7.7.2)**.
4. **Who is on the waka?** This step identifies who are the right people to engage with, for example, rangatahi, kaumatua, as well as trusted scientists, policymakers, researchers and planners. Who are the partners that will help us to accomplish our adaptation vision? How do we work together? And how do we make space for new people and knowledge that adds to the collective vision? Bringing all the decision-makers together from the kāwanatanga and rangatiratanga spheres, tangata whenua and tangata tiriti communities to achieve ōritetanga, an equitable and united pathway forward.

5. **Waka is sailing:** Where are we going, and are we ready to adapt to changes along the way? This requires everyone on the waka to be working together to ensure it stays afloat. If we need to change path for a period, how can we allow for this and eventually make it to the destination?
6. **Reflect:** This is a time to reflect and identify if the decisions that were made are effective in achieving the vision. This stage also begs the questions as to how we monitor and review and what are our back up plan(s) to get back on track.

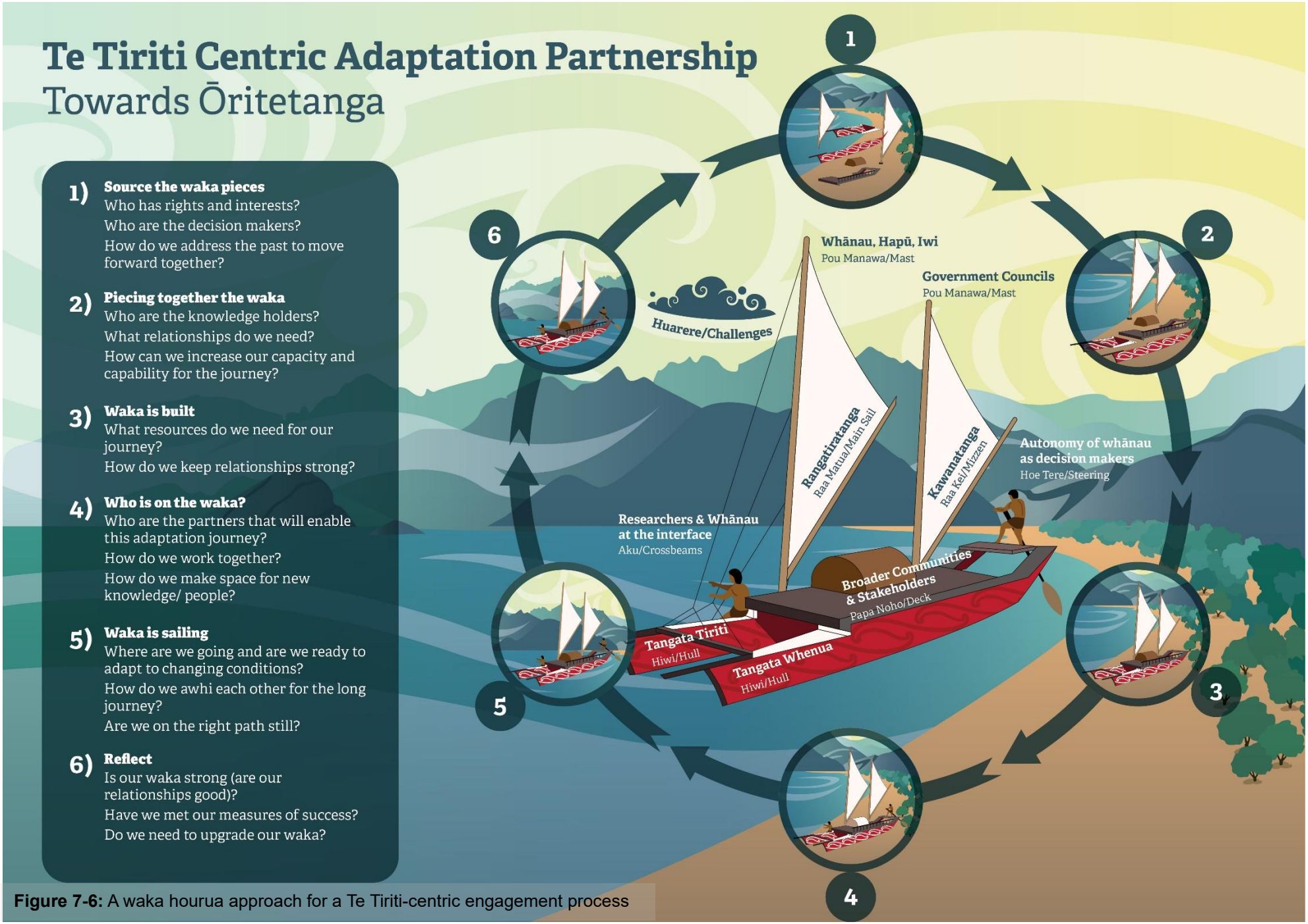

Figure 7-6: A waka hourua approach for a Te Tiriti-centric engagement process

7.7.2 Māori decision-making wheel

The waka hourua approach is an example of a Te Tiriti-centric approach to the relationships that are required with all partners and affected communities to adapt to climate change **(Section 7.6.1)**. The waka hourua provides the vessel to collectively adapt to climate change in a way that preserves rangatiratanga, but we also need practical guidelines that hapū and iwi Māori can utilise in their adaptation decision-making process **(Section 7.4)**. While there are many ways to approach this, for this paper we have built upon the MfE 10-step decision-making wheel, incorporating foundational principles from other global and national adaptation frameworks, as well as those key recommendations from the wānanga **(Figure 7-7)**.

7.7.2.1 What has happened?

This question isn't explicitly asked in the current MfE 10-step decision-making wheel from a Māori perspective, but our wānanga participants shared their experiences of intergenerational trauma related to historical land dispossession and inadequate Government engagement with hapū and iwi Māori. When this step isn’t given appropriate respect and acknowledgement, adaptation discussions (especially when led by Government representatives) become even more difficult. This is where a resourced safe space to release some of that mamae and tension will enable less tense and more productive discussions in identifying a pathway forward. This step also provides an opportunity to come together to learn who holds the mātauranga Māori and the local knowledge of the area, such as in terms of tohu (signals), environmental changes and hazards that can support risk assessments, and any information related to relocation or adaptation to empower hapū and iwi Māori. Opportunities to dig deeper into aspects like: Have you relocated in the past? Are there any pūrākau (ancestral stories) that can support decision-making? What are the local tohu relevant to climate change? What is our collective experience with environmental change?

7.7.2.2 What is happening?

This question is asked in the MfE 10-step decision-making wheel. It is important that we look and listen to the observations and experiences of those who live on the ground and in the area to collate and utilise their information to support the creation of baseline data that can inform their decision-making. However, for hapū and iwi Māori to include their expertise and mātauranga Māori in strategies or assessments, there needs to be time and resources to support this (Taylor et al., 2023). In addition, there needs to be a discussion around Te Tiriti, particularly around Treaty settlements, both those that are complete and those that are underway (Iorns, 2019). There needs to be careful consideration of the risk and vulnerability

of any land that is being returned and/or the investigation of current land holdings' risks to climate impacts and the opportunity for land to be made available (Peart & Tombs, 2023).

7.7.2.3 Where do we want to go?

"Where do we want to go?" is asked in the MfE decision-making wheel; however, it is phrased as "what matters most", which sets to identify what is of value, what is the objective of adaptation, and what is the vulnerability and risk of the community. We encourage thinking beyond this and intergenerationally for mokopuna (grandchildren) to come, similar to **Te Huringa ki te Rangi – He Rautaki Tāwariwari** framework by Colliar and Blackett (2018) centred on their intergenerational vision. Important to visioning is to have clear and tangible pathways that current generations can do to contribute to that intergenerational vision. In addition, identifying adaptation options that can achieve that intergenerational vision whilst at the same time identifying transformative opportunities for building capacity and capability within the hapū is imperative, as seen in **Figure 7-7**.

7.7.2.4 Who do we want on our waka?

This question is asked in the MfE decision-making wheel but in identifying the roles and responsibilities. However, the wānanga highlighted the need for further fostering of mana-enhancing partnerships between hapū and iwi Māori and the Crown as imperative for climate change adaptation. The process of establishing and strengthening these relationships is just as important as the adaptation planning and implementation process. An exploration is needed to identify who the decision-makers are and who are the accomplices that can support and enhance the adaptation process? equally important, how do you ensure the waka and its people are united and strong **(Refer to Section 7.7.1 and Figure 7-6)**.

7.7.2.5 What can we do about it?

This question is asked in the MfE decision-making wheel and is a step that identifies and evaluates adaptation options that fit best for the local context, which is critical for Māori. The MfE guidance highlights the importance of engaging a suite of options with the community and identifying adaptation thresholds (i.e. what the community do not want to see happen). They also identify pathways to test and evaluate options using different decision-support tools like cost-benefit analysis or multi-criteria decision analysis. We would emphasise the need to align adaptation options with the values and aspirations of the hapū and iwi, such as with existing hapū or iwi management plans or other appropriate visioning documents. This will ensure options consider aspects like the environment and other aspects of value to Māori.

7.7.2.6 How do we implement? And, How do we monitor or review?

These last questions around implementation and monitoring/reviewing the adaptation implemented are part of the MfE decision-making wheel. Here, we stress the importance of identifying opportunities for funding and relationships needed with decision-makers to implement the plan. We assert the necessity for strong monitoring plans and systems to guarantee that the adaptation options implemented are fully aligned with hapū and iwi aspirations. An approach that effectively enhances the capability and capacity of hapū and iwi, grounding efforts in kaupapa Māori methods that embrace mātauranga Māori and the relevant tikanga. These could include the inclusion of tohu, the use of the maramataka (lunar calendar), and/or centring monitoring using pūrākau. We also included the question ‘is it working?’ and this would need a deeper discussion on the view of success. For instance, it may, in part, be a reduction in risk or impacts to be seen as successful, but it could also be the reappearance of key species or accessibility to a certain wāhi tapu during certain times of year. Hence, a broader discussion around what this could look like is needed.

1) What has happened?

What has enabled our historical adaptation?
Who has our mātauranga?
How do we create space to work through mamae?

2) What is happening?

What have we seen change?
What does the data show?
What is our understanding of climate change?

3) Where do we want to go?

What do we value most?
What are our adaptation outcomes?
How can adaptation support collective vision?

4) Who do we want on our waka hourua?

Who are the decision makers?
Who are our accomplices?
How do we make the waka strong?

5) What can we do about it?

What options align with our values and aspirations?
Which options are suitable for the environment?
What are the funding opportunities?

6) How do we implement?

How do we carry our plan into a stautory framework?
What are the implementation opportunities?
Who are the authorities and funding streams?

7) How do we monitor or review?

What and how do we monitor?
Who will monitor?
Is it working?

Figure 7-7: Māori Climate Adaptation Framework

7.8 Conclusion

This paper contributes a Māori adaptation framework centred in a Te Tiriti-centric approach to fostering partnerships between decision-makers, as well as providing tangible guidance to support hapū and iwi Māori in planning and implementing climate change adaptation. This framework also provides a different perspective for local and central Government to consider how they undertake climate change adaptation with Māori communities. This contribution emphasises the need for adaptation frameworks that ensure relationships and partnerships are strengthened, Indigenous knowledge and cultural values are valued and incorporated, intergenerational thinking and visioning are at the centre, and guidance is provided for communities. In addition, the climate adaptation wānanga emphasised three key themes relevant to the context of Māori climate change adaptation, including: The importance and relevance of Te Tiriti o Waitangi for adaptation, the relevance of historical experiences, and the importance of autonomous adaptation. Our framework draws from existing adaptation frameworks and the wānanga kōrero to posit a Māori climate change adaptation framework focussing on relationships and guidance. Our framework incorporates a Te Tiriti-centric waka hourua approach that brings together the three spheres of influence (kāwanatanga, rangatiratanga, and ōritetanga) a unified approach to working together in the context of climate change adaptation. Adaptation planning follows a 7-stage decision-making process that prioritizes acknowledging and resourcing pathways for hapū and iwi to address trauma from relocation and to centre adaptation plans in their own mātauranga Māori, achieving their intergenerational vision. This framework can act as a starting point for hapū and iwi across A-NZ to begin developing their own thinking around adaptation and what works best for them.

Chapter 8 – Discussion

8.1 Introduction

This thesis aimed to develop a Māori adaptation framework that promotes an equitable and culturally sensitive approach to adaptation to climate change by and with hapū/ iwi Māori. To achieve this aim, the objectives were to: 1) Explore and collate examples of historical relocations of pā in response to natural hazards; 2) Analyse the current risk of coastal pā to coastal flooding with sea level rise; 3) Understand the current challenges to adapt by Indigenous peoples; and 4) Develop a Māori climate adaptation framework. Detailed discussions have been given in Chapters 3 to 7 about the findings for each thesis objective, and here I briefly discuss key findings and implications of the overall thesis findings concerning the previous state of knowledge and identify opportunities for further research. I focus this discussion on four topics that integrate and reflect critical contributions of this thesis: 1) Māori communities are at risk of climate change; 2) “We’ve done it before, and we can do it again”; 3) Adaptation approaches cannot be a one size fits all; and 4) A Te Tiriti centred approach is needed.

8.2 Hapū and iwi Māori are at risk to climate change

Climate change is and will undeniably impact communities worldwide, including the hapū, iwi and other Māori groups/communities in A-NZ. Many Māori communities and cultural infrastructure, such as coastal marae and pā, are at risk of coastal flooding and erosion exacerbated by rising sea levels. In A-NZ, understanding national infrastructure and community exposure and risk to sea level rise is a rapidly developing space with research identifying flood exposure (Stephens et al., 2021; Paulik et al., 2023b), changes in mean sea level (Bell et al., 2000; Naish et al., 2024), community isolation (Logan et al., 2023) and impacts to Māori communities (King et al., 2012a; King et al., 2013; Kenney & Phibbs, 2015; Colliar & Blackett, 2018; Bailey-Winiata, 2021). For example, Bailey-Winiata (2021) found that 191 marae are within 1 km of the coastline, with 71% (136) coastal marae are at elevations less than 20 m above MSL, and a further 39% (74) coastal marae are less than 150 m from the coastline (Bailey-Winiata, 2021). This research also found that 41 coastal marae are potentially at risk of a 100–year extreme sea level event with 3 m SLR. Furthermore, the work of King et al. (2012a); King et al. (2012b); King et al. (2013) were place-based studies identifying the future climate change-induced coastal hazards for three communities, Manaia in the Hauraki, Ngāti Huirapa in Temuka and Mitimiti in the Hokianga. These studies identified key climate exposures faced by the three Māori communities and began to understand the

factors that facilitate whānau responses to the hazards. Blackett et al. (2021) and Colliar and Blackett (2018) developed and implemented the “serious game” marae-opoly to support adaptation planning and decision-making for hapū and iwi. Marae-opoly was used as a tool to support the marae community and hapū of Tangoio Marae in Hawkes Bay to identify their adaptation options which led to their marae adaptation strategy.

Chapter 5 contributes original knowledge to this discourse by using higher resolution spatial data which shows that by 2150, 14% of a total of 874 coastal marae buildings could have between 75–100% of their building footprints exposed to coastal flooding. Direct impacts could include physical damage from floodwaters and collision by large objects carried during large storm events. Indirect impacts could include loss of access to the marae by the hapū or iwi as well as isolation from external emergency services (Lan et al., 2023). This picture highlighting the vulnerability of key cultural infrastructure in A-NZ to sea level rise, reflects a growing body of global research showing the risks of cultural heritage sites (Reeder-Myers, 2015; García Sánchez et al., 2020; Aktürk & Lerski, 2021) and Indigenous communities to climate change(Furgal & Seguin, 2006; Maldonado et al., 2013; Carmichael, 2015; Ford et al., 2021) .

In addition to marae buildings, **Chapter 5** also identified that 11% of a total 186 marae land parcels could have 75–100% of their land parcel exposed to a 1000–year ARI coastal flood event under SSP5–8.5. Under the same parameters, 10% of marae land parcels have between 0–25% of their land parcel exposed. Those marae with 0–25% of their land parcel exposed could potentially relocate their buildings within their existing land parcel. This could make relocation more attainable as place attachment is maintained and there is likely a smaller financial cost. However, more detailed analysis is required to determine if this is feasible. Conversely, those marae that have between 75–100% of their land parcel exposed to coastal flooding may have to consider relocation outside of their original land parcel or consider other adaptation options such as hard engineered protective structures, and/or nature-based solutions. Suitable land for communities to relocate to is a challenge across the board, and particularly for hapū and iwi Māori who have kinship ties and deep connections to land (Expert Working Group on Managed Retreat, 2023). Globally, finding such suitable land is generally complicated for all Indigenous communities, although opportunities exist to explore ways to assess lands utilizing Indigenous cultural values and knowledges (DeLancey, 2023), ensuring community health and wellbeing is enhanced (McMichael & Powell, 2021) or identifying governance structures and economic opportunity of lands (McDonald & Figueiredo, 2022).

The focus on marae in this thesis is only “the tip of the iceberg”. Māori cultural infrastructure extends well beyond marae buildings and immediate land parcels, and may include for example papakāinga, urupā, kōhanga reo and kura kaupapa (Māori language school). While

adaptation could involve a range of options, some of which may buy time, in many cases, relocation in some form will be inevitable and current adaptation frameworks and processes are not equipped to deal with the scale, spread and nuance of this burgeoning problem for Māori communities. This was one of the catalysts for the Māori adaptation framework I contributed in this thesis which illustrates an example framework for adaptation planning and that is centred in Māori cultural values and takes a by Māori and for Māori approach.

8.3 We've done it before we can do it again

Relocation by hapū and iwi Māori in A-NZ has occurred relatively frequently, and historically hapū and iwi Māori were generally highly mobile such as moving between various seasonal pā (Phibbs & Kenney, 2022). While this is generally known, prior to this thesis there was a lack of literature exploring this mobility to understand the process, enablers and barriers which can be used both to empower hapū and iwi Māori today as they plan to adapt to climate change, and to support the development of frameworks and processes.

This thesis provides a written evidence base to show that there is a wealth of examples where hapū and iwi Māori have relocated or adapted to environmental change, with lessons learned and opportunities for future growth **(Chapter 4)**. Although this work is comprehensive, I recognize that it contributes to the efforts of many other researchers studying Māori community responses to natural hazards and climate change, and that there are numerous examples not included here (King et al., 2007; King et al., 2012a; McFadgen, 2013; Wilkinson et al., 2020; Smith et al., 2024). Although relocation to natural hazards is a common occurrence in the past, many communities approach relocation now with caution due to a myriad of reasons. For Māori, such reasons can include the intergenerational impact of colonial land confiscations, injustices and marginalisation of hapū and iwi Māori (Thom & Grimes, 2022), the complexity of funding mechanisms for relocation (Boston & Lawrence, 2018; Peart et al., 2023), and/or inadequate legislation and policy to guide relocation process (Expert Working Group on Managed Retreat, 2023; Peart & Tombs, 2023), and the challenges of place attachment (Hayward, 2008; Mach & Siders, 2021; Siders et al., 2021; Ryan et al., 2022).

When considering lessons learned from past examples of relocation and their application to the present, it is important to consider how the world, policy, and society has changed. For example, **Chapter 4** highlighted four enablers to the historical relocation of Tūhourangi and Ngāti Rangitihi following the 1886 Tarawera Eruption, showing that land gifting, autonomy in decision-making, perspective on lands and infrastructure and relocation sites, enabled their relocation. Land gifting occurred between Tūhourangi, and Ngāti Maru ki Hauraki based on whakapapa, during the mid to late 19th century. This occurred at the same time that land was rapidly being sold or confiscated (Boast & Hill, 2010), yet there was still available land to gift.

This is complicated in modern A-NZ, land is now highly commodified, combined with a severe and chronic housing crisis (White & Nandedkar, 2021), a lack of relocation policy and guidance (White & Lawrence, 2020), and a lack of land under Māori guardianship (Mutu, 2019b), makes finding suitable land to relocate to complicated (Piggott-McKellar & Vella, 2023). This gesture of land gifting was encompassed by two further enablers: autonomy in decision-making and perspective of lands and infrastructure in that the land wasn't a commodity. The land was an entity that would support, nourish and heal the displaced people and ensure their continuation as decided by them for them. Autonomy is necessary, ensuring adaptation is accepted by the community who are having to adapt (Gini et al., 2024). This results in benefits not only in terms of reducing risk to hazards, but also provides other benefits such as strengthening relationships between authorities and community and/or redress of historical wrongs. This research focused on a A-NZ specific subset of what globally is a burgeoning repository of examples of historical relocation, such as seasonal rounds and settlements (Pinter, 2021a; Siders & Ajibade, 2021), that could be used to inform future climate change adaptations and relocations (Pinter, 2021a; Siders & Ajibade, 2021). Although I have presented an A-NZ specific relocation example, the four enablers that supported Tūhourangi and Ngāti Rangitihi are still relevant now, just in a different way. I do not negate the fact that the enabler of historical land gifting is complicated in current times, but the foundational values of manaakitanga, awhi and tino rangatiratanga that are common practices of all hapū and iwi Māori, will continue to play an important role in adapting to future climate impacts. Importantly, this thesis isn't an attempt to highlight what hapū and iwi Māori already know, but it is resurfacing those experiences and examples to showcase a potential Māori relocation blueprint and empower Māori communities to know that we've done it before, and we can do it again.

8.4 Adaptation approach cannot be a one size fits all

"One size does not fit all" is a dominant theme of this PhD thesis and is a poignant reminder that adaptation cannot take a "blanket approach" for communities at risk to climate change, especially Indigenous communities. Numerous Indigenous communities around the globe are adapting to climate change impacts and **Chapter 6** highlighted key challenges and mechanisms used by Indigenous communities to overcome them. Adaptation is complicated, in that to overcome the same problem, often there is more than one approach. For instance, the challenge of giving space for Indigenous knowledge and methods in adaptation planning. Examples such as Hiwasaki et al. (2015) suggest that Indigenous knowledge should be integrated into adaptation plans with Western knowledge verifying the Indigenous knowledge. Whereas Thompson and Ban (2022) and Leonard (2021) both recommend that Indigenous knowledge needs to be at the centre of adaptation, with a focus on Indigenous self-

determination and knowledge. For example, the Tangoio Marae example in Colliar and Blackett (2018) described in **Section 8.2** focussed on incorporating Western knowledges to support and enhance the adaptation project and plan that was created by the hapū and centred in their Indigenous knowledge. These examples showcase the variation, intricacies and nuances that exists at the local level which can be missed with a high-level mainstream approach. In the context of A-NZ, mainstream approaches to adaptation include decision-making planning tools like DAPP (Lawrence et al., 2019; Haasnoot et al., 2024), with its encouraged use by local and central Government in A-NZ (Ministry for the Environment, 2024).

As discussed in **Chapter 7**, wānanga participants discussed the wealth of these existing frameworks, approaches and assessments to achieve adaptation for communities, such as DAPP at the national level. However, the deficit of these frameworks and approaches not being centred or including cultural values, nor any significant input from Māori communities was a big disadvantage. The wānanga called for a waka hourua approach to guide inclusive ways to guide how current adaptation frameworks could be used in unison with Māori approaches and mātauranga Māori as well as a method to include Western science and knowledge to support the collective adaptation approach, or the exploration to develop adaptation approaches or assessments centred in Te Ao Māori. The research identified a range of frameworks to support adaptation **(see Chapter 7)** where those developed by or for Indigenous communities often focus on the necessary relationships and partnerships needed to achieve adaptation success (Whyte, 2013; Matike Mai Aotearoa, 2016), while others focus on high level cultural perspectives and positioning (Leonard, 2021). It also provided evidence to support the argument however, that a process-based framework for A-NZ that Māori can draw from and adapt is needed. In this thesis, the dual process-based and relationship-based frameworks developed occur at a time of rapidly changing adaptation policy, including the creation of a pending national adaptation framework that outlines the Government's approach to sharing the costs and the planning of adapting to a changing climate. It is imperative that we continue to emphasise the need for diversity and engagement with all partners, their knowledges and cultural perspectives for adaptation. Particularly with global Indigenous communities, we are all diverse, in terms of our histories and contemporary circumstances (e.g., economic, social and cultural aspects), as well as our specific hazardscapes and likely climate impacts we face, will require unique and nuanced approaches to adaptation.

8.5 Adaptation in A-NZ needs a Te Tiriti-centric approach

The final contribution of this PhD thesis is a Māori adaptation framework that could be utilised and evolved by hapū, iwi and Māori communities to support their adaptation decision-making,

planning and process in **Chapter 7**. There are many ways developing such a framework could be approached, and for this thesis we opted to use the current mainstream adaptation process approach as a starting point. This approach may not work for everyone, and it is acknowledged that there is more work to be done to refine and test such a framework. The framework developed for this thesis was informed by a wānanga with nearly 100 Māori contributing, combined with a review of current global and national adaptation frameworks by or for Indigenous communities which discuss the need for relationships, partnerships, cultural resonant adaptation and implementable guidance. This process of wānanga to develop a framework shows the power and effectiveness of kaupapa Māori methodology in research, where the wānanga clearly highlighted barriers, needs and some solutions for future climate adaptation planning, process and practice. Similar processes have been applied by international Indigenous peoples such as talking circles of Native Americans (Cameron et al., 2021; Hanson et al., 2024), yarning circles of Indigenous Australians (Ali, 2018; Morgan-Bulled et al., 2023), and Mo'olelo of Hawaii (Kurashima et al., 2018; Miller & Moses, 2024). This highlights the important role of creating spaces that are comfortable for Indigenous people to share kōrero without fear of condemnation, a space that is under cultural rules and protocols, acknowledgement of ancestors and future generations, and the presence of facilitators to ensure adaptation discussions remain on track.

In the justice forward framework developed by Whyte (2013) he emphasised the importance of Government-to-Government relationships, i.e. between the settler-colonial Governments and the Indigenous sovereigns of the lands. He emphasises that working in a partnership and acknowledging Indigenous peoples as not “stakeholders”, but sovereigns and partners is important to adaptation decision-making (Whyte, 2013). This partnership was reiterated in the spheres of influence model by Matike Mai Aotearoa (2016), where two equal sovereigns, kāwanantanga (Crown) and rangatiratanga (Māori) work together in a partnership to achieve ōritetanga which means equality. This Māori adaptation framework has a Te Tiriti-centric focus, with a focus on the building of the partnership between Māori and the Crown using a waka hourua metaphor to emphasise the importance of identifying the parts, relationships, and the strengthening of the connections that holds the waka together, which supports a Tiriti partnership approach to support adaptation planning and practice with all communities in A-NZ. This can then provide the structure to support the adaptation process.

As this thesis is being finalised, there is rapidly changing national adaptation guidance, experts and organisations are beginning to beg the question, what responsibilities do the national Government, a Treaty partner, have to protect Māori interests under Te Tiriti o Waitangi (Iorns, 2019), despite its debated intention and translation of concepts. The Environmental Defence Society touched on this in their working paper 2 whether the Government’s duty of active

protection under Te Tiriti includes assisting Māori to access land for adaptation and relocation (Peart & Tombs, 2023). Te Tiriti is at the focus of current political discourse, with decades of disputes about the mistranslation of terms, its relevance, particularly its principles, are being brought into question as in the context of modern-day A-NZ (Ministry of Justice, 2024). This research supports the view that adaptation to climate change needs a partnership approach, and not only for Māori but for the whole of A-NZ, and Te Tiriti o Waitangi provides guidance as how to foster the necessary partnership for adaptation as discussed in **Section 2.5.3**. Te Tiriti is context specific to A-NZ, but there are many relevant themes on considering what partnership between Indigenous peoples and the Crown/ Governments/ decisions-makers looks like that could support other Indigenous and non-Indigenous communities in their adaptation process. Furthermore, the ability of Te Tiriti to be used as a mechanism to provide the impetus for settler colonial Governments to assist hapū and iwi Māori in adaptation is unique and not all Indigenous communities globally have this type of agreement. However, Te Tiriti shows the power of legislation and policy in the ability for it to be used in ways that builds and ensures Indigenous autonomy in adaptation. This is still a developing space, and the eyes of the world are looking to how Māori, and the A-NZ Government will move forward.

8.6 Future research directions

This thesis has employed a multidisciplinary approach to understand some of the needs of hapū and iwi and Māori to adapt to climate change, and there is much scope for future research and practice to support the development of processes, frameworks, guidance and case studies. Here I highlight a few key remaining research needs, the first of which is considering learnings from previous pā relocations. **Chapter 3** and **Chapter 4**, sampled only a selection of written English documents available in sources such as Press Reader, Māori Maps, Treaty settlement documents and Google search engine to identify historical cases of pā relocation. This revealed 51 examples of pā relocation to various natural hazards, however this is only a small insight into the prevalence of such mobility of Māori. Notably, the approach taken does not include exploring oral histories, which is a keyway Māori pass down and retain knowledge, nor documents written in languages other than English. I have heard about many other examples of pā relocations due to natural hazards from kōrero (conversations) with various tangata whenua that are not captured in these examples. **Chapter 4** highlights the rich information from kōrero tuku iho from one example of pā relocation due to a natural hazard (the relocation of Tūhourangi and Ngāti Rangitihi due to the Tarawera eruption in 1886) that showed lessons on barriers and enablers to relocation after the eruption. There are many more stories of relocation examples that could be explored (if this is deemed appropriate by whānau/ hapū/ iwi and correct research protocols are followed to better understand these barriers and enablers to climate adaptation in the present day. In addition, other forms of

mātauranga Māori could also be explored such as pūrākau, waiata, mōteatea, and more. It is also relevant to consider other forms of relocation such as forced removals and land confiscations, which could foster a broader discussion around lessons learned from those types of relocations, as well as opening the discussion around the potential for redress and potential risks of climate change adaptation.

The systematic review in **Chapter 6** gave an initial understanding of what is happening in the global field of climate change adaptation by and for Indigenous communities. Opportunities for further research include digging deeper into grey literature rather than just the peer-reviewed literature, as a lot can be found in reports and plans which aren't published in academic platforms. In addition, having case studies can enable "on the ground" discussion and sharing of knowledge that would add another layer of information that could be utilised to support Indigenous adaptation planning. Another area for potential future research is to build on the work showcased in **Chapter 5** which focused on the future impacts of a rising sea level on coastal marae buildings and land parcels. There are many other factors relevant to coastal marae that could contribute to their risk to climate change in addition to sea level rise. This includes other hazards such as drought (Hendy et al., 2018), temperature change (Jones et al., 2014), extreme weather (Harrington et al., 2023), landslide (Jones et al., 2014), groundwater (Bosserelle et al., 2022), health and wellbeing (Jones et al., 2014), and food security with impacts on mahinga kai and māra kai (gardens) (Awatere et al., 2021b; Wehi et al., 2023).

Finally, this thesis has contributed a Māori climate adaptation framework that is centred on the importance and relevance of the relationships, partnerships needed for adaptation between hapū and iwi Māori with the Crown. This framework recognized the necessity of a tangible step by step guidance that can support hapū and iwi Māori develop their adaptation plans. Although the framework is based on information shared from a wānanga and other sources such as the review of other frameworks, the framework itself is yet to be tested, implemented and refined to identify its effectiveness and opportunities for adjustments. I recommend and implore the need for a flexible framework that actively promotes and gives guidance to local communities and hapū or iwi to lead their adaptation planning, which avoids a one-size-fits-all.

8.7 Reflections

Throughout this PhD, I have had many wise and experienced mentors who have provided the diverse support required to work in this space. These mentors have given me plenty of

motivational quotes, words of encouragement and sage advice, these include: He tangata, he tangata, he tangata – it is the people that matter, and we've done it before we can do it again.

He tangata, he tangata, he tangata. Given my training as a coastal scientist, I can see the value and importance of more robust science, data and research, and I advocate for more of it. I am not a social scientist or policy expert, nor do I claim to be, but if research and science isn't connected to the people who it concerns or it is relevant to, then what's the point? This is especially important to climate change, natural hazards and adaptation. If people aren't part of the equation, an equation that can result in the complete altering of people's lifestyles, livelihoods, culture, connection and so much more, then what is the point? We are inevitably just creating more issues down the track. The focus on people and community has been influential when working with Māori communities, people across generations, living and non-living, are important and need to be included in the discussions, planning and implementation, no matter what.

As the PhD progressed, I read more, spoke to more people and several learnings really stand out for me. The first is, when I engaged in adaptation and relocation discussions regarding marae, hapū and iwi, particularly with Māori, I was often encountered with a mixture of anxious resistance with uncertain perceptions of where we were going. Others showed relief that this was being looked into, and some shared stories of adaptation and relocation that their ancestors had done. There was obviously something to dig into here, especially looking forward with climate led relocation, which for some hapū and iwi Māori will be inevitable. But it was also clear that there is a lot of mamae (pain) that plays a strong role in how Māori feel about climate change adaptation that needs to be given space and support to be part of the process. The reasons for this mamae are many and have many parallels with other Indigenous peoples, including the intergenerational trauma of forced relocations and land confiscations, alongside decisions being made "about us without us" and being a "tick box" when it comes to engagement and diversity/inclusion.

I found myself in a dilemma, how do I dig into something that can result in pain, anxiety and uncertainty, but without which, there is a very real risk of worse outcomes for Māori including lack of time to lead processes and to have our voices heard and knowledge included if we end up in a reactive rather than proactive process. Again, I came back to, if it's coming from a place of aroha and it's about people, it's worth a try. I'm glad we did give it a try, because I was able to shine a light on what many people already knew but often forgot, that relocation and adaptation is not uncommon for Māori, it's in our whakapapa, our tīpuna were the experts in adaptation and relocation. We've done it before we can do it again is a motto that has come out of this research because it's true. There is power in knowing that our tīpuna did it before

and we can do it again. No one can get rid of the anxiety and uncertainty of adaptation or relocation, it will always be there, but for Māori, we shouldn't be afraid, we need to embrace it and lead adaptation for us, by us.

Māori glossary of common words

Aotearoa	Land of the long white cloud, Māori name for New Zealand
Aroha	Love or compassion
Ātea	Courtyard
Atua	God or supernatural being
Awa	River, stream or creek
Awhi	To support/embrace
Hapū	Sub-tribe (group of whānau)
Hapori	Community
Haukāinga	Home people
Hui	Meeting
Iwi	Tribe (group of hapū)
Kai	Food
Kai awa	Freshwater food
Kai moana	Seafood
Kaitiaki	Steward or guardian
Kaitiakitanga	Inherent obligation to look after the natural environment
Karakia	Prayer
Kaumātua	Elders
Kaupapa	Agenda
Kaupapa Māori	Māori research methodology
Kāwanatanga	British crown or governorship
Koha	Gift/donation
Kōhanga reo	Māori preschool
Kōrero	Prose/discussion/ story/ to talk
Kōrero tuku iho	Passed down stories / oral traditions
Kotahitanga	Unity
Mahinga kai	Traditional food gathering sites
Mamae	Pain or sorrow
Mana	Authority/ prestige/ status
Mana whenua	Māori with traditional authority over an area
Manaaki	Support
Manaakitanga	Kindness or generosity
Māori	Indigenous peoples of Aotearoa New Zealand
Māra	Gardens
Marae	Māori meeting grounds
Mātauranga Māori	Māori traditional knowledge
Mātauranga-taiao	Knowledge of the environment
Mātauranga-a-whānau	Knowledge at the whānau level
Mātauranga-a-hapū	Knowledge at the hapū level
Mātauranga-a-iwi	Knowledge at the iwi level
Maunga	Mountain
Mauri	Life force and metaphysical essence or energy of landscapes and systems

Moana	Ocean, sea, or large lake
Mōteatea	Lament or chant
Ōritetanga	Equality
Pā	Complex of Māori structures and places important to Māori
Pākehā	Non-Māori
Papatūānuku	Earth Mother
Pūrākau	Traditional Māori narrative represented as a type of codified knowledge
Rangatira	Leader
Rangatiratanga	Authority/ sovereignty/ self-determination/ autonomy
Ranginui	Sky Father
Taiao	Environment or nature
Tangata whenua	People of the land
Tangi	Funeral
Taniwha	Water spirit or guardians within the environment
Taonga	Tangible and intangible things of significance
Te Ao Māori	Māori worldview
Te Ika A Māui	North Island of A-NZ
Te Reo Māori	Māori language
Te Tiriti o Waitangi	Treaty of Waitangi (founding document of Aotearoa New Zealand)
Te Waipounamu	South Island of A-NZ
Tikanga	Māori customs and practices
Tino rangatiratanga	Self-determination or autonomy
Tīpuna	Ancestors
Tohu	Environmental sign
Tohu Taiao	Environmental indicators
Tuku whenua	Land gifting
Urupā	Cemetery
Wāhi tapu	Sacred site / place
Waiata	Song
Wānanga	Places or learning, workshops
Whakapapa	Genealogical connection
Whakataukī / Whakatauākī	Proverbs/ significant sayings where the person who said it first is unknown and known, respectively
Whakawhanaungatanga	Process of establishing relationships
Whānau	Close and extended family
Whanaungatanga	Relationships / connections
Wharekai	Kitchen or dining quarters on a marae
Wharekarakia	Place of prayer/ church
Wharenui / Whare tīpuna	Meeting house of a marae
Whenua	Land and placenta

References

Adamson, G. C. D., Hannaford, M. J., & Rohland, E. J. (2018). Re-thinking the present: The role of a historical focus in climate change adaptation research. *Global Environmental Change*, *48*, 195-205. https://doi.org/10.1016/j.gloenvcha.2017.12.003

Adger, W. N., Arnell, N. W., & Tompkins, E. L. (2005). Successful adaptation to climate change across scales. *Global environmental change*, *15*(2), 77-86. https://doi.org/10.1016/j.gloenvcha.2004.12.005

Adger, W. N., Dessai, S., Goulden, M., Hulme, M., Lorenzoni, I., Nelson, D. R., Naess, L. O., Wolf, J., & Wreford, A. (2009). Are there social limits to adaptation to climate change? *Climatic Change*, *93*(3), 335-354. https://doi.org/10.1007/s10584-008-9520-z

Agrawal, A. (1995). Dismantling the Divide Between Indigenous and Scientific Knowledge. *Development and Change*, *26*(3), 413-439. https://doi.org/10.1111/j.1467-7660.1995.tb00560.x

Agyeman, J., Devine-Wright, P., & Prange, J. (2009). Close to the Edge, down by the River? Joining up Managed Retreat and Place Attachment in a Climate Changed World. *Environment and Planning A: Economy and Space*, *41*(3), 509-513. https://doi.org/10.1068/a41301

Aktürk, G., & Lerski, M. (2021). Intangible cultural heritage: a benefit to climate-displaced and host communities. *Journal of Environmental Studies and Sciences*, *11*(3), 305-315. https://doi.org/10.1007/s13412-021-00697-y

Albert, S., Bronen, R., Tooler, N., Leon, J., Yee, D., Ash, J., Boseto, D., & Grinham, A. (2018). Heading for the hills: climate-driven community relocations in the Solomon Islands and Alaska provide insight for a 1.5°C future. *Regional Environmental Change*, *18*(8), 2261-2272. https://doi.org/10.1007/s10113-017-1256-8

Ali, M. E. (2018). Adaptation of Marrubium vulgare L Species to The Habitat Alteration in Disturbance Regime. *Egyptian Journal of Botany*, *58*(2), 287-296. https://doi.org/10.21608/ejbo.2017.1467.1116

Allgood, L., & McNamara, K. E. (2017). Climate-induced migration: Exploring local perspectives in Kiribati. *Singapore Journal of Tropical Geography*, *38*(3), 370-385. https://doi.org/10.1111/sjtg.12202

Amare, G., & Gacheno, D. (2021). Indigenous Knowledge for Climate Smart Agriculture—A Review. *International Journal of Food Science and Agriculture*, *5*(2), 332-338. https://doi.org/10.26855/ijfsa.2021.06.019

Asugeni, R., Redman-MacLaren, M., Asugeni, J., Esau, T., Timothy, F., Massey, P., & MacLaren, D. (2019). A community builds a "bridge": an example of community-led adaptation to sea-level rise in East Kwaio, Solomon Islands. *Climate & Development*, *11*(1), 91-96. https://doi.org/10.1080/17565529.2017.1411239

Awatere, S., King, D. N., Reid, J., Williams, L., Masters-Awatere, B., Harris, P., Tassell-Matamua, N., Jones, R., Eastwood, K., & Pirker, J. (2021a). Te Arotahi. https://maramatanga.devr.net/sites/default/files/2021-10/teArotahi_7_21-1910%20Climate%20Change_Awatere.pdf

Awatere, S., King, D. N., Reid, J., Williams, L., Masters-Awatere, B., Harris, P., Tassell-Matamua, N., Jones, R., Eastwood, K., Pirker, J., & Jackson, A. M. (2021b). *He huringa āhuarangi, he huringa ao: a changing climate, a changing world*. http://www.maramatanga.co.nz/report/he-huringa-huarangi-he-huringa-ao-changing-climate-changing-world

Bailey-Winiata, A. P. (2021). *Understanding the potential exposure of coastal marae and urupā in Aotearoa New Zealand to sea level rise* [Masters, The University of Waikato]. Tauranga, New Zealand. https://hdl.handle.net/10289/14567

Bailey-Winiata, A. P., Gallop, S. L., Hikuroa, D., & White, I. (2022). The role of coastal marae in natural hazard response and climate change adaptation. *New Zealand Coastal Society Special Publication*, 41-44. https://www.coastalsociety.org.nz/assets/Uploads/files/SP5-Coastal-Adaptation-Complete-reading-version.pdf#page=49

Bailey-Winiata, A. P., Gallop, S. L., White, I., Wotherspoon, L., Fa'aui, T., Dickson, M., & Ellis, J. (2024). Looking backwards to move forwards: insights for climate change adaptation from historical Māori relocation due to natural hazards in Aotearoa New Zealand. *Regional Environmental Change*, *24*(2), 80. https://doi.org/10.1007/s10113-024-02240-5

Barnett, J., & McMichael, C. (2018). The effects of climate change on the geography and timing of human mobility. *Population and Environment*, *39*(4), 339-356. https://doi.org/10.1007/s11111-018-0295-5

Battiste, M. (2004). Unfolding the Lessons of Colonization. In C. Sugars (Ed.), *Unhomely States: Theorizing English-Canadian Postcolonialism* (pp. 209-220). Broadview press.

Bell, R. G., Goring, D. G., & de Lange, W. P. (2000). Sea-level change and storm surges in the context of climate change. *IPENZ Transactions*, *27*(1), 1-10. https://hdl.handle.net/10289/1548

Benevolenza, M. A., & DeRigne, L. (2019). The impact of climate change and natural disasters on vulnerable populations: A systematic review of literature. *Journal of Human Behavior in the Social Environment*, *29*(2), 266-281. https://doi.org/10.1080/10911359.2018.1527739

Berrang-Ford, L., Pearce, T., & Ford, J. D. (2015). Systematic review approaches for climate change adaptation research. *Regional Environmental Change*, *15*(5), 755-769. https://doi.org/10.1007/s10113-014-0708-7

Bethel, M. B., Braud, D. H., Lambeth, T., Dardar, D. S., & Ferguson-Bohnee, P. (2022). Mapping risk factors to climate change impacts using traditional ecological knowledge to support adaptation planning with a Native American Tribe in Louisiana. *Journal of Environmental Management*, *301*. https://doi.org/10.1016/j.jenvman.2021.113801

Bickler, S., Clough, R., & Macready, S. (2013). *The impact of climate change on the archaeology of New Zealand's coastline: A case study from the Whangarei District*. https://www.doc.govt.nz/documents/science-and-technical/sfc322high_res.pdf

Bierbaum, R., Smith, J. B., Lee, A., Blair, M., Carter, L., Chapin, F. S., Fleming, P., Ruffo, S., Stults, M., McNeeley, S., Wasley, E., & Verduzco, L. (2013). A comprehensive review of climate adaptation in the United States: more than before, but less than needed.

Mitigation and Adaptation Strategies for Global Change, *18*(3), 361-406. https://doi.org/10.1007/s11027-012-9423-1

Bindoff, N. L., Willebrand, J., Artale, V., Cazenave, A., Gregory, J., Gulev, S., Hanawa, K., Le Quéré, C., Levitus, S., Nojiri, Y., Shum, C. K., Talley, L. D., & Unnikrishnan, A. S. (2007). Observations: Oceanic Climate Change and Sea Level. In S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K. B. Averyt, M. Tignor, & H. L. Miller (Eds.), *Climate Change 2007: The Physical Science Basis: Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (pp. 1-48). IPCC. https://www.ipcc.ch/site/assets/uploads/2018/02/ar4-wg1-chapter5-1.pdf

Birdling, M. (2004). Healing the Past or Harming the Future?: Large Natural Groupings and the Waitangi Settlement Process. *New Zealand Journal of Public and International Law*, *2*(2), 259-283.

Bishop, R. (1995). *Collaborative research stories: Whakawhanaungatanga* University of Otago]. Dunedin, New Zealand. http://hdl.handle.net/10523/531

Bishop, R. (1999). Kaupapa Maori Research: An indigenous approach to creating knowledge. https://hdl.handle.net/10289/874

Bishop, R., & Glynn, T. (1999). Researching in Maori contexts: An interpretation of participatory consciousness. *Journal of Intercultural Studies*, *20*(2), 167-182. https://doi.org/10.1080/07256868.1999.9963478

Blackett, P., FitzHerbert, S., Luttrell, J., Hopmans, T., Lawrence, H., & Colliar, J. (2021). Marae-opoly: supporting localised Māori climate adaptation decisions with serious games in Aotearoa New Zealand. *Sustainability Science*. https://doi.org/10.1007/s11625-021-00998-9

Boas, I., Wiegel, H., Farbotko, C., Warner, J., & Sheller, M. (2022). Climate mobilities: migration, im/mobilities and mobility regimes in a changing climate. *Journal of Ethnic and Migration Studies*, *48*(14), 3365-3379. https://doi.org/10.1080/1369183X.2022.2066264

Boast, R., & Hill, R. S. (2010). *Raupatu: The confiscation of Maori land*. Victoria University Press.

Bodeker, G., Cullen, N., Katurji, M., McDonald, A., Morgenstern, O., Noone, D., Renwick, J., Revell, L., & Tait, A. (2022). *Aotearoa New Zealand climate change projections guidance: Interpreting the latest IPCC WG1 report findings.* https://environment.govt.nz/assets/publications/Aotearoa-New-Zealand-climate-change-projections-guidance-Feb-23.pdf

Bosserelle, A. L., Morgan, L. K., & Hughes, M. W. (2022). Groundwater Rise and Associated Flooding in Coastal Settlements Due To Sea-Level Rise: A Review of Processes and Methods. *Earth's Future*, *10*(7). https://doi.org/10.1029/2021EF002580

Boston, J., & Lawrence, J. (2018). Funding climate change adaptation: the case for a new policy framework. *Policy Quarterly*, *14*(2), 40-49. https://ojs.victoria.ac.nz/pq/article/view/5093/4533

Bourassa, S. C., & Strong, A. L. (2002). Restitution of Land to New Zealand Maori: The Role of Social Structure. *Pacific Affairs*, *75*(2), 227-260. https://doi.org/10.2307/4127184

Brady, M. B., & Leichenko, R. (2020). The impacts of coastal erosion on Alaska's North Slope communities: a co-production assessment of land use damages and risks. *Polar Geography*, *43*(4), 259-279. https://doi.org/10.1080/1088937x.2020.1755907

Braun, V., & Clarke, V. (2012). Thematic analysis. In H. Cooper, P. M. Camic, D. L. Long, A. T. Panter, D. Rindskopf, & K. J. Sher (Eds.), *APA handbook of research methods in psychology* (Vol. 2, pp. 57-71). American Psychological Association. https://doi.org/10.1037/13620-004

Braun, V., & Clarke, V. (2022). Conceptual and design thinking for thematic analysis. *Qualitative psychology*, *9*(1), 3. https://doi.org/10.1037/qup0000196

Brinkmann, S., & Kvale, S. (2018). *Doing Interviews* (Second ed.). SAGE Publishers. https://doi.org/10.4135/9781529716665

Bronen, R. (2010). Forced migration of Alaskan indigenous communities due to climate change. In T. Afifi & J. Jager (Eds.), *Environment, forced migration and social vulnerability* (pp. 87-98). Springer. https://doi.org/10.1007/978-3-642-12416-7_7

Bronen, R. (2015). Climate-induced community relocations using integrated social-ecological assessments to foster adaptation and resilience. *Ecology and Society*, *20*(3), 1-9. http://dx.doi.org/10.5751/ES-07801-200336

Bronen, R. (2018). Community-based adaptation. In Z. Zommers & K. Alverson (Eds.), *Resilience: The Science of Adaptation to Climate Change* (pp. 117-126). https://doi.org/10.1037/13620-004

Bronen, R. (2021). Climigration: Creating a National Governance Framework for Climate-Forced Community Relocation. *NYU Rev. L. & Soc. Change*, *45*(4), 574-631. https://socialchangenyu.com/wp-content/uploads/2022/05/Bronen_45.4_Climmigration-National-Governance-Framework.pdf

Bronen, R., & Cochran, P. (2021). Decolonize climate adaptation research. *Science*, *372*(6548), 1245-1245. https://doi.org/10.1126/science.abi9127

Bronen, R., Pollock, D., Overbeck, J., Stevens, D., Natali, S., & Maio, C. (2020). Usteq: integrating indigenous knowledge and social and physical sciences to coproduce knowledge and support community-based adaptation. *Polar Geography*, *43*(2-3), 188-205. https://doi.org/10.1080/1088937x.2019.1679271

Broughton, D., & McBreen, K. (2015). Mātauranga Māori, tino rangatiratanga and the future of New Zealand science. *Journal of the Royal Society of New Zealand*, *45*(2), 83-88. https://doi.org/10.1080/03036758.2015.1011171

Brown, S., Nicholls, R. J., Hanson, S., Brundrit, G., Dearing, J. A., Dickson, M. E., Gallop, S. L., Gao, S., Haigh, I. D., Hinkel, J., Jiménez, J. A., Klein, R. J. T., Kron, W., Lázár, A. N., Neves, C. F., Newton, A., Pattiaratachi, C., Payo, A., Pye, K., Sánchez-Arcilla, A., Siddall, M., Shareef, A., Tompkins, E. L., Vafeidis, A. T., van Maanen, B., Ward, P. J., & Woodroffe, C. D. (2014). Shifting perspectives on coastal impacts and adaptation. *Nature Climate Change*, *4*(9), 752-755. https://doi.org/10.1038/nclimate2344

Brubaker, M. Y., Bell, J. N., Berner, J. E., & Warren, J. A. (2011). Climate change health assessment: a novel approach for Alaska Native communities. *International Journal of Circumpolar Health*, *70*(3), 266-273. https://doi.org/10.3402/ijch.v70i3.17820

Brundage, A. (2017). *Going to the Sources: A Guide to Historical Research and Writing*. John Wiley & Sons, Incorporated. https://www.wiley.com/en-gb/Going+to+the+Sources%3A+A+Guide+to+Historical+Research+and+Writing%2C+6th+Edition-p-9781119262855

Bryant, M., Allan, P., & Smith, H. (2017). Climate change adaptations for coastal farms: Bridging science and mātauranga māori with art and design. *Plan Journal*, *2*(2), 497-518. https://doi.org/10.15274/tpj.2017.02.02.25

Burley, D., Jenkins, P., Laska, S., & Davis, T. (2007). Place Attachment and Environmental Change in Coastal Louisiana. *Organization & Environment*, *20*(3), 347-366. https://doi.org/10.1177/1086026607305739

Burns, C., Hetaraka, M., & Jones, A. (2024). Te Tiriti o Waitangi: The Treaty of Waitangi, Principles and Other Representations. *New Zealand Journal of Educational Studies*, *59*(1), 15-29. https://doi.org/10.1007/s40841-024-00312-y

Cain, P. J., & Hopkins, A. G. (2016). *British Imperialism: 1688-2015*. Taylor and Francis. https://doi.org/10.4324/9781315677798

Cameron, L., Courchene, D., Ijaz, S., & Mauro, I. (2021). 'A change of heart': Indigenous perspectives from the Onjisay Aki Summit on climate change. *Climatic Change*, *164*(3), 43. https://doi.org/10.1007/s10584-021-03000-8

Canuel, R., MacKenzie, E., Senior, A., & Torabi, N. (2017). Apps for academic success: Developing digital literacy and awareness to increase usage. *Education for information*, *33*(3), 135-152. https://doi.org/10.3233/EFI-160085

Carmichael, B. (2015). Supporting Indigenous rangers' management of climate-change impacts on heritage sites: developing an effective planning tool and assessing its value. *The Rangeland journal*, *37*(6), 597-607. https://doi.org/10.1071/RJ15048

Carmichael, B., Wilson, G., Namarnyilk, I., Nadji, S., Brockwell, S., Webb, B., Hunter, F., & Bird, D. (2018). Local and Indigenous management of climate change risks to archaeological sites. *Mitigation and Adaptation Strategies for Global Change*, *23*(2), 231-255. https://doi.org/10.1007/s11027-016-9734-8

Cave, A. A. (2003). Abuse of Power: Andrew Jackson and the Indian Removal Act of 1830. *The Historian*, *65*(6), 1330-1353. https://doi.org/10.1111/j.0018-2370.2003.00055.x

Cazenave, A., & Cozannet, G. L. (2014). Sea level rise and its coastal impacts. *Earth's Future*, *2*(2), 15-34. https://doi.org/10.1002/2013EF000188

Christie, K. S., Hollmen, T. E., Huntington, H. P., & Lovvorn, J. R. (2018). Structured decision analysis informed by traditional ecological knowledge as a tool to strengthen subsistence systems in a changing Arctic. *Ecology and Society*, *23*(4). https://doi.org/10.5751/es-10596-230442

Civil Defence. (2024). *Declared States of Emergency*. National Emergency Management Agency. Retrieved 19/03/24 from https://www.civildefence.govt.nz/resources/previous-emergencies/declared-states-of-emergency

Clar, C., & Steurer, R. (2019). Climate change adaptation at different levels of government: Characteristics and conditions of policy change. *Natural Resources Forum*, *43*(2), 121-131. https://doi.org/10.1111/1477-8947.12168

Cochran, P., Huntington, O., Pungowiyi, C., Tom, S., Chapin, F., Huntington, H., Maynard, N., & Trainor, S. (2013). Indigenous frameworks for observing and responding to climate change in Alaska. Climate Change and Indigenous Peoples in the United States. In J. K. Maldonado, B. Colombi, & R. Pandya (Eds.), *Climate change and Indigenous Peoples in the United States* (pp. 557-567). Springer, Cham. https://doi.org/10.1007/978-3-319-05266-3_5

Colliar, J., & Blackett, P. (2018). *Tangoio Climate Change Adaptation Decision Model: A process for exploring adaptation pathways for Tangoio Marae*. NIWA. https://deepsouthchallenge.co.nz/wp-content/uploads/2020/10/Tangoio-report-FINAL-Aug-2018.pdf

Conway, D., Nicholls, R. J., Brown, S., Tebboth, M. G. L., Adger, W. N., Ahmad, B., Biemans, H., Crick, F., Lutz, A. F., De Campos, R. S., Said, M., Singh, C., Zaroug, M. A. H., Ludi, E., New, M., & Wester, P. (2019). The need for bottom-up assessments of climate risks and adaptation in climate-sensitive regions. *Nature Climate Change*, *9*(7), 503-511. https://doi.org/10.1038/s41558-019-0502-0

Cowie, L. J., Greaves, L. M., Milfont, T. L., Houkamau, C. A., & Sibley, C. G. (2016). Indigenous identity and environmental values: Do spirituality and political consciousness predict environmental regard among Māori? *International Perspectives in Psychology: Research, Practice, Consultation*, *5*(4), 228-244. https://doi.org/10.1037/ipp0000059

Cradock-Henry, N. A., Diprose, G., & Frame, B. (2021). Towards local-parallel scenarios for climate change impacts, adaptation and vulnerability. *Climate Risk Management*, *34*, 100372. https://doi.org/10.1016/j.crm.2021.100372

Cretney, R., White, I., & Hanna, C. (2024). Navigating adaptive futures: analysing the scope of political possibilities for climate adaptation. *Kōtuitui: New Zealand Journal of Social Sciences Online*, 1-22. https://doi.org/10.1080/1177083X.2024.2344497

Dandy, J., Horwitz, P., Campbell, R., Drake, D., & Leviston, Z. (2019). Leaving home: place attachment and decisions to move in the face of environmental change. *Regional Environmental Change*, *19*(2), 615-620. https://doi.org/10.1007/s10113-019-01463-1

Dannenberg, A. L., Frumkin, H., Hess, J. J., & Ebi, K. L. (2019). Managed retreat as a strategy for climate change adaptation in small communities: public health implications. *Climatic Change*, *153*(1-2), 1-14. https://doi.org/10.1007/s10584-019-02382-0

David-Chavez, D. M., & Gavin, M. C. (2018). A global assessment of Indigenous community engagement in climate research. *Environmental Research Letters*, *13*(12), 1-18. https://doi.org/10.1088/1748-9326/aaf300

Day, W. (2018). A hapū's quest to save their marae. *Te Ao Māori News*. https://www.teaomaori.news/hapus-quest-save-their-marae

de Scally, D., & Doberstein, B. (2021). Local knowledge in climate change adaptation in the Cook Islands. *Climate and Development*, *14*(4), 360-373. https://doi.org/10.1080/17565529.2021.1927658

Dedekorkut-Howes, A., Torabi, E., & Howes, M. (2020). When the tide gets high: a review of adaptive responses to sea level rise and coastal flooding. *Journal of Environmental Planning and Management*, *63*(12), 2102-2143. https://doi.org/10.1080/09640568.2019.1708709

DeLancey, D. (2023). Decolonizing evaluation of indigenous land-based programs: A settler perspective on what we can learn from the LANDBACK movement. *Journal of MultiDisciplinary Evaluation*, *19*(44), 172-182.

Department of the Prime Minister and Cabinet. (2023). *Future of Severely Affected Land (FOSAL) - Information Pack*. Department of the Prime Minister and Cabinet, Retrieved from https://www.dpmc.govt.nz/sites/default/files/2023-07/Future-of-Severely-Affected-Land-FOSAL-Information-Pack.pdf

Desjardins, S. P. A., Friesen, T. M., & Jordan, P. D. (2020). Looking back while moving forward: How past responses to climate change can inform future adaptation and mitigation strategies in the Arctic. *Quaternary International*, *549*, 239-248. https://doi.org/10.1016/j.quaint.2020.05.043

Desmarais, F. (2023). Cyclone Gabrielle: $15m package to support Māori communities. https://www.1news.co.nz/2023/02/28/cyclone-gabrielle-15m-package-to-support-maori-communities/

Dewan, T. H. (2015). Societal impacts and vulnerability to floods in Bangladesh and Nepal. *Weather and Climate Extremes*, *7*, 36-42. https://doi.org/10.1016/j.wace.2014.11.001

Dexter, G. (2023). Climate change minister's legislative balancing act after Gabrielle. *Radio New Zealand*. https://www.rnz.co.nz/news/national/484507/climate-change-minister-s-legislative-balancing-act-after-gabrielle

Doberstein, B., Fitzgibbons, J., & Mitchell, C. (2019). Protect, accommodate, retreat or avoid (PARA): Canadian community options for flood disaster risk reduction and flood resilience. *Natural Hazards*, *98*(1), 31-50. https://doi.org/10.1007/s11069-018-3529-z

Domingue, S. J. (2021). The (In)Dispensability of Environmental Justice Communities: A Case Study of Climate Adaptation Injustices in Coastal Louisiana and Narratives of Resistance. *Environmental Justice*, *15*(4). https://doi.org/10.1089/env.2021.0098

Donatuto, J., Grossman, E. E., Konovsky, J., Grossman, S., & Campbell, L. W. (2014). Indigenous Community Health and Climate Change: Integrating Biophysical and Social Science Indicators. *Coastal Management*, *42*(4), 355-373. https://doi.org/10.1080/08920753.2014.923140

Drake, A. K., Dunmall, K. M., Nguyen, V. M., Provencher, J. F., Henri, D. A., & Alexander, S. M. (2023). Bridging Indigenous and Western sciences: Decision points guiding aquatic research and monitoring in Inuit Nunangat. *Conservation Science and Practice*, *5*(8). https://doi.org/10.1111/csp2.12972

Dronkers, J., Gilbert, J. T. E., Butler, L. W., Carey, J. J., Campbell, J., James, E., McKenzie, C., Misdorp, R., Quin, N., Ries, K. L., Schroder, P. C., Spradley, J. R., Titus, J. G., Vallianos, L., & von Dadelszen, J. (1990). Strategies for Adaptation to Sea Level Rise. In *Report of the IPCC Coastal Zone Management Subgroup*. Intergovernmental Panel on Climate Change.

Dulal, H. B., Shah, K. U., & Ahmad, N. (2009). Social equity considerations in the implementation of caribbean climate change adaptation policies. *Sustainability*, *1*(3), 363-383. https://doi.org/10.3390/su1030363

Durie, M. (2004, 01/01). Exploring the Interface Between Science and Indigenous Knowledge. 5 th APEC Research and Development Leaders Forum,

Dutra, L. X. C., Bayliss, P., McGregor, S., Christophersen, P., Scheepers, K., Woodward, E., Ligtermoet, E., & Melo, L. F. C. (2018). Understanding climate-change adaptation on Kakadu National Park, using a combined diagnostic and modelling framework: a case study at Yellow Water wetland. *Marine and Freshwater Research*, *69*(7), 1146-1158. https://doi.org/10.1071/mf16166

Eicken, H. (2010). Indigenous knowledge and sea ice science: What can we learn from indigenous ice users? In *SIKU: Knowing Our Ice: Documenting Inuit Sea Ice Knowledge and Use* (pp. 357-376). https://doi.org/10.1007/978-90-481-8587-0_15

Eketone, A. (2008). Theoretical underpinnings of Kaupapa Maori directed practice. *MAI review*, *1*. http://hdl.handle.net/10523/7084

Elkington, B., Jackson, M., Kiddle, R., Mercier, O. R., Ross, M., Smeaton, J., & Thomas, A. (2020). *Imagining Decolonisation*. Bridget Williams Books.

Ens, E., Reyes-García, V., Asselin, H., Hsu, M., Reimerson, E., Reihana, K., Sithole, B., Shen, X., Cavanagh, V., & Adams, M. (2021). Recognition of Indigenous Ecological Knowledge Systems in Conservation and Their Role to Narrow the Knowledge-Implementation Gap. In C. C. Ferreira & C. F. C. Klütsch (Eds.), *Closing the Knowledge-Implementation Gap in Conservation Science: Interdisciplinary Evidence Transfer Across Sectors and Spatiotemporal Scales* (pp. 109-139). Springer International Publishing. https://doi.org/10.1007/978-3-030-81085-6_5

Expert Working Group on Managed Retreat. (2023). *Report of the Expert Working Group on Managed Retreat: A Proposed System for Te Hekenga Rauora/Planned Relocation*. Wellington: Expert Working Group on Managed Retreat Retrieved from https://environment.govt.nz/assets/publications/climate-change/Report-of-the-Expert-Working-Group-on-Managed-Retreat-updated-25-08-2023.pdf

Eyring, V., Gillett, N. P., Achuta Rao, K. M., Barimalala, R., Barreiro Parrillo, M., Bellouin, N., Cassou, C., Durack, P. J., Kosaka, Y., McGregor, S., Min, S., Morgenstern, O., & Sun, Y. (2021). Human Influence on the Climate System. In V. Masson-Delmotte, P. Zhai, A., Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K., Leitzell, E. Lonnoy, J. B. R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu and B. Zhou (Ed.), *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Asessment Report of the Intergovernmental Panel on Climate Change* (pp. 423-552). Cambridge University Press. https://doi.org/10.1017/9781009157896.005

Fa'aui, T. N., & Morgan, T. (2014). Restoring the Mauri to the pre-MV Rena state. *MAI journal*, *3*(1), 3-17. https://ndhadeliver.natlib.govt.nz/delivery/DeliveryManagerServlet?dps_pid=FL20395890

Farbotko, C., & Lazrus, H. (2012). The first climate refugees? Contesting global narratives of climate change in Tuvalu. *Global Environmental Change*, *22*(2), 382-390. https://doi.org/10.1016/j.gloenvcha.2011.11.014

Farbotko, C., & McMichael, C. (2019). Voluntary immobility and existential security in a changing climate in the Pacific. *Asia Pacific Viewpoint*, *60*(2), 148-162. https://doi.org/10.1111/apv.12231

Farbotko, C., Watson, P., Kitara, T., & Stratford, E. (2021). Decolonising methodologies: Emergent learning in island research. *Geographical Research*. https://doi.org/10.1111/1745-5871.12519

Fayazi, M., Bisson, I.-A., & Nicholas, E. (2020). Barriers to climate change adaptation in indigenous communities: A case study on the mohawk community of Kanesatake, Canada. *International Journal of Disaster Risk Reduction*, *49*. https://doi.org/10.1016/j.ijdrr.2020.101750

Felipe Pérez, B., & Tomaselli, A. (2021). Indigenous Peoples and climate-induced relocation in Latin America and the Caribbean: managed retreat as a tool or a threat? *Journal of Environmental Studies and Sciences*, *11*(3), 352-364. https://doi.org/10.1007/s13412-021-00693-2

Finance and Expenditure Committee. (2024). *Inquiry into climate adaptation: Terms of Reference*. Wellington, New Zealand: Finance and Expenditure Committee Retrieved from https://www.parliament.nz/en/pb/sc/make-a-submission/document/54SCFIN_SCF_F4A021AF-6284-4959-1470-08DC7066FF1A/inquiry-into-climate-adaptation#RelatedAnchor

Fischer, M., Maxwell, K., Nuunoq, Pedersen, H., Greeno, D., Jingwas, N., Graham Blair, J., Hugu, S., Mustonen, T., Murtomäki, E., & Mustonen, K. (2021). Empowering her guardians to nurture our Ocean's future. *Reviews in Fish Biology and Fisheries*, *32*, 271-296. https://doi.org/10.1007/s11160-021-09679-3

Fish, C. S. (2020). Cartographic content analysis of compelling climate change communication. *Cartography and Geographic Information Science*, *47*(6), 492-507. https://doi.org/10.1080/15230406.2020.1774421

Flynn, M., Ford, J. D., Pearce, T., & Harper, S. L. (2018). Participatory scenario planning and climate change impacts, adaptation and vulnerability research in the Arctic. *Environmental Science & Policy*, *79*, 45-53. https://doi.org/10.1016/j.envsci.2017.10.012

Ford, J. D., Berrang-Ford, L., Bunce, A., McKay, C., Irwin, M., & Pearce, T. (2015). The status of climate change adaptation in Africa and Asia. *Regional Environmental Change*, *15*(5), 801-814. https://doi.org/10.1007/s10113-014-0648-2

Ford, J. D., King, N., Galappaththi, E. K., Pearce, T., McDowell, G., & Harper, S. L. (2020). The Resilience of Indigenous Peoples to Environmental Change. *One Earth*, *2*(6), 532-543. https://doi.org/10.1016/j.oneear.2020.05.014

Ford, J. D., Pearce, T., Canosa, I. V., & Harper, S. (2021). The rapidly changing Arctic and its societal implications. *Wiley Interdisciplinary Reviews: Climate Change*, *12*(6). https://doi.org/10.1002/wcc.735

Ford, J. D., Smit, B., Wandel, J., Allurut, M., Shappa, K., Ittusarjuat, H., & Qrunnut, K. (2008). Climate change in the Arctic: current and future vulnerability in two Inuit communities in Canada. *The Geographical Journal*, *174*(1), 45-62. https://doi.org/10.1111/j.1475-4959.2007.00249.x

Forster, M. (2019). He Tātai Whenua: Environmental Genealogies. *Genealogy*, *3*(3), 1-14. https://doi.org/10.3390/genealogy3030042

Fraser, A. (2024). 9 The Bikini Atoll Community: A Case Study in Displacement, Climate Change Vulnerability and (Im) mobility. *De Gruyter Handbook of Climate Migration and Climate Mobility Justice*, *3*, 191.

Furgal, C., & Seguin, J. (2006). Climate Change, Health, and Vulnerability in Canadian Northern Aboriginal Communities. *Environmental Health Perspectives*, *114*(12), 1964-1970. https://doi.org/10.1289/ehp.8433

Gaillard, J. C., & Castree, N. (2021). *The Invention of Disaster: Power and Knowledge in Discourses on Hazard and Vulnerability* (1st Edition ed.). Routledge.

García Sánchez, F., García Sánchez, H., & Ribalaygua, C. (2020). Cultural heritage and sea level rise threat: risk assessment of coastal fortifications in the Canary Islands. *Journal of Cultural Heritage*, *44*, 211-217. https://doi.org/10.1016/j.culher.2020.02.005

Gardiner, E. P., Herring, D. D., & Fox, J. F. (2019). The U.S. Climate Resilience Toolkit: evidence of progress. *Climatic Change*, *153*(4), 477-490. https://doi.org/10.1007/s10584-018-2216-0

Gauer, V. H., Schaepe, D. M., & Welch, J. R. (2021). Supporting Indigenous adaptation in a changing climate: Insights from the Stó:lō Research and Resource Management Centre (British Columbia) and the Fort Apache Heritage Foundation (Arizona). *Elementa: Science of the Anthropocene*, *9*(1). https://doi.org/10.1525/elementa.2020.00164

Gini, G., Piggott-McKellar, A., Wiegel, H., Neu, F. N., Link, A.-C., Fry, C., Tabe, T., Adegun, O., Wade, C. T., Bower, E. R., Koeltzow, S., Harrington-Abrams, R., Jacobs, C., van der Geest, K., Zivdar, N., Alaniz, R., Cherop, C., Durand-Delacre, D., Pill, M., Shekhar, H., Yates, O., Khan, M. A. A., Nansam-Aggrey, F. K., Grant, L., Nizar, D. A., Owusu-Daaku, K. N., Preato, A., Stefancu, O., & Yee, M. (2024). Navigating tensions in climate change-related planned relocation. *Ambio*, *53*(9), 1262-1266. https://doi.org/10.1007/s13280-024-02035-2

Glavovic, B. C., Saunders, W. S. A., & Becker, J. S. (2010). Land-use planning for natural hazards in New Zealand: the setting, barriers, 'burning issues' and priority actions. *Natural Hazards*, *54*(3), 679-706. https://doi.org/10.1007/s11069-009-9494-9

Godoi, V. A., Bryan, K. R., & Gorman, R. M. (2018). Storm wave clustering around New Zealand and its connection to climatic patterns. *International journal of climatology*, *38*, 401-417. https://doi.org/10.1002/joc.5380

Goff, J. R. (2021). New Zealand's tsunami death toll rises. *Natural Hazards*, *107*(2), 1925-1934. https://doi.org/10.1007/s11069-021-04665-1

Goff, J. R., & Chagué-Goff, C. (2001). *Catastrophic events in New Zealand coastal environments*. Department of Conservation. https://www.doc.govt.nz/globalassets/documents/science-and-technical/casn333.pdf

Google Developers. (2022). *site: search operator*. Google. Retrieved 10/08/2022 from https://developers.google.com/search/docs/advanced/debug/search-operators/all-search-site

Grace-McCaskey, C. A., Pearce, S. C., Harris, L., Corra, M., & Evans, K. J. (2021). Finding voices in the floods of Freedom Hill: innovating solutions in Princeville, North Carolina. *Journal of Environmental Studies and Sciences*, *11*(3), 341-351. https://doi.org/10.1007/s13412-021-00701-5

Green, D., Alexander, L., McLnnes, K., Church, J., Nicholls, N., & White, N. (2010). An assessment of climate change impacts and adaptation for the Torres Strait Islands, Australia. *Climatic Change*, *102*(3-4), 405-433. https://doi.org/10.1007/s10584-009-9756-2

Green, D., & Raygorodetsky, G. (2010). Indigenous knowledge of a changing climate. *Climatic Change*, *100*(2), 239-242. https://doi.org/10.1007/s10584-010-9804-y

Green, K. M., Beaudreau, A. H., Lukin, M. H., & Crowder, L. B. (2021). Climate change stressors and social-ecological factors mediating access to subsistence resources in Arctic Alaska. *Ecology and Society*, *26*(4). https://doi.org/10.5751/es-12783-260415

Gregory, J. M., & Church, J. A. (2002). Changes in sea-level. *Weather*, *57*(8), 287-295. https://doi.org/10.1256/004316502320517380

Haasnoot, M., Di Fant, V., Kwakkel, J., & Lawrence, J. (2024). Lessons from a decade of adaptive pathways studies for climate adaptation. *Global Environmental Change*, *88*. https://doi.org/10.1016/j.gloenvcha.2024.102907

Haasnoot, M., Kwakkel, J. H., Walker, W. E., & ter Maat, J. (2013). Dynamic adaptive policy pathways: A method for crafting robust decisions for a deeply uncertain world. *Global Environmental Change*, *23*(2), 485-498. https://doi.org/10.1016/j.gloenvcha.2012.12.006

Haasnoot, M., Lawrence, J., & Magnan, A. K. (2021). Pathways to coastal retreat. *Science*, *372*(6548), 1287-1290. https://doi.org/10.1126/science.abi6594

Hagen, I., Huggel, C., Ramajo, L., Chacon, N., Ometto, J. P., Postigo, J. C., & Castellanos, E. J. (2022). Climate change-related risks and adaptation potential in Central and South America during the 21st century. *Environmental Research Letters*, *17*(3). https://doi.org/10.1088/1748-9326/ac5271

Hallegatte, S., Green, C., Nicholls, R. J., & Corfee-Morlot, J. (2013). Future flood losses in major coastal cities. *Nature Climate Change*, *3*(9), 802-806. https://doi.org/10.1038/nclimate1979

Hamilton, L. C., Saito, K., Loring, P. A., Lammers, R. B., & Huntington, H. P. (2016). Climigration? Population and climate change in Arctic Alaska. *Population and Environment*, *38*(2), 115-133. https://doi.org/10.1007/s11111-016-0259-6

Hanna, C. (2019). *Restraints of change : limits to 'managed retreats' in Aotearoa New Zealand* [Doctoral, The University of Waikato]. Hamilton, New Zealand. https://hdl.handle.net/10289/12896

Hanna, C., Cretney, R., & White, I. (2022). Re-Imagining Relationships with Space, Place, and Property: The Story of Mainstreaming Managed Retreats in Aotearoa-New Zealand. *Planning Theory & Practice*, *23*(5), 681-702. https://doi.org/10.1080/14649357.2022.2141845

Hanna, C., White, I., & Glavovic, B. (2017). *Managed retreat in New Zealand: revealing the terminology, approaches and direction of local planning instruments*. https://hdl.handle.net/10289/14288

Hanna, C., White, I., & Glavovic, B. (2019). Managed retreat in practice: Mechanisms and challenges for implementation.

Hanson, B., McCann, R. B., & Smiley, D. (2024). Exploring Indigenous Climate Change Perceptions Through Tribal Talking Circles in the Colorado Plateau. *Journal of Sustainability Research*, 1. https://doi.org/10.20900/jsr20240061

Hardy, D., Spinks, A., Richardson, J., Poutama, M., Patterson, M., Smith, H., & Manning, M. (2019). *Planning for Climate Change Impacts on Māori Coastal Ecosystems and Economies: A Case Study of 5 Māori-owned land blocks in the Horowhenua Coastal Zone.*

Harrington, L. J., Dean, S. M., Awatere, S., Rosier, S., Queen, L., Gibson, P. B., Barnes, C., Zachariah, M., Philip, S., & Kew, S. (2023). *The role of climate change in extreme rainfall associated with Cyclone Gabrielle over Aotearoa New Zealand's East Coast*. https://doi.org/10.25561/102624

Hashemnezhad, H., Heidari, A. A., & Mohammad Hoseini, P. (2013). Sense of place" and "place attachment. *International Journal of Architecture and Urban Development*, *3*(1), 5-12.

Hayes, S., & O'Neill, S. (2021). The Greta effect: Visualising climate protest in UK media and the Getty images collections. *Global Environmental Change*, *71*, 102392. https://doi.org/10.1016/j.gloenvcha.2021.102392

Hayward, B. (2008). 'Nowhere Far From the Sea': Political Challenges of Coastal Adaptation To Climate Change in New Zealand. *Political Science*, *60*(1), 47-59. https://doi.org/10.1177/003231870806000105

Hayward, J. (2004). Te Tiriti o Waitangi - The Treaty of Waitangi. In T. M. Ka'ai, J. C. Moorfield, M. P. J. Reily, & S. Mosley (Eds.), *Ki Te Whaiao : An Introduction to Maori Culture and Society* (pp. 151-162). Peason Education NZ.

Healy, S. (2009). 'Tuku Whenua'as Customary Land Allocation: Contemporary Fabrication or Historical Fact? *The Journal of the Polynesian Society*, *118*(2), 111-134. http://www.jstor.org/stable/20707478

Hendy, J., Kerr, S., Halliday, A., Owen, S., Ausseil, A.-G., Bell, K., Deans, N. A., Dickie, B. N., Hale, J. W., & Hale, S. (2018). *Drought and climate change adaptation: impacts and projections*. Motu Economic and Public Policy Research Wellington, New Zealand.

Henry, E., & Pene, H. (2001). Kaupapa Maori: Locating Indigenous Ontology, Epistemology and Methodology in the Academy. *Organization*, *8*(2), 234-242. https://doi.org/10.1177/1350508401082009

Higham, T., Anderson, A., & Jacomb, C. (1999). Dating the first New Zealanders: the chronology of Wairau Bar. *Antiquity*, *73*(280), 420-427. https://doi.org/10.1017/S0003598X00088360

Hikuroa, D. (2017). Mātauranga Māori—the ūkaipō of knowledge in New Zealand. *Journal of the Royal Society of New Zealand*, *47*(1), 5-10. https://doi.org/10.1080/03036758.2016.1252407

Hikuroa, D. (2020). Matauranga Maori and its role in coastal management. *New Zealand Coastal Society Special Publication*, 5-9. https://www.coastalsociety.org.nz/assets/Publications/Special-Issues/SP4-Low-res-version.pdf

Hikuroa, D., Clark, J., Olsen, A., & Camp, E. (2018). Severed at the head: towards revitalising the mauri of Te Awa o te Atua. *New Zealand journal of marine and freshwater research*, *52*(4), 643-656. https://doi.org/10.1080/00288330.2018.1532913

Hill, R., Walsh, F. J., Davies, J., Sparrow, A., Mooney, M., Wise, R. M., & Tengö, M. (2020). Knowledge co-production for Indigenous adaptation pathways: Transform post-colonial articulation complexes to empower local decision-making. *Global Environmental Change*, *65*. https://doi.org/10.1016/j.gloenvcha.2020.102161

Hino, M., Field, C. B., & Mach, K. J. (2017). Managed retreat as a response to natural hazard risk. *Nature climate change*, *7*(5), 364-370. https://doi.org/10.1038/nclimate3252

Hiwasaki, L., Luna, E., Syamsidik, & Marcal, J. A. (2015). Local and indigenous knowledge on climate-related hazards of coastal and small island communities in Southeast Asia. *Climatic Change*, *128*(1-2), 35-56. https://doi.org/10.1007/s10584-014-1288-8

Hiwasaki, L., Luna, E., Syamsidik, & Shaw, R. (2014). Process for integrating local and indigenous knowledge with science for hydro-meteorological disaster risk reduction and climate change adaptation in coastal and small island communities. *International Journal of Disaster Risk Reduction*, *10*, 15-27. https://doi.org/10.1016/j.ijdrr.2014.07.007

Hopkins, D., Campbell-Hunt, C., Carter, L., Higham, J. E. S., & Rosin, C. (2015). Climate change and Aotearoa New Zealand. *WIREs Climate Change*, *6*(6), 559-583. https://doi.org/10.1002/wcc.355

Hossain, R. R., Guest, S., Ng, S. G., Misra, S., & McKelvie, J. (2022). Pop-up community-based vision screening in New Zealand. *Clinical and Experimental Ophthalmology*, *49*(8), 901-902. https://pesquisa.bvsalud.org/global-literature-on-novel-coronavirus-2019-ncov/resource/pt/covidwho-1583621

Hudson, J. T., & Hughes, E. (2007). *The role of marae and Māori communities in post-disaster recovery: A case study. GNS Science Report*.

Hudson, M., Milne, M., Russell, K., Smith, B., Reynolds, P., & Atatoa-Carr, P. (2016a). The development of guidelines for indigenous research ethics in Aotearoa/New Zealand.

Hudson, M., Watene-Rawiri, E., Robb, M., Collier, K., Awatere, S., Harmsworth, G., Henry, J., Quinn, J., Death, R., Hamilton, D., & Maru, J. (2016b). Integrating Indigenous Knowledge and Freshwater Management: An Aotearoa/New Zealand Case Study. *The International Journal of Science in Society*, *8*, 1-14. https://doi.org/doi.org/10.18848/1836-6236/CGP/v08i01/1-14

Huntington, H. P., Carey, M., Apok, C., Forbes, B. C., Fox, S., Holm, L. K., Ivanova, A., Jaypoody, J., Noongwook, G., & Stammler, F. (2019). Climate change in context:

putting people first in the Arctic. *Regional Environmental Change*, *19*(4), 1217-1223. https://doi.org/10.1007/s10113-019-01478-8

Huntington, H. P., Goodstein, E., & Euskirchen, E. (2012). Towards a Tipping Point in Responding to Change: Rising Costs, Fewer Options for Arctic and Global Societies. *Ambio*, *41*(1), 66-74. https://doi.org/10.1007/s13280-011-0226-5

Hutton, N. S., & Allen, T. R. (2020). The Role of Traditional Knowledge in Coastal Adaptation Priorities: The Pamunkey Indian Reservation. *Water*, *12*(12). https://doi.org/10.3390/w12123548

Ihirangi. (2021). *Insight to the Rauora Indigenous Worldview Framework for the National Climate Change Adaptation Plan*. https://environment.govt.nz/publications/exploring-an-indigenous-worldview-framework-for-the-national-climate-change-adaptation-plan/

Iorns, C. J. (2019). *Treaty of Waitangi duties relevant to adaptation to coastal hazards from sea level rise.* https://deepsouthchallenge.co.nz/wp-content/uploads/2020/12/Treaty-of-Waitangi-duties-relevant-to-adaptation-to-coastal-hazards-from-sea-level-rise.pdf

IPCC. (2013). *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press.

IPCC. (2022). Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. In D. C. R. H.-O. Pörtner, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (Ed.). Cambridge University Press. https://www.ipcc.ch/report/ar6/wg2/

Jacomb, C., Holdaway, R. N., Allentoft, M. E., Bunce, M., Oskam, C. L., Walter, R., & Brooks, E. (2014). High-precision dating and ancient DNA profiling of moa (Aves: Dinornithiformes) eggshell documents a complex feature at Wairau Bar and refines the chronology of New Zealand settlement by Polynesians. *Journal of Archaeological Science*, *50*, 24-30. https://doi.org/10.1016/j.jas.2014.05.023

Jamero, M. L., Onuki, M., Esteban, M., Billones-Sensano, X. K., Tan, N., Nellas, A., Takagi, H., Thao, N. D., & Valenzuela, V. P. (2017). Small-island communities in the Philippines prefer local measures to relocation in response to sea-level rise. *Nature Climate Change*, *7*(8), 581-586. https://doi.org/10.1038/nclimate3344

Johnson, D. E., Parsons, M., & Fisher, K. (2021). Indigenous climate change adaptation: New directions for emerging scholarship. *Environment and Planning E: Nature and Space*, *5*(3). https://doi.org/10.1177/25148486211022450

Jones, B. D., Dickson, M. E., Ford, M., Hikuroa, D., & Ryan, E. J. (2023). Aotearoa New Zealand's coastal archaeological heritage: A geostatistical overview of threatened sites. *The Journal of Island and Coastal Archaeology*, 1-21. https://doi.org/10.1080/15564894.2023.2207493

Jones, C. (2016). *New treaty, new tradition: reconciling New Zealand and Maori law*. UBC Press.

Jones, L., Harvey, B., Cochrane, L., Cantin, B., Conway, D., Cornforth, R. J., De Souza, K., & Kirbyshire, A. (2018). Designing the next generation of climate adaptation research for

development. *Regional Environmental Change*, *18*(1), 297-304. https://doi.org/10.1007/s10113-017-1254-x

Jones, R., Bennett, H., Keating, G., & Blaiklock, A. (2014). Climate change and the right to health for Maori in Aotearoa/New Zealand. *Health and Human Rights Journal*, *16*(1), 54-68. https://pubmed.ncbi.nlm.nih.gov/25474611/

Jongman, B., Ward, P. J., & Aerts, J. C. J. H. (2012). Global exposure to river and coastal flooding: Long term trends and changes. *Global Environmental Change*, *22*(4), 823-835. https://doi.org/10.1016/j.gloenvcha.2012.07.004

Ka'ai, T. M., & Higgins, R. (2004). Te ao Maori - Maori world-view. In T. M. Ka'ai, J. C. Moorfield, M. P. J. Reilly, & S. Mosley (Eds.), *Ki te Whaiao: An Introduction to Maori Culture and Society* (pp. 13-26). Pearson Education New Zealand.

Kassam, K.-A., Ruelle, M., Haag, I., Bulbulshoev, U., Kaziev, D., Louis, L., Ullmann, A., Edwards, I., Khan, A. A., Trabucco, A., & Samimi, C. (2021). Engaging Transformation: Using Seasonal Rounds to Anticipate Climate Change. *Human Ecology*, *49*(5), 509-523. https://doi.org/10.1007/s10745-021-00269-2

Kawharu, M. (2000). Kaitiakitanga: A Māori Anthropological perspective of the Māori socio-environmental ethic of resource management. *The Journal of the Polynesian Society*, *109*(4), 349-370. www.jstor.org/stable/20706951

Kawharu, M. (2001). Local Maori development and government policies. *Social Policy Journal of New Zealand*, 1-16.

Kawharu, M. (2010). Environment as a marae locale. In R. Selby, P. J. G. Moore, & M. Mulholland (Eds.), *Māori and the Environment: Kaitiaki* (pp. 221-239). Huia Publishing. https://www.researchgate.net/publication/313512818_Environment_as_Marae_Locale

Keam, R. F. (1988). *Tarawera : the volcanic eruption of 10 June 1886*. R.F. Keam.

Keam, R. F. (2016). The Tarawera eruption, Lake Rotomahana, and the origin of the Pink and White Terraces. *Journal of Volcanology and Geothermal Research*, *314*, 10-38. https://doi.org/10.1016/j.jvolgeores.2015.11.009

Kearney, A., Bradley, J., & Brady, L. M. (2019). Kincentric Ecology, Species Maintenance and the Relational Power of Place in Northern Australia. *Oceania*, *89*(3), 316-335. https://doi.org/10.1002/ocea.5232

Kelman, I., Mercer, J., & Gaillard, J. (2012). Indigenous knowledge and disaster risk reduction. *Geography*, *97*(1), 12-21. https://doi.org/10.1080/00167487.2012.12094332

Kenney, C., & Phibbs, S. (2015). A Māori love story: Community-led disaster management in response to the Ōtautahi (Christchurch) earthquakes as a framework for action. *International Journal of Disaster Risk Reduction*, *14*, 46-55. https://doi.org/10.1016/j.ijdrr.2014.12.010

Kenney, C., & Phibbs, S. (2021). Indigenous peoples and climate change: situating culture, identity, and place in climate change risk mitigation and resilience. In *Handbook of Climate Change Management: Research, Leadership, Transformation* (pp. 2201-2227). Springer.

Kenney, C., Phibbs, S., Meo-Sewabu, L., Awatere, S., McCarthy, M., Kaiser, L., Harmsworth, G., Harcourt, N., Taylor, L., & Douglas, N. (2023). Indigenous approaches to disaster risk reduction, community sustainability, and climate change resilience. In *Disaster Risk Reduction for Resilience: Climate Change and Disaster Risk Adaptation* (pp. 37-59). Springer. https://link.springer.com/chapter/10.1007/978-3-031-22112-5_2

Kettle, N. P., Sam, J. M., Trainor, S. F., & Gray, G. T. (2018). Supporting climate adaptation planning in northwest alaska. In Paul R. Lachapelle & D. E. Albrecht (Eds.), *Addressing Climate Change at the Community Level in the United States* (pp. 215-231). https://doi.org/10.4324/9781351211727-14

King, D. N., Dalton, W., Bind, J., Srinivasan, M. S., Duncan, M., Skipper, A., Ashford-Hosking, D., Williams, B., Renata, H., & Baker, M. (2012a). *Coastal Adaptation to Climate Variability and Change: Examining community risk, vulnerability and endurance at Manaia Settlement, Hauraki-Waikato, Aotearoa-New Zealand*. NIWA. https://niwa.co.nz/sites/niwa.co.nz/files/niwa_report_akl2012-029.pdf

King, D. N., Dalton, W., Bind, J., Srinivasan, M. S., Hicks, D. M., Iti, W., Skipper, A., Home, M., & Ashford-Hosking, D. (2013). *Coastal adaptation to climate variability and change: Examining community risk, vulnerability and endurance at Mitimiti, Hokianga, Aotearoa-New Zealand*. NIWA. https://niwa.co.nz/sites/niwa.co.nz/files/NIWA%20Report%20AKL2013-022_smaller.pdf

King, D. N., Dalton, W., Home, M., Duncan, M., Srinivasan, M. S., Bind, J., Zammit, C., McKerhar, A., Ashford-Hosking, D., & Skipper, A. (2012b). *Māori community adaptation to climate variability and change: Examining risk, vulnerability and adaptive strategies with Ngāti Huirapa at Arowhenua Pā, Te Umu Kaha (Temuka), New Zealand.* NIWA. https://niwa.co.nz/sites/niwa.co.nz/files/niwa_report_akl2011-015_0.pdf

King, D. N., Goff, J., & Skipper, A. (2007). Māori environmental knowledge and natural hazards in Aotearoa‐New Zealand. *Journal of the Royal Society of New Zealand*, *37*(2), 59-73. https://doi.org/10.1080/03014220709510536

King, D. N., Goff, J. R., Chagué-Goff, C., McFadgen, B., Jacobsen, G. E., Gadd, P., & Horrocks, M. (2017). Reciting the layers: Evidence for past tsunamis at Mataora-Wairau Lagoon, Aotearoa-New Zealand. *Marine Geology*, *389*, 1-16. https://doi.org/10.1016/j.margeo.2017.05.001

King, D. N., Manawatu, M., & Shaw, W. S. (2020). Comparing and combining ethnographic records with active Māori histories to provide insights on tsunami hazard. *Quaternary Research*, *95*, 43-55. https://doi.org/10.1017/qua.2019.84

King, D. N., Penny, G., & Severne, C. (2010). The climate change matrix facing Māori society. In R. A. C. Nottage, D. S. Wratt, J. F. Bornman, & K. Jones (Eds.), *Climate change adaptation in New Zealand: Future scenarios and some sectoral perspectives* (pp. 100-111). New Zealand Climate Change Centre.

King, D. N., Shaw, W. S., Meihana, P. N., & Goff, J. R. (2018). Māori oral histories and the impact of tsunamis in Aotearoa-New Zealand. *Nat. Hazards Earth Syst. Sci.*, *18*(3), 907-919. https://doi.org/10.5194/nhess-18-907-2018

Kitara, T., Suliman, S., & Farbotko, C. (2024). Fale Pili: a Tuvaluan perspective on mobility justice. *Applied Mobilities*, 1-15. https://doi.org/10.1080/23800127.2023.2298559

Kopp, R. E., Horton, R. M., Little, C. M., Mitrovica, J. X., Oppenheimer, M., Rasmussen, D. J., Strauss, B. H., & Tebaldi, C. (2014). Probabilistic 21st and 22nd century sea-level projections at a global network of tide-gauge sites. *Earth's Future*, *2*(8), 383-406. https://doi.org/10.1002/2014EF000239

Korovulavula, I., Nunn, P. D., Kumar, R., & Fong, T. (2020). Peripherality as key to understanding opportunities and needs for effective and sustainable climate-change adaptation: a case study from Viti Levu Island, Fiji. *Climate & Development*, *12*(10), 888-898. https://doi.org/10.1080/17565529.2019.1701972

Kukutai, T., Russo Carroll, S., & Walter, M. (2020). Indigenous data sovereignty. In D. Mamo (Ed.), *The Indigenous World 2020* (34 ed., pp. 654-662). http://iwgia.org/images/yearbook/2020/IWGIA_The_Indigenous_World_2020.pdf

Kurashima, N., Jeremiah, J., Whitehead, A. N., Tulchin, J., Browning, M., & Duarte, T. (2018). ʻĀina Kaumaha: The Maintenance of Ancestral Principles for 21st Century Indigenous Resource Management. *Sustainability*, *10*(11). https://doi.org/10.3390/su10113975

Kurian, P., Munshi, D., Cretney, R., Morrison, S., & Kathlene, L. (2021). The cultural politics of climate change adaptation: an analysis of the tourism sector in Aotearoa New Zealand. *Political Science*, *73*(2), 143-160. https://doi.org/10.1080/00323187.2021.2021803

Lam, D. P. M., Hinz, E., Lang, D. J., Tengo, M., von Wehrden, H., & Martin-Lopez, B. (2020). Indigenous and local knowledge in sustainability transformations research: a literature review. *Ecology and Society*, *25*(1). https://doi.org/10.5751/es-11305-250103

Lan, C., Wild, A., Paulik, R., Wotherspoon, L., & Zorn, C. (2023). Assessing Indirect Impacts of Extreme Sea Level Flooding on Critical Infrastructure. *Journal of Marine Science and Engineering*, *11*(7). https://doi.org/10.3390/jmse11071420

Lawrence, J., Boston, J., Bell, R., Olufson, S., Kool, R., Hardcastle, M., & Stroombergen, A. (2020). Implementing Pre-Emptive Managed Retreat: Constraints and Novel Insights. *Current Climate Change Reports*, *6*(3), 66-80. https://doi.org/10.1007/s40641-020-00161-z

Lawrence, J., Gallop, S. L., Marquardt, L., Bell, G. R., Blackett, P., Cradock-Henry, N. A., & Wreford, A. (In review). *Dynamic adaptive pathways planning for adaptation: lessons learned from a decade of practice in Aotearoa New Zealand*.

Lawrence, J., Haasnoot, M., McKim, L., Atapattu, D., Campbell, G., & Stroombergen, A. (2019). Dynamic adaptive policy pathways (DAPP): From theory to practice. In V. A. W. J. Marchau, W. E. Walker, P. J. T. M. Bloemen, & S. W. Popper (Eds.), *Decision Making under Deep Uncertainty* (pp. 187-199). Springer, Cham.

Lawrence, J., & Saunders, W. (2017). The Planning Nexus Between Disaster Risk Reduction and Climate Change Adaptation. In *The Routledge Handbook of Disaster Risk Reduction Including Climate Change Adaptation* (1 ed., pp. 418-428). Routledge. https://doi.org/10.4324/9781315684260-39

Lawrence, J., Wreford, A., & Allan, S. (2022). Adapting to Avoidable and Unavoidable Climate Change: What must Aotearoa New Zealand do? *Policy Quarterly*, *18*(2), 51-60. https://doi.org/10.26686/pq.v18i2.7575

Lawrence, J., Wreford, A., Blackett, P., Hall, D., Woodward, A., Awatere, S., Livingston, M. E., Macinnis-Ng, C., Walker, S., Fountain, J., Costello, M. J., Ausseil, A.-G. E., Watt, M. S., Dean, S. M., Cradock-Henry, N. A., Zammit, C., & Milfont, T. L. (2024). Climate change adaptation through an integrative lens in Aotearoa New Zealand. *Journal of the Royal Society of New Zealand*, *54*(4), 491-522. https://doi.org/10.1080/03036758.2023.2236033

Le Grice, J. S., & Braun, V. (2016). Mātauranga Māori and reproduction: Inscribing connections between the natural environment, kin and the body. *AlterNative: An International Journal of Indigenous Peoples*, *12*(2), 151-164. https://doi.org/10.20507/AlterNative.2016.12.2.4

Leatherman, S. P., Zhang, K., & Douglas, B. C. (2000). Sea level rise shown to drive coastal erosion. *Eos, Transactions American Geophysical Union*, *81*(6), 55-57. https://doi.org/10.1029/00EO00034

Leonard, K. (2021). WAMPUM Adaptation framework: eastern coastal Tribal Nations and sea level rise impacts on water security. *Climate and Development*, *13*(9), 842-851. https://doi.org/10.1080/17565529.2020.1862739

Leonard, S., Parsons, M., Olawsky, K., & Kofod, F. (2013). The role of culture and traditional knowledge in climate change adaptation: Insights from East Kimberley, Australia. *Global Environmental Change*, *23*(3), 623-632. https://doi.org/10.1016/j.gloenvcha.2013.02.012

Levy, R., Naish, T., Lowry, D., Priestley, R., Winefield, R., Alevropolous-Borrill, A., Beck, E., Bell, R., Blick, G., Dadic, R., Gillies, T., Golledge, N., Heine, Z., Jendersie, S., Lawrence, J., O'Leary, K., Paulik, R., Roberts, C., Taitoko, M., & Trayling, N. (2024). Melting ice and rising seas – connecting projected change in Antarctica's ice sheets to communities in Aotearoa New Zealand. *Journal of the Royal Society of New Zealand*, *54*(4), 449-472. https://doi.org/10.1080/03036758.2023.2232743

Lim, B., Spanger-Siegfried, E., Burton, I., Malone, E., & Huq, S. (2005). Adaptation policy frameworks for climate change: developing strategies, policies and measures. In: Cambridge University Press, Cambridge.

LINZ. (2024a). *NZ Building Outlines* LINZ. https://data.linz.govt.nz/layer/101290-nz-building-outlines/

LINZ. (2024b). *NZ Primary Land Parcels* LINZ. https://data.linz.govt.nz/layer/50823-nz-primary-land-parcels/

Loch, T. K., & Riechers, M. (2021). Integrating indigenous and local knowledge in management and research on coastal ecosystems in the Global South: A literature review. *Ocean & Coastal Management*, *212*. https://doi.org/10.1016/j.ocecoaman.2021.105821

Logan, T. M., Anderson, M. J., & Reilly, A. C. (2023). Risk of isolation increases the expected burden from sea-level rise. *Nature Climate Change*, *13*(4), 397-402. https://doi.org/10.1038/s41558-023-01642-3

Lomnitz, C. (2004). Major earthquakes of Chile: a historical survey, 1535-1960. *Seismological Research Letters*, *75*(3), 368-378. https://doi.org/10.1785/gssrl.75.3.368

Luetz, J. M. (2024). Can Indigenous ecotheology save the world? Affinities between traditional worldviews and environmental sustainability. *Climate and Development*, 1-9. https://doi.org/10.1080/17565529.2024.2305883

Macfarlane, A., & Macfarlane, S. (2018). Toitū te Mātauranga: Valuing culturally inclusive research in contemporary times. *Psychology Aotearoa (Jubilee Edition)*, *10*(2), 71-76.

Macfarlane, S., Macfarlane, A., & Gillon, G. (2015). Sharing the food baskets of knowledge: Creating space for a blending of streams. *Sociocultural realities: Exploring new horizons*, 52-67.

Mach, K. J., & Siders, A. R. (2021). Reframing strategic, managed retreat for transformative climate adaptation. *Science*, *372*(6548), 1294-1299. https://doi.org/10.1126/science.abh1894

Magnan, A. K., Schipper, E. L. F., Burkett, M., Bharwani, S., Burton, I., Eriksen, S., Gemenne, F., Schaar, J., & Ziervogel, G. (2016). Addressing the risk of maladaptation to climate change. *WIREs Climate Change*, *7*(5), 646-665. https://doi.org/10.1002/wcc.409

Mahuika, N. (2019). *Rethinking Oral History and Tradition: An Indigenous Perspective*. Oxford University Press. https://doi.org/10.1093/oso/9780190681685.001.0001

Mahuika, N., & Mahuika, R. (2020). Wānanga as a research methodology. *AlterNative: An International Journal of Indigenous Peoples*, *16*(4), 369-377. https://doi.org/10.1177/1177180120968580

Maketu Iwi Collective. (2023). *He Toka Tu Moana Mo Maketu - Maketu Climate Change Adaptation Plan*. https://maketuclimateplan.iwi.nz/wp-content/uploads/2023/11/Maketu-Climate-Change-Adaptation-Plan-He-Toka-Tu-Moana-Mo-Maketu.pdf

Makondo, C. C., & Thomas, D. S. G. (2018). Climate change adaptation: Linking indigenous knowledge with western science for effective adaptation. *Environmental Science & Policy*, *88*, 83-91. https://doi.org/10.1016/j.envsci.2018.06.014

Maldonado, J. K. (2014). A multiple knowledge approach for adaptation to environmental change: lessons learned from coastal Louisiana's tribal communities. *Journal of Political Ecology*, *21*, 61-82. https://doi.org/10.2458/v21i1.21125

Maldonado, J. K. (2015). Everyday Practices and Symbolic Forms of Resistance: Adapting to Environmental Change in Coastal Louisiana. In *Hazards, Risks and, Disasters in Society* (pp. 199-216). https://doi.org/10.1016/B978-0-12-396451-9.00012-3

Maldonado, J. K., Bennett, T. M. B., Chief, K., Cochran, P., Cozzetto, K., Gough, B., Redsteer, M. H., Lynn, K., Maynard, N., & Voggesser, G. (2016). Engagement with indigenous peoples and honoring traditional knowledge systems. In K. Jacobs, S. Moser, & J. Buizer (Eds.), *The US National Climate Assessment: Innovations in Science and Engagement* (pp. 111-126). Springer International Publishing. https://doi.org/10.1007/978-3-319-41802-5_9

Maldonado, J. K., Shearer, C., Bronen, R., Peterson, K., & Lazrus, H. (2013). The impact of climate change on tribal communities in the US: displacement, relocation, and human rights. *Climatic Change*, *120*(3), 601-614. https://doi.org/10.1007/s10584-013-0746-z

Maldonado, J. K., Wang, I. F. C., Eningowuk, F., Iaukea, L., Lascurain, A., Lazrus, H., Naquin, C. A., Naquin, J., Nogueras-Vidal, K. M., Peterson, K., Rivera-Collazo, I., Souza, M. K., Stege, M., & Thomas, B. (2021). Addressing the challenges of climate-driven community-led resettlement and site expansion: knowledge sharing, storytelling, healing, and collaborative coalition building. *Journal of Environmental Studies and Sciences*, *11*(3), 294-304. https://doi.org/10.1007/s13412-021-00695-0

Manning, M., Lawrence, J., King, D., & Chapman, R. (2015). Dealing with changing risks: a New Zealand perspective on climate change adaptation. *Regional Environmental Change*, *15*(4), 581-594. https://doi.org/10.1007/s10113-014-0673-1

Manrique, D. R., Corral, S., & Pereira, A. G. (2018). Climate-related displacements of coastal communities in the Arctic: Engaging traditional knowledge in adaptation strategies and policies. *Environmental Science & Policy*, *85*, 90-100. https://doi.org/10.1016/j.envsci.2018.04.007

Maric, T. (2016). From the valley to the shore: A hypothesis of the spatial evolution of ceremonial centres on Tahiti and Ra'iatea, Society Islands. *Journal of the Polynesian Society*, *125*, 239–262. https://doi.org/10.3316/informit.470760463064020

Marino, E. (2018). Adaptation privilege and Voluntary Buyouts: Perspectives on ethnocentrism in sea level rise relocation and retreat policies in the US. *Global Environmental Change*, *49*, 10-13. https://doi.org/10.1016/j.gloenvcha.2018.01.002

Marlow, J. J., & Sancken, L. E. (2017). Reimagining relocation in a regulatory void: The inadequacy of existing us federal and state regulatory responses to Kivalina's climate displacement in the Alaskan Arctic. *Climate Law*, *7*(4), 290-321. https://doi.org/10.1163/18786561-00704004

Marsden, M. (1992). *Kaitiakitanga : a definitive introduction to the holistic world view of the Maori*. Wellington, N.Z. : Ministry for the Environment.

Massey, C., Beetham, D., Severne, C., Archibald, G., Hancox, G., & Power, W. (2009). *Field investigations at Waihi Landslide, Taupo 30 June & 1 July 2009* G. S. Report. https://static.geonet.org.nz/info/reports/landslide/SR_2009-034.pdf

Matamua, N., Moriarty, T. R., & Tassell-Matamua, N. (2023). Mai i te Pū ki te Wānanga: Interpreting Synchronistic Meaning Through a Wānanga Methodology. *Knowledge Cultures*, *11*(1), 84-97. https://doi.org/10.22381/kc11120235

Matike Mai Aotearoa. (2016). *He Whakaaro Here Whakaumu Mō Aotearoa*. https://matikemai.maori.nz/wpcontent/uploads/2024/01/MatikeMaiAotearoa25an16-1.pdf

Maxwell, K. H., Ratana, K., Davies, K. K., Taiapa, C., & Awatere, S. (2020). Navigating towards marine co-management with Indigenous communities on-board the Waka-Taurua. *Marine Policy*, *111*. https://doi.org/10.1016/j.marpol.2019.103722

Mbah, M., Ajaps, S., & Molthan-Hill, P. (2021). A Systematic Review of the Deployment of Indigenous Knowledge Systems towards Climate Change Adaptation in Developing World Contexts: Implications for Climate Change Education. *Sustainability*, *13*(9), 4811. https://doi.org/10.3390/su13094811

McAdam, J. (2014). Historical Cross-Border Relocations in the Pacific: Lessons for Planned Relocations in the Context of Climate Change. *The Journal of Pacific History*, *49*(3), 301-327. https://doi.org/10.1080/00223344.2014.953317

McAdam, J. (2015). Lessons from planned relocation and resettlement in the past. *Forced Migration Review*(49).

McCarthy, M. (1997). Raising a Māori child under a new right state. In P. Te Whāiti, M. McCarthy, & A. Durie (Eds.), *Mai i Rangiātea*. Auckland University Press - Bridget Williams Books.

McConnell, J. R., Chellman, N. J., Mulvaney, R., Eckhardt, S., Stohl, A., Plunkett, G., Kipfstuhl, S., Freitag, J., Isaksson, E., Gleason, K. E., Brugger, S. O., McWethy, D. B., Abram, N. J., Liu, P., & Aristarain, A. J. (2021). Hemispheric black carbon increase after the 13th-century Māori arrival in New Zealand. *Nature*, *598*(7879), 82-85. https://doi.org/10.1038/s41586-021-03858-9

McDonald, C., & Figueiredo, L. (2022). A Framework for Comparative Assessment of Indigenous Land Governance. *Land*, *11*(6), 906. https://www.mdpi.com/2073-445X/11/6/906

McDonald, R. A. (2022). *He moana pukepuke e ekengia e te waka: Navigating a changing climate: A waka voyaging perspective* The University of Waikato].

McEvoy, D., & Mitchell, D. (2019). Climate resilient land governance in the global south. In S. Davoudi, Cowell, R., White, I., Blanco, H. (Ed.), *The Routledge Companion to Environmental Planning* (pp. 225-237). Routledge. https://doi.org/10.4324/9781315179780

McEvoy, D., Mitchell, D., & Trundle, A. (2020). Land tenure and urban climate resilience in the South Pacific. *Climate and Development*, *12*(1), 1-11. https://doi.org/10.1080/17565529.2019.1594666

McFadgen, B. G. (2013). *Hostile Shores: Catastrophic Events in Prehistoric New Zealand and Their Impact on Maori Coastal Communities*. Auckland University Press.

McFadgen, B. G., & Goff, J. R. (2007). Tsunamis in the New Zealand archaeological record. *Sedimentary Geology*, *200*(3), 263-274. https://doi.org/10.1016/j.sedgeo.2007.01.007

McKemey, M., Ens, E., Rangers, Y. M., Costello, O., & Reid, N. (2020). Indigenous Knowledge and Seasonal Calendar Inform Adaptive Savanna Burning in Northern Australia. *Sustainability*, *12*(3).

McLeod, E., Bruton-Adams, M., Foerster, J., Franco, C., Gaines, G., Gorong, B., James, R., Posing-Kulwaum, G., Tara, M., & Terk, E. (2019). Lessons From the Pacific Islands - Adapting to Climate Change by Supporting Social and Ecological Resilience. *Frontiers in Marine Science*, *6*. https://doi.org/10.3389/fmars.2019.00289

McMichael, C., & Powell, T. (2021). Planned Relocation and Health: A Case Study from Fiji. *International Journal of Environmental Research and Public Health*, *18*(8). https://doi.org/10.3390/ijerph18084355

McMurdo Hamilton, T., Canessa, S., Clark, K., Gleeson, P., Mackenzie, F., Makan, T., Moses-Te Kani, G., Oliver, S., Parker, K. A., & Ewen, J. G. (2021). Applying a values-based

decision process to facilitate comanagement of threatened species in Aotearoa New Zealand. *Conservation Biology*, *35*(4), 1162-1173. https://doi.org/10.1111/cobi.13651

McNamara, K. E., Bronen, R., Fernando, N., & Klepp, S. (2018). The complex decision-making of climate-induced relocation: adaptation and loss and damage. *Climate Policy*, *18*(1), 111-117. https://doi.org/10.1080/14693062.2016.1248886

McNamara, K. E., & Des Combes, H. J. (2015). Planning for Community Relocations Due to Climate Change in Fiji. *International Journal of Disaster Risk Science*, *6*(3), 315-319. https://doi.org/10.1007/s13753-015-0065-2

McNamara, K. E., & Westoby, R. (2011). Local knowledge and climate change adaptation on Erub Island, Torres Strait. *Local Environment*, *16*(9), 887-901. https://doi.org/10.1080/13549839.2011.615304

McNamara, K. E., Westoby, R., & Chandra, A. (2021). Exploring climate-driven non-economic loss and damage in the Pacific Islands. *Current Opinion in Environmental Sustainability*, *50*, 1-11. https://doi.org/10.1016/j.cosust.2020.07.004

McNamara, K. E., Westoby, R., & Smithers, S. G. (2017). Identification of limits and barriers to climate change adaptation: case study of two islands in Torres Strait, Australia. *Geographical Research*, *55*(4), 438-455. https://doi.org/10.1111/1745-5871.12242

McWethy, D. B., Whitlock, C., Wilmshurst, J. M., McGlone, M. S., Fromont, M., Li, X., Dieffenbacher-Krall, A., Hobbs, W. O., Fritz, S. C., & Cook, E. R. (2010). Rapid landscape transformation in South Island, New Zealand, following initial Polynesian settlement. *Proceedings of the National Academy of Sciences*, *107*(50), 21343-21348. https://doi.org/10.1073/pnas.1011801107

Mead, H. M. (2003). *Tikanga Maori: Living by Maori Values*. Huia Publishers.

Mercer, J., Kelman, I., Alfthan, B., & Kurvits, T. (2012). Ecosystem-Based Adaptation to Climate Change in Caribbean Small Island Developing States: Integrating Local and External Knowledge. *Sustainability*, *4*(8), 1908-1932. https://doi.org/10.3390/su4081908

Mercier, O. R. (2018). Mātauranga and science. *New Zealand Science Review*, *74*(4), 83-90.

Mercier, O. R., Stevens, N., & Tia, A. (2011). Mātauranga Māori and the Data-Information-Knowledge–Wisdom Hierarchy: A conversation on interfacing knowledge systems. *MAI Journal: A New Zealand Journal of Indigenous Scholarship*, *1*(2), 103-116. https://www.journal.mai.ac.nz/content/m%C4%81tauranga-m%C4%81ori-and-data%E2%80%93information%E2%80%93knowledge%E2%80%93wisdom-hierarchy-conversation-interfacing

Miller, J., & Moses, K. L. (2024). Living in Relation. *Journal of Architectural Education*, *78*(2), 314-330. https://doi.org/10.1080/10464883.2024.2381427

Ministry for the Environment. (2020). *National Climate Change Risk Assessment for New Zealand*. Wellington: Ministry for the Environment Retrieved from https://environment.govt.nz/assets/Publications/Files/national-climate-change-risk-assessment-main-report.pdf

Ministry for the Environment. (2022a). *Aotearoa New Zealand's first national adaptation plan*. Wellington: Ministry for the Environment, Retrieved from

https://environment.govt.nz/publications/aotearoa-new-zealands-first-national-adaptation-plan/

Ministry for the Environment. (2022b). *Exploring an indigenous worldview framework for the national climate change adaptation plan*. Ministry for the Environment Retrieved from https://environment.govt.nz/publications/exploring-an-indigenous-worldview-framework-for-the-national-climate-change-adaptation-plan/

Ministry for the Environment. (2022c). *Our Future Resource Management System: Overview – Te Pūnaha Whakahaere Rauemi o Anamata: Tirowhānui.* Wellington Retrieved from https://environment.govt.nz/assets/publications/RM-reform/Our-future-resource-management-system-overview.pdf

Ministry for the Environment. (2023). *Community-led retreat and adaptation funding: Issues and options*. Wellington Retrieved from https://environment.govt.nz/assets/publications/climate-change/Community-led-retreat-Issues-and-options.pdf

Ministry for the Environment. (2024). *Coastal hazards and climate change guidance*. Wellington: Ministry for the Environment Retrieved from https://environment.govt.nz/assets/publications/Coastal-hazards-and-climate-change-guidance-2024-ME-1805.pdf

Ministry of Justice. (2021). *Contemporary claims*. Ministry of Justice,. Retrieved 08/06/2023 from https://www.waitangitribunal.govt.nz/inquiries/contemporary-claims/

Ministry of Justice. (2024). *A Treaty Principles Bill*. Ministry of Justice,. Retrieved 25/11/2024 from https://www.justice.govt.nz/justice-sector-policy/key-initiatives/a-treaty-principles-bill/

Moeke-Pickering, T. (1996). *Maori Identity Within Whanau: A review of literature.* University of Waikato]. Hamilton.

Moewaka Barnes, H., & McCreanor, T. (2019). Colonisation, hauora and whenua in Aotearoa. *Journal of the Royal Society of New Zealand*, *49*(1), 19-33. https://doi.org/10.1080/03036758.2019.1668439

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & Group*, P. (2009). Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Annals of internal medicine*, *151*(4), 264-269. https://doi.org/10.1136/bmj.b2535

Mohin, M., Kunzwa, L., & Patel, S. (2022). Using mentimeter to enhance learning and teaching in a large class. *International Journal of Educational Policy Research and Review*, *9*(2), 48. https://doi.org/10.15739/IJEPRR.22.005

Moorfield, J. C. (2023). Te Aka: Māori Dictionary. In https://www.maoridictionary.co.nz/

Morgan-Bulled, D., Bullio, R., Webb, T., Cooper, S., Green, J., Hopkins, M., McInnes, K., Holbrook, N., Jackson, G., & Kirono, D. (2023). First Peoples voices on climate change at the national level. https://doi.org/10.21203/rs.3.rs-3287446/v1

Morgan, T. K. K. B. (2006). Waiora and Cultural Identity: Water quality assessment using the Mauri Model. *AlterNative: An International Journal of Indigenous Peoples*, *3*(1), 42-67. https://doi.org/10.1177/117718010600300103

Morgan, T. K. K. B., & Manuel, R. (2020). Western Science and Indigenous wisdom: Is integration possible, practical, plausible? *New Zealand Science Review*, *76*(2), 6-12. https://doi.org/10.26686/nzsr.v76i1-2.7827

Morris, R. L., Konlechner, T. M., Ghisalberti, M., & Swearer, Stephen E. (2018). From grey to green: Efficacy of eco-engineering solutions for nature-based coastal defence. *Global Change Biology*, *24*(5), 1827-1842. https://doi.org/10.1111/gcb.14063

Mulholland, M., & Bargh, R. (2015). *Marae : the heart of Māori culture*. Huia Publishers. https://huia.co.nz/huia-bookshop/bookshop/marae-the-heart-of-maori-culture/

Mullane, T., Harwood, M., & Warbrick, I. (2022). Tangata Hourua: a framework drawing from Kaupapa Māori and Pacific research methodologies. *AlterNative: An International Journal of Indigenous Peoples*, *18*(3), 383-390. https://doi.org/10.1177/11771801221116727

Mutu, M. (2011). Constitutional Intentions: The Treaty of Waitangi Texts. In M. Mulholland & V. Tawhai (Eds.), *Weeping waters : The treaty of waitangi and constitutional change*. Huia Publishers.

Mutu, M. (2018). Behind the smoke and mirrors of the Treaty of Waitangi claims settlement process in New Zealand: no prospect for justice and reconciliation for Māori without constitutional transformation. *Journal of Global Ethics*, *14*(2), 208-221. https://doi.org/10.1080/17449626.2018.1507003

Mutu, M. (2019a). 'To honour the treaty, we must first settle colonisation' (Moana Jackson 2015): the long road from colonial devastation to balance, peace and harmony. *Journal of the Royal Society of New Zealand*, *49*(1), 4-18. https://doi.org/10.1080/03036758.2019.1669670

Mutu, M. (2019b). The treaty claims settlement process in New Zealand and its impact on Māori. *Land*, *8*(10), 152.

Naish, T., Levy, R., Hamling, I., Hreinsdóttir, S., Kumar, P., Garner, G. G., Kopp, R. E., Golledge, N., Bell, R., Paulik, R., Lawrence, J., Denys, P., Gillies, T., Bengtson, S., Howell, A., Clark, K., King, D., Litchfield, N., & Newnham, R. (2024). The Significance of Interseismic Vertical Land Movement at Convergent Plate Boundaries in Probabilistic Sea-Level Projections for AR6 Scenarios: The New Zealand Case. *Earth's Future*, *12*(6). https://doi.org/10.1029/2023EF004165

Narain, U., Margulis, S., & Essam, T. (2011). Estimating costs of adaptation to climate change. *Climate Policy*, *11*(3), 1001-1019. https://doi.org/10.1080/14693062.2011.582387

Nauels, A., Rogelj, J., Schleussner, C.-F., Meinshausen, M., & Mengel, M. (2017). Linking sea level rise and socioeconomic indicators under the Shared Socioeconomic Pathways. *Environmental Research Letters*, *12*(11). https://doi.org/10.1088/1748-9326/aa92b6

Neumann, B., Vafeidis, A. T., Zimmermann, J., & Nicholls, R. J. (2015). Future Coastal Population Growth and Exposure to Sea-Level Rise and Coastal Flooding - A Global Assessment. *PLOS ONE*, *10*(3). https://doi.org/10.1371/journal.pone.0118571

New Zealand Herald. (1910). Lake Taupo Landslip. *New Zealand Herald,*. https://paperspast.natlib.govt.nz/newspapers/NZH19100323.2.80

Newton, J., Paci, C. D. J., & Ogden, A. (2005). Climate Change and Natural Hazards in Northern Canada: Integrating Indigenous Perspectives with Government Policy. *Mitigation and Adaptation Strategies for Global Change*, *10*(3), 541-571. https://doi.org/10.1007/s11027-005-0060-9

Ngcamu, B. S. (2023). Climate change effects on vulnerable populations in the Global South: a systematic review. *Natural Hazards*, *118*(2), 977-991. https://doi.org/10.1007/s11069-023-06070-2

Nicholls, R. J., & Cazenave, A. (2010). Sea-Level Rise and Its Impact on Coastal Zones. *Science*, *328*(5985), 1517-1520. https://doi.org/10.1126/science.1185782

Nicholls, R. J., Leatherman, S. P., Dennis, K. C., & Volonté, C. R. (1995). Impacts and Responses to Sea-Level Rise: Qualitative and Quantitative Assessments. *Journal of Coastal Research*, 26-43. http://www.jstor.org/stable/25735699

Noble, I. R., Huq, S., Anokhin, Y. A., Carmin, J., Goudou, D., Lansigan, F. P., Osman-Elasha, B., & Villamizar, A. (2014). Adaptation needs and options. In C. B. Field, V. R. Barros, D. J. Dokken, K. J. Mach, M. D. Mastrandrea, T. E. Bilir, M. Chatterjee, K. L. Ebi, Y. O. Estrada, R. C. Genova, B. Girma, E. S. Kissel, A. N. Levy, S. MacCracken, P. R. Mastrandrea, & L. L. White (Eds.), *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (pp. 833-868). Cambridge University Press.

Nordgren, J., Stults, M., & Meerow, S. (2016). Supporting local climate change adaptation: Where we are and where we need to go. *Environmental Science & Policy*, *66*, 344-352. https://doi.org/10.1016/j.envsci.2016.05.006

Nunn, P. D., & Campbell, J. R. (2020). Rediscovering the past to negotiate the future: How knowledge about settlement history on high tropical Pacific Islands might facilitate future relocations. *Environmental Development*, *35*. https://doi.org/10.1016/j.envdev.2020.100546

Nursey-Bray, M., & Palmer, R. (2018). Country, climate change adaptation and colonisation: insights from an Indigenous adaptation planning process, Australia. *Heliyon*, *4*(3).

Nursey-Bray, M., Palmer, R., Chischilly, A. M., Rist, P., & Yin, L. (2022). Indigenous Adaptation – Not Passive Victims. In M. Nursey-Bray, R. Palmer, A. M. Chischilly, P. Rist, & L. Yin (Eds.), *Old Ways for New Days: Indigenous Survival and Agency in Climate Changed Times* (pp. 25-56). Springer International Publishing. https://doi.org/10.1007/978-3-030-97826-6_3

NZME. (2023). Te Karaka relocation needs 50 percent community support - Willie Te Aho. *Te Ao Maori News*. https://www.teaonews.co.nz/2023/04/25/te-karaka-relocation-needs-50-percent-community-support-willie-te-aho/

O'Hare, P., White, I., & Connelly, A. (2016). Insurance as maladaptation: Resilience and the 'business as usual'paradox. *Environment and Planning C: Government and Policy*, *34*(6), 1175-1193. https://doi.org/10.1177/0263774X15602

O'Neill, C., Green, D., & Lui, W. (2012). How to make climate change research relevant for Indigenous communities in Torres Strait, Australia. *Local Environment*, *17*(10), 1104-1120. https://doi.org/10.1080/13549839.2012.716405

ODESC. (2007). *National Hazardscape Report*. Wellington. NZ,: Officials' Committee for Domestic and External Security Coordination, Retrieved from https://www.civildefence.govt.nz/assets/Uploads/publications/national-hazardscape-report-sept-2007-complete.pdf

Orange, C. (2020). *The Treaty of Waitangi / Te Tiriti o Waitangi: An Illustrated History* (J. Parkin, Ed.). Bridget Williams Books. https://doi.org/10.7810/9781988587189

Orlove, B., Shwom, R., Markowitz, E., & Cheong, S.-M. (2020). Climate Decision-Making. In A. Gadgil & T. P. Tomich (Eds.), *Annual Review of Environment and Resources, Vol 45* (Vol. 45, pp. 271-303). https://doi.org/10.1146/annurev-environ-012320-085130

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., McGuinness, L. A., Stewart, L. A., Thomas, J., Tricco, A. C., Welch, V. A., Whiting, P., & Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *International Journal of Surgery*, *88*. https://doi.org/10.1016/j.ijsu.2021.105906

Parsons, M., & Fisher, K. (2022). Decolonising Flooding and Risk Management: Indigenous Peoples, Settler Colonialism, and Memories of Environmental Injustices. *Sustainability*, *14*(18). https://www.mdpi.com/2071-1050/14/18/11127

Parsons, M., & Nalau, J. (2019). Adaptation policy and planning in Pacific small island developing states. In *Research Handbook on Climate Change Adaptation Policy* (pp. 273-290). Edward Elgar Publishing.

Paul-Burke, K., Ngarimu-Cameron, R., Paul, W., Burke, J., Cameron, K., O'Brien, T., & Bluett, C. (2022). Nga tohu o te taiao: Observing signs of the natural world to identify seastar over-abundance as a detriment to shellfish survival in Ohiwa Harbour, Aotearoa/New Zealand. *New Zealand Sociology*, *37*(1), 186-210. https://search.informit.org/doi/10.3316/informit.370473699963108

Paulik, R., Horspool, N., Woods, R., Griffiths, N., Beale, T., Magill, C., Wild, A., Popovich, B., Walbran, G., & Garlick, R. (2023a). RiskScape: a flexible multi-hazard risk modelling engine. *Natural Hazards*, *119*(2), 1073-1090. https://doi.org/10.1007/s11069-022-05593-4

Paulik, R., Wild, A., Stephens, S., Welsh, R., & Wadhwa, S. (2023b). National assessment of extreme sea-level driven inundation under rising sea levels. *Frontiers in Environmental Science*, *10*. https://doi.org/10.3389/fenvs.2022.1045743

Paulik, R., Wild, A., Zorn, C., Wotherspoon, L., & Williams, S. (2024). Evaluation of residential building damage for the July 2021 flood in Westport, New Zealand. *Geoscience Letters*, *11*(1), 15. https://doi.org/10.1186/s40562-024-00323-z

Pearson, J., Jackson, G., & McNamara, K. E. (2021). Climate-driven losses to Indigenous and local knowledge and cultural heritage. *Anthropocene Review*. https://doi.org/10.1177/20530196211005482

Peart, R., Boston, J., Maher, S., & Konlechner, T. M. (2023). *Principles and Funding for Managed Retreat: Working Paper 1*. https://eds.org.nz/wp-content/uploads/2022/11/Climate-Adaptation-Working-Paper-1_FINAL.pdf

Peart, R., & Tombs, B. D. (2023). *Current Legislative and Policy Framework for Managed Relocation - Working Paper 2*. https://eds.org.nz/wp-content/uploads/2023/05/Climate-Adaptation-Working-Paper-2-FINAL.pdf

Pene, D. G. R. (2015). *Sites of Significance to Tuhourangi* Tuhourangi Tribal Authority.

Penetito, K., Lee-Morgan, J., & Eruera, N. (2021). Manaakitanga: A marae response to Covid-19. *Scope: Kaupapa Kai Tahu*, *6*, 44-52. https://doi.org/10.34074/scop.2006012

Petheram, L., Stacey, N., & Fleming, A. (2015). Future sea changes: Indigenous women's preferences for adaptation to climate change on South Goulburn Island, Northern Territory (Australia). *Climate and Development*, *7*(4), 339-352. https://doi.org/10.1080/17565529.2014.951019

Petzold, J., Andrews, N., Ford, J. D., Hedemann, C., & Postigo, J. C. (2020). Indigenous knowledge on climate change adaptation: a global evidence map of academic literature. *Environmental Research Letters*, *15*(11). https://doi.org/10.1088/1748-9326/abb330

Phibbs, S., & Kenney, C. (2022). Indigenous responses to environmental hazard events. In *Routledge Handbook of Environmental Hazards and Society* (pp. 273-286). Routledge.

Phillips, H. (2015). The capacity to adapt to climate change at heritage sites—The development of a conceptual framework. *Environmental Science & Policy*, *47*, 118-125. https://doi.org/10.1016/j.envsci.2014.11.003

Piggott-McKellar, A., McMichael, C., & Powell, T. (2021). Generational retreat: locally driven adaption to coastal hazard risk in two Indigenous communities in Fiji. *Regional Environmental Change*, *21*(2), 49. https://doi.org/10.1007/s10113-021-01780-4

Piggott-McKellar, A., & Vella, K. (2023). Lessons learned and policy implications from climate-related planned relocation in Fiji and Australia. *Frontiers in Climate*, *5*. https://doi.org/doi.org/10.3389/fclim.2023.1032547

Piggott-McKellar, A. E., McNamara, K. E., Nunn, P. D., & Sekinini, S. T. (2019). Moving People in a Changing Climate: Lessons from Two Case Studies in Fiji. *Social Sciences*, *8*(5), 133. https://doi.org/10.3390/socsci8050133

Pihama, L., Cram, F., & Walker, S. (2002). Creating methodological space: A literature review of Kaupapa Maori research. *Canadian Journal of Native Education*, *26*(1), 30-43.

Pinter, N. (2021a). The lost history of managed retreat and community relocation in the United States. *Elementa: Science of the Anthropocene*, *9*(1). https://doi.org/10.1525/elementa.2021.00036

Pinter, N. (2021b). True Stories of Managed Retreat From Rising Waters: As more communities face threats from rising sea levels and climate-induced flooding, a rich 140-year history of relocation projects offers valuable insights. *Issues in Science and Technology*, *37*.

Powick, K. (2003). *Māori research ethics: A literature review of the ethical issues and implications of kaupapa Māori research and research involving Māori for researchers, supervisors and ethics committees.* . University of Waikato.

Rameka, L. (2016). Kia whakatōmuri te haere whakamua: 'I walk backwards into the future with my eyes fixed on my past'. *Contemporary Issues in Early Childhood*, *17*(4), 387-398. https://doi.org/10.1177/1463949116677923

Rata, A., Hutchings, J., & Liu, J. H. (2012). The Waka Hourua Research Framework: A dynamic approach to research with urban Māori communities. *Australian Community Psychologist*, *24*(1), 64-75. https://psychology.org.au/aps/media/acp/rata-et-al-acp-24(1)64-75.pdf

Reed, G., Brunet, N. D., Longboat, S., & Natcher, D. C. (2021). Indigenous guardians as an emerging approach to indigenous environmental governance. *Conservation Biology*, *35*(1), 179-189. https://doi.org/10.1111/cobi.13532

Reeder-Myers, L. A. (2015). Cultural Heritage at Risk in the Twenty-First Century: A Vulnerability Assessment of Coastal Archaeological Sites in the United States. *The Journal of Island and Coastal Archaeology*, *10*(3), 436-445. https://doi.org/10.1080/15564894.2015.1008074

Reibold, K. (2023). Settler Colonialism, Decolonization, and Climate Change. *Journal of Applied Philosophy*, *40*(4), 624-641. https://doi.org/10.1111/japp.12573

Reid, J., Challies, E., Tau, T. M., & Awatere, S. (2024). Adapting to climate change through nature-based solutions and indigenous knowledge: the case for landscape-scale ecosystem regeneration in the Rokohouia Delta. *Kōtuitui: New Zealand Journal of Social Sciences Online*, 1-19. https://doi.org/10.1080/1177083X.2023.2299364

Reid, M. G., Hamilton, C., Reid, S. K., Trousdale, W., Hill, C., Turner, N., Picard, C. R., Lamontagne, C., & Matthews, H. D. (2014). INDIGENOUS CLIMATE CHANGE ADAPTATION PLANNING USING A VALUES-FOCUSED APPROACH: A CASE STUDY WITH THE GITGA'AT NATION. *Journal of Ethnobiology*, *34*(3), 401-424. https://doi.org/10.2993/0278-0771-34.3.401

Reilly, M. P. J. (2004). Whanaungatanga. In T. M. Ka'ai, J. C. Moorfield, M. P. J. Reilly, & S. Mosley (Eds.), *Ki te Whaiao: An Introduction to Maori Culture and Society* (pp. 61-72). Pearson Education

Reimann, L., Vafeidis, A. T., Brown, S., Hinkel, J., & Tol, R. S. J. (2018). Mediterranean UNESCO World Heritage at risk from coastal flooding and erosion due to sea-level rise. *Nature Communications*, *9*(1). https://doi.org/10.1038/s41467-018-06645-9

Reiss, J., & Sprenger, J. (2014). *Scientific objectivity* (Winter 2020 ed.). The Stanford Encyclopedia of Philosophy. https://plato.stanford.edu/archives/win2020/entries/scientific-objectivity/

Resource Management Act 1991, (1991). https://www.legislation.govt.nz/act/public/1991/0069/latest/DLM230265.html

Riahi, K., van Vuuren, D. P., Kriegler, E., Edmonds, J., O'Neill, B. C., Fujimori, S., Bauer, N., Calvin, K., Dellink, R., Fricko, O., Lutz, W., Popp, A., Cuaresma, J. C., Kc, S., Leimbach, M., Jiang, L., Kram, T., Rao, S., Emmerling, J., Ebi, K., Hasegawa, T., Havlik, P., Humpenöder, F., Da Silva, L. A., Smith, S., Stehfest, E., Bosetti, V., Eom, J., Gernaat, D., Masui, T., Rogelj, J., Strefler, J., Drouet, L., Krey, V., Luderer, G., Harmsen, M., Takahashi, K., Baumstark, L., Doelman, J. C., Kainuma, M., Klimont, Z., Marangoni, G., Lotze-Campen, H., Obersteiner, M., Tabeau, A., & Tavoni, M. (2017). The Shared Socioeconomic Pathways and their energy, land use, and greenhouse gas

emissions implications: An overview. *Global Environmental Change*, *42*, 153-168. https://doi.org/10.1016/j.gloenvcha.2016.05.009

Roberts, M., Norman, W., Minhinnick, N., Wihongi, D., & Kirkwood, C. (1995). Kaitiakitanga: Maori perspectives on conservation. *Pacific conservation biology*, *2*(1), 7. https://doi.org/10.1071/PC950007

Rosales, J., & Chapman, J. L. (2015). Perceptions of Obvious and Disruptive Climate Change: Community-Based Risk Assessment for Two Native Villages in Alaska. *Climate*, *3*(4), 812-832. https://doi.org/10.3390/cli3040812

Rotzoll, K., & Fletcher, C. H. (2013). Assessment of groundwater inundation as a consequence of sea-level rise. *Nature Climate Change*, *3*(5), 477-481. https://doi.org/10.1038/nclimate1725

Rouse, H. L., Bell, R. G., Lundquist, C. J., Blackett, P. E., Hicks, D. M., & King, D. N. (2017). Coastal adaptation to climate change in Aotearoa-New Zealand. *New Zealand Journal of Marine and Freshwater Research*, *51*(2), 183-222. https://doi.org/10.1080/00288330.2016.1185736

Rout, M., Awatere, S., Reid, J., Campbell, E., Huang, A., & Warmenhoven, T. (2024). A 'te ao Māori' disaster risk reduction framework. *Disasters*. https://doi.org/10.1111/disa.12622

Ruru, J. (2011). Maori legal rights to water: Ownership, management, or just consultation. *Resource Management Theory & Practice*, *7*, 119-135.

Ruru, J. (2013). Indigenous restitution in settling water claims: The developing cultural and commercial redress opportunities in Aotearoa, New Zealand. *Pac. Rim L. & Pol'y J.*, *22*, 311. https://digitalcommons.law.uw.edu/wilj/vol22/iss2/5

Ruru, J. (2018). Listening to Papatūānuku: a call to reform water law. *Journal of the Royal Society of New Zealand*, *48*(2-3), 215-224. https://doi.org/10.1080/03036758.2018.1442358

Ryan, E. J., Owen, S. D., Lawrence, J., Glavovic, B., Robichaux, L., Dickson, M., Kench, P. S., Schneider, P., Bell, R., & Blackett, P. (2022). Formulating a 100-year strategy for managing coastal hazard risk in a changing climate: Lessons learned from Hawke's Bay, New Zealand. *Environmental Science & Policy*, *127*, 1-11. https://doi.org/10.1016/j.envsci.2021.10.012

Salmón, E. (2000). Kincentric Ecology: Indigenous perceptions of the human-nature relationship. *Ecological Applications*, *10*(5), 1327-1332. https://doi.org/10.1890/1051-0761(2000)010[1327:KEIPOT]2.0.CO;2

Salmond, A., Brierley, G., Hikuroa, D., & Lythberg, B. (2022). Tai Timu, Tai Pari, the ebb and flow of the tides: working with the Waimatā from the Mountains to the Sea. *New Zealand Journal of Marine and Freshwater Research*, *56*(3), 430-446. https://doi.org/10.1080/00288330.2022.2096084

Savo, V., Lepofsky, D., Benner, J. P., Kohfeld, K. E., Bailey, J., & Lertzman, K. (2016). Observations of climate change among subsistence-oriented communities around the world. *Nature Climate Change*, *6*(5), 462-473. https://doi.org/10.1038/nclimate2958

Schlingmann, A., Graham, S., Benyei, P., Corbera, E., Martinez Sanesteban, I., Marelle, A., Soleymani-Fard, R., & Reyes-García, V. (2021). Global patterns of adaptation to

climate change by Indigenous Peoples and local communities. A systematic review. *Current Opinion in Environmental Sustainability*, *51*, 55-64. https://doi.org/10.1016/j.cosust.2021.03.002

Schmidt, J. I., Hausner, V. H., & Monz, C. (2021). Building adaptive capacity in a changing Arctic by use of technology. *Ecology and Society*, *26*(4). https://doi.org/10.5751/es-12605-260401

Schneider, P., Glavovic, B., & Farrelly, T. (2017). So Close Yet So Far Apart: Contrasting Climate Change Perceptions in Two "Neighboring" Coastal Communities on Aotearoa New Zealand's Coromandel Peninsula. *Environments*, *4*(3), 65. https://doi.org/10.3390/environments4030065

Selby, R., Moore, P. J. G., & Mulholland, M. (2010). *Māori and the environment:kaitiaki*. Huia.

Sesana, E., Gagnon, A. S., Ciantelli, C., Cassar, J., & Hughes, J. J. (2021). Climate change impacts on cultural heritage: A literature review. *WIREs Climate Change*, *12*(4), e710. https://doi.org/10.1002/wcc.710

Shaieree, C., Doberstein, B., Henstra, D., & Wandel, J. (2021). Evaluating property buyouts and disaster recovery assistance (Rebuild) options in Canada: A comparative analysis of Constance Bay, Ontario and Pointe Gatineau, Quebec. *Natural Hazards*, *109*(1), 201-220. https://doi.org/10.1007/s11069-021-04832-4

Siders, A. R. (2019). Managed Retreat in the United States. *One Earth*, *1*(2), 216-225. https://doi.org/10.1016/j.oneear.2019.09.008

Siders, A. R., & Ajibade, I. (2021). Introduction: Managed retreat and environmental justice in a changing climate. *Journal of Environmental Studies and Sciences*, *11*(3), 287-293. https://doi.org/10.1007/s13412-021-00700-6

Siders, A. R., Ajibade, I., & Casagrande, D. (2021). Transformative potential of managed retreat as climate adaptation. *Current Opinion in Environmental Sustainability*, *50*, 272-280. https://doi.org/10.1016/j.cosust.2021.06.007

Siders, A. R., Hino, M., & Mach, K. J. (2019). The case for strategic and managed climate retreat. *Science (American Association for the Advancement of Science)*, *365*(6455), 761-763. https://doi.org/10.1126/science.aax8346

Siders, A. R., & Keenan, J. M. (2020). Variables shaping coastal adaptation decisions to armor, nourish, and retreat in North Carolina. *Ocean & Coastal Management*, *183*. https://doi.org/10.1016/j.ocecoaman.2019.105023

Sietsma, A. J., Ford, J. D., Callaghan, M. W., & Minx, J. C. (2021). Progress in climate change adaptation research. *Environmental Research Letters*, *16*(5). https://doi.org/10.1088/1748-9326/abf7f3

Simms, J. R. Z., Waller, H. L., Brunet, C., & Jenkins, P. (2021). The long goodbye on a disappearing, ancestral island: a just retreat from Isle de Jean Charles. *Journal of Environmental Studies and Sciences*, *11*(3), 316-328. https://doi.org/10.1007/s13412-021-00682-5

Simpson, M. (2020). The Anthropocene as colonial discourse. *Environment and Planning D: Society and Space*, *38*(1), 53-71. https://doi.org/10.1177/0263775818764679

Skinner, D. (2016). *The Māori Meeting House: Introducing the Whare Whakairo.* Te Papa Press.

Sloane, D. R., Ens, E., Wunungmurra, Y., Gumana, Y., Wunungmurra, B., Wirrpanda, M., Towler, G., Preece, D., & Rangers, Y. (2021). Lessons from old fenced plots: Eco-cultural Impacts of feral ungulates and potential decline in sea-level rise resilience of coastal floodplains in northern Australia. *Ecological Management & Restoration*, *22*(2), 191-203. https://doi.org/10.1111/emr.12464

Smith, G., LeTissier, M., O'Hagan, A. M., & Farrell, E. J. (2022). Policy Coherence for Climate Change Adaptation at the Land-Sea Interface in Ireland. *Planning Practice & Research*, *37*(2), 173-188. https://doi.org/10.1080/02697459.2021.1991657

Smith, H. (2020). Collaborative Strategies for Re-Enhancing Hapu Connections to Lands and Making Changes with Our Climate. *Contemporary Pacific*, *32*(1), 21-46. http://hdl.handle.net/10453/145756

Smith, H., Allan, P., Bryant, M., Hardy, D., Manning, M., Patterson, M., Poutama, M., Richards, A., Richardson, J., & Spinks, A. (2024). Adaptation strategies to address climate change impacts on coastal Māori communities in Aotearoa New Zealand: A case study of dairy farming in the Horowhenua-Kāpiti coastal zone. https://doi.org/10.60919/niwa.26011135

Smith, L. T. (2012). *Decolonizing methodologies: research and indigenous peoples* (Second ed.). Otago University Press.

Smith, L. T. (2015). Kaupapa māori research-some kaupapa māori principles. In L. Pihama, K. Southey, & S.-J. Tiakiwai (Eds.), *Kaupapa Rangahau A Reader: A Collection of Readings from the Kaupapa Maori Research Workshop Series Led* (pp. 46-52). Te Kotahi Research Institute.

Stafford, D. (2016). *Te Arawa: A History of the Arawa People* (2016 ed.). Oratia Books.

Stephens, S. A., Paulik, R., Reeve, G., Wadhwa, S., Popovich, B., Shand, T., & Haughey, R. (2021). Future Changes in Built Environment Risk to Coastal Flooding, Permanent Inundation and Coastal Erosion Hazards. *Journal of Marine Science and Engineering*, *9*(9), 1-20. https://doi.org/10.3390/jmse9091011

Stephenson, J., Kawharu, M., Bond, S., Diprose, G., Maketu Iwi Collective, Te Kaahui o Rauru, Kati Huirapa ki Puketeraki, & Aukaha. (2024). Kete Whakaaro: A basket of ideas from mana whenua who are leading their own climate change adaptation. https://hdl.handle.net/10523/36243

Stewart‐Harawira, M. W. (2020). Troubled waters: Maori values and ethics for freshwater management and New Zealand's fresh water crisis. *Wiley interdisciplinary reviews. Water*, *7*(5). https://doi.org/10.1002/wat2.1464

Stewart, E. (2023). 'Our tīpuna knew when to move' - The difficult conversations about managed retreat for Māori. *RNZ*. https://www.rnz.co.nz/news/in-depth/489011/our-tipuna-knew-when-to-move-the-difficult-conversations-about-managed-retreat-for-maori

Stokes, E. (1992). The treaty of Waitangi and the Waitangi tribunal: Maori claims in New Zealand. *Applied Geography*, *12*(2), 176-191. https://doi.org/10.1016/0143-6228(92)90006-9

Storey, D., & Hunter, S. (2010). Kiribati: an environmental 'perfect storm'. *Australian Geographer*, *41*(2), 167-181. https://doi.org/10.1080/00049181003742294

Suliman, S., Farbotko, C., Ransan-Cooper, H., Elizabeth McNamara, K., Thornton, F., McMichael, C., & Kitara, T. (2019). Indigenous (im)mobilities in the Anthropocene. *Mobilities*, *14*(3), 298-318. https://doi.org/10.1080/17450101.2019.1601828

Sultana, N., & Luetz, J. M. (2022). Adopting the Local Knowledge of Coastal Communities for Climate Change Adaptation: A Case Study From Bangladesh. *Frontiers in Climate*, *4*. https://doi.org/10.3389/fclim.2022.823296

Taig, T., Massey, C., & Webb, T. (2012). *Canterbury Earthquakes 2010/11 Port Hills Slope Stability: Principles and Criteria for the assessment of Risk from Slope Instability in the Port Hills, Christchurch*. GNS. https://www.ccc.govt.nz/assets/Documents/Environment/Land/gns-ph-riskassesscriteria12684519.pdf

Tapsell, P. (2002). Marae and Tribal Identity in urban Aotearoa / New Zealand. *Pacific studies*, *25*(1), 141-171. https://www.researchgate.net/publication/279186299_MARAE_AND_TRIBAL_IDENTITY_IN_URBAN_AOTEAROANEW_ZEALAND

Tapsell, P. (2005). *Te Arawa*. https://teara.govt.nz/en/te-arawa/print

Tapsell, P. (2021). *Kainga: People, Land, Belonging*. Bridget Williams Books. https://doi.org/10.7810/9781988587585

Tau, T. M., & Anderson, A. (2008). *Ngai Tahu: A Migration History*. Bridget Williams Books Publishing Trust.

Tauranga Moana District Maori Council. (1989). *Aku Taumata Korero: Nga Marae me nga iwi o te Moana o Tauranga*. Moana Press.

Taylor, L., Hikuroa, D., & Whaanga-Schollum, D. (2024). *Te Kete Kaitiakitanga: Tools to enable kaitiakitanga & ecosystem-based management*. MBIE.

Taylor, L., Walker, S., Bailey-Winiata, A., & Gallop, S. L. (2023). *SUBMISSION TO THE ENVIRONMENT SELECT COMMITTEE ON THE INQUIRY INTO COMMUNITYLED RETREAT AND CLIMATE ADAPTATION: E Oho! Awakening Aotearoa New Zealand*. https://www.researchgate.net/publication/385717759_SUBMISSION_TO_THE_ENVIRONMENT_SELECT_COMMITTEE_ON_THE_INQUIRY_INTO_COMMUNITYLED_RETREAT_AND_CLIMATE_ADAPTATION_E_Oho_Awakening_Aotearoa_New_Zealand/references

Te Potiki National Trust, L. (2011). *New Zealand Marae* Te Potiki National Trust Limited. https://maorimaps.com/info

Thom, R. R. M., & Grimes, A. (2022). Land loss and the intergenerational transmission of wellbeing: The experience of iwi in Aotearoa New Zealand. *Social Science & Medicine*, *296*. https://doi.org/10.1016/j.socscimed.2022.114804

Thomas, K.-L., Kaiser, L., Campbell, E., Johnston, D., Campbell, H., Solomon, R., Jack, H., Borrero, J., & Northern, A. (2020). Disaster memorial events for increasing awareness and preparedness: 150 years since the Arica tsunami in Aotearoa- New Zealand. *The*

Australian Journal of Emergency Management, *35*(3), 71-78. https://search.informit.org/doi/10.3316/informit.309549570138929

Thompson, K.-L., & Ban, N. C. (2022). "Turning to the territory": A Gitga'at Nation case study of Indigenous climate imaginaries and actions. *Geoforum*, *137*, 230-236. https://doi.org/10.1016/j.geoforum.2021.11.006

Tompkins, E. L., Adger, W. N., Boyd, E., Nicholson-Cole, S., Weatherhead, K., & Arnell, N. (2010). Observed adaptation to climate change: UK evidence of transition to a well-adapting society. *Global Environmental Change*, *20*(4), 627-635. https://doi.org/10.1016/j.gloenvcha.2010.05.001

Tonkin+Taylor. (2007). *West Coast Hazard Project*.

Treadwell, J. (2017). Cosmology and Structure: The Tāhuhu in the 19th-Century Whare Māori. *The Journal of the Polynesian Society*, *126*(1), 93-122. https://doi.org/10.15286/jps.126.1.93-122

Tubridy, F., Scott, M., & Lennon, M. (2021). Managed retreat in response to flooding: lessons from the past for contemporary climate change adaptation. *Planning Perspectives*, *36*(6), 1249-1268. https://doi.org/10.1080/02665433.2021.1939115

Tuck, E., & Yang, K. W. (2012). Decolonization is not a metaphor. *Decolonization: Indigeneity, education & society*, *1*(1).

Ulluwishewa, R., Roskruge, N., Harmsworth, G., & Antaran, B. (2008). Indigenous knowledge for natural resource management: a comparative study of Māori in New Zealand and Dusun in Brunei Darussalam. *GeoJournal*, *73*(4), 271-284. https://doi.org/10.1007/s10708-008-9198-9

Van Aalst, M. K. (2006). The impacts of climate change on the risk of natural disasters. *Disasters*, *30*(1), 5-18. https://doi.org/10.1111/j.1467-9523.2006.00303.x

van der Ploeg, J., Sukulu, M., Govan, H., Minter, T., & Eriksson, H. (2020). Sinking Islands, Drowned Logic; Climate Change and Community-Based Adaptation Discourses in Solomon Islands. *Sustainability*, *12*(17). https://doi.org/10.3390/su12177225

Veland, S., Howitt, R., Dominey-Howes, D., Thomalla, F., & Houston, D. (2013). Procedural vulnerability: Understanding environmental change in a remote indigenous community. *Global Environmental Change*, *23*(1), 314-326. https://doi.org/10.1016/j.gloenvcha.2012.10.009

Vierros, M. K., Harrison, A.-L., Sloat, M. R., Crespo, G. O., Moore, J. W., Dunn, D. C., Ota, Y., Cisneros-Montemayor, A. M., Shillinger, G. L., Watson, T. K., & Govan, H. (2020). Considering Indigenous Peoples and local communities in governance of the global ocean commons. *Marine Policy*, *119*. https://doi.org/10.1016/j.marpol.2020.104039

Vousdoukas, M. I., Voukouvalas, E., Mentaschi, L., Dottori, F., Giardino, A., Bouziotas, D., Bianchi, A., Salamon, P., & Feyen, L. (2016). Developments in large-scale coastal flood hazard mapping. *Nat. Hazards Earth Syst. Sci.*, *16*(8), 1841-1853. https://doi.org/10.5194/nhess-16-1841-2016

Waaka, P. K. S. (1982). *Whakarewarewa: The Growth of Maori Village* University of Auckland]. Auckland.

Waipapa Marae Trust. (2022). *Ko nga Pepeha o Waipapa me Nga Ariki*. Retrieved 26/04/2022 from https://waipapamt.wixsite.com/waipapamarae/untitled-c1k6o

Waitangi Tribunal. (2014). *He Whakaputanga me Te Tiriti: The Declaration and the Treaty: The Report on Stage 1 of the Paparahi o Te Raki Inquiry (Wai 1040)*.

Waiti, J., & Wheaton, B. (2022). Culture: Indigenous Māori knowledges of the ocean and leisure practices. In *The Routledge handbook of ocean space* (pp. 85-100). Routledge.

Walker, S., Eketone, A., & Gibbs, A. (2006). An exploration of kaupapa Maori research, its principles, processes and applications. *International Journal of Social Research Methodology*, *9*(4), 331-344. https://doi.org/10.1080/13645570600916049

Walsh-Tapiata, W. (2003). A model for Maori research: Te whakaeke i te ao rangahau o te Maori. In R. Munford (Ed.), *Making a Difference in Families: Research that creates change* (pp. 19). Routledge. https://doi.org/10.4324/9781003116349

Walter, S., Brüggemann, M., & Engesser, S. (2018). Echo Chambers of Denial: Explaining User Comments on Climate Change. *Environmental Communication*, *12*(2), 204-217. https://doi.org/10.1080/17524032.2017.1394893

Wehi, P. M., Cox, M. P., Whaanga, H., & Roa, T. (2023). Tradition and change: celebrating food systems resilience at two Indigenous Māori community events. *Ecology and Society*, *28*(1). https://doi.org/10.5751/ES-13786-280119

Westoby, R., McNamara, K. E., Kumar, R., & Nunn, P. D. (2020). From community-based to locally led adaptation: Evidence from Vanuatu. *AMBIO - A Journal of the Human Environment*, *49*(9), 1466-1473. https://doi.org/10.1007/s13280-019-01294-8

White, I., & Lawrence, J. (2020). Continuity and change in national riskscapes: a New Zealand perspective on the challenges for climate governance theory and practice. *Cambridge Journal of Regions, Economy and Society*, *13*(2), 215-231. https://doi.org/10.1093/cjres/rsaa005

White, I., & Nandedkar, G. (2021). The housing crisis as an ideological artefact: Analysing how political discourse defines, diagnoses, and responds. *Housing Studies*, *36*(2), 213-234. https://doi.org/10.1080/02673037.2019.1697801

Whitney, C. K., & Ban, N. C. (2019). Barriers and opportunities for social-ecological adaptation to climate change in coastal British Columbia. *Ocean & Coastal Management*, *179*. https://doi.org/10.1016/j.ocecoaman.2019.05.010

Whitney, C. K., Frid, A., Edgar, B. K., Walkus, J., Siwallace, P., Siwallace, I. L., & Ban, N. C. (2020). "Like the plains people losing the buffalo": perceptions of climate change impacts, fisheries management, and adaptation actions by Indigenous peoples in coastal British Columbia, Canada. *Ecology and Society*, *25*(4). https://doi.org/10.5751/es-12027-250433

Whyte, K. P. (2013). Justice forward: Tribes, climate adaptation and responsibility. In *Climate change and indigenous peoples in the United States: Impacts, experiences and actions* (pp. 9-22). Springer.

Whyte, K. P. (2014). Indigenous Women, Climate Change Impacts, and Collective Action. *Hypatia-a Journal of Feminist Philosophy*, *29*(3), 599-616. https://doi.org/10.1111/hypa.12089

Whyte, K. P. (2016). Is it colonial déjà vu? Indigenous peoples and climate injustice. In J. Adamson, M. Davis, & H. Huang (Eds.), *Humanities for the Environment* (pp. 88 - 104). Earthscan. https://doi.org/10.2139/ssrn.2925277

Whyte, K. P. (2017). Indigenous climate change studies: Indigenizing futures, decolonizing the Anthropocene. *English Language Notes*, *55*(1), 153-162. https://doi.org/10.1215/00138282-55.1-2.153

Whyte, K. P., Brewer, J. P., & Johnson, J. T. (2016). Weaving Indigenous science, protocols and sustainability science. *Sustainability Science*, *11*(1), 25-32. https://doi.org/10.1007/s11625-015-0296-6

Whyte, K. P., Talley, J., & Gibson, J. (2019). Indigenous mobility traditions, colonialism, and the anthropocene. *Mobilities*, *14*(3), 319-335. https://doi.org/10.1080/17450101.2019.1611015

Wildcat, D. R. (2014). Introduction: climate change and indigenous peoples of the USA. In J. K. Maldonado, B. Colombi, & R. Pandya (Eds.), *Climate Change and Indigenous Peoples in the United States: Impacts, Experiences and Actions* (pp. 1-7). Springer International Publishing. https://doi.org/10.1007/978-3-319-05266-3_1

Wilkinson, C., Hikuroa, D. C. H., Macfarlane, A. H., & Hughes, M. W. (2020). Mātauranga Māori in geomorphology: existing frameworks, case studies, and recommendations for incorporating Indigenous knowledge in Earth science. *Earth Surface Dynamics*, *8*(3), 595-618. https://doi.org/10.5194/esurf-8-595-2020

Wilkinson, C., Macfarlane, A. H., Hikuroa, D. C. H., McConchie, C., Payne, M., Holmes, H., Mohi, R., & Hughes, M. W. (2022). Landscape change as a platform for environmental and social healing. *Kōtuitui: New Zealand Journal of Social Sciences Online*, *17*(3), 352-377. https://doi.org/10.1080/1177083X.2021.2003826

Winiata, M. (1956). Leadership in Pre-European Maori Society. *The Journal of the Polynesian Society*, *65*(3), 212-231.

Wolsko, C., & Marino, E. (2016). Disasters, migrations, and the unintended consequences of urbanization: What's the harm in getting out of harm's way? *Population and Environment*, *37*(4), 411-428. https://doi.org/10.1007/s11111-015-0248-1

Wong, P. P., Losada, I. J., Gattuso, J.-P., Hinkel, J., Khattabi, A., McInnes, K. L., Saito, Y., & A. Sallenger. (2014). Coastal systems in low-lying areas. In C. B. Field, V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, & L. L. W. P.R. Mastrandrea (Eds.), *Climate Change 2014: Impacts,Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (pp. 361-409). Cambridge University Press. https://www.ipcc.ch/report/ar5/wg2/

Wyllie de Echeverria, V. R., & Thornton, T. F. (2019). Using traditional ecological knowledge to understand and adapt to climate and biodiversity change on the Pacific coast of North America. *Ambio*, *48*(12), 1447-1469. https://doi.org/10.1007/s13280-019-01218-6

Yee, M., McMichael, C., McNamara, K. E., & Piggott-McKellar, A. (2024). Partial planned relocation and livelihoods: Learnings from Narikoso, Fiji. *Asia Pacific Viewpoint*, *n/a*(n/a). https://doi.org/10.1111/apv.12409

Zander, K. K., Petheram, L., & Garnett, S. T. (2013). Stay or leave? Potential climate change adaptation strategies among Aboriginal people in coastal communities in northern Australia. *Natural Hazards*, *67*(2), 591-609. https://doi.org/10.1007/s11069-013-0591-4

Zhou, Z., Zhang, L., Chen, J., She, D., Wang, G., Zhang, Q., Xia, J., & Zhang, Y. (2023). Projecting global drought risk under various SSP‐RCP scenarios. *Earth's Future*, *11*(5). https://doi.org/10.1029/2022EF003420

Appendices

Appendix 1

Ethics declaration

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Telephone +64 77 838 4060
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THE UNIVERSITY OF WAIKATO
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1 March 2022

Akuhata Patrick Stephen Bailey-Winiata
Shari Gallop
Iain White
Liam Wotherspoon
Mark Dickson
Joanne Ellis

Re: HECS Ethics Approval of Application HREC(HECS)2022#02 "A framework to decolonise managed retreat in Aotearoa New Zealand"

Dear Akuhata:

Thank you for submitting your amended application HREC(HECS)2022#02 for ethical approval.

We are pleased to provide formal approval for your project, including the following activities:

- Recruitment of Participants for one-to-one interviews and workshops for the development of a decolonised managed retreat strategy for Aotearoa New Zealand to enable Indigenous self-determination in effective climate change decision making to protect marae and communities.
- Interviews will take no longer than two hours and be audio recorded. Participants will be provided transcripts for review within three weeks after the interview and have up to 4 weeks to withdraw.
- Workshops will take no longer than 4 hours (with breaks). Consultation with participants will occur after the workshop to ensure accuracy of discussions. Participants can withdraw at any point until the end of the workshop but it may not be possible to withdraw contributions up to that point.

Please contact the committee by email (hecs-ethics@waikato.ac.nz) if you wish to make changes to your project as it unfolds, quoting your application number with your future correspondence. Any minor changes or additions to the approved research activities can be handled outside the monthly application cycle.

We wish you all the best with your research.

Kind regards,

Brett Langley, PhD
Chairperson
HECS Human Ethics Committee
University of Waikato

Appendix 2

Supplementary File Chapter 4

Looking Backwards to Move Forwards: Insights for Climate Change Adaptation from Historical Māori Relocation due to Natural Hazards

Regional Environmental Change

Bailey–Winiata, A.P.[1] *, Gallop, S.L., White, I., Wotherspoon, L., Fa'aui, T., Dickson, M., Ellis, J.

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Table 1: Keywords used in the textual analysis.

Pā (Mulholland & Bargh, 2015; Tapsell, 2021)						
Pā	Marae	Papa kāinga or Papakāinga	Kainga	Urupā	Wāhi Tapu	Hapū and Iwi
Complex of Māori structures and places important to Māori culture and identity.	The complex of buildings (wharenui, wharekai, marae ātea, and wharepaku) around the marae where formal greetings and discussions take place.	Original home / home base / village / communal Māori land	Home / residence / village / settlement / habitat	Cemetery	Sacred place / site. For example: puna (spring), maunga (mountain), historic battle site	Sub–tribe and tribe

Wharenui	Wharekai	Wharepaku	Marae ātea
Meeting house – main building of a marae where guests are accommodated.	Dining hall and kitchen facilities	Lavatory, bathroom	Area in front of wharenui

Natural Hazards (ODESC, 2007)			
Flood	Erosion	Hazard	Weather
Volcan*	Tsunami	Storm	Tornado
Cyclone	Wildfire	Landslide	
Drought	Snow	Earthquake	

Managed retreat/relocation (Hanna et al., 2017)			
Managed retreat	Retreat	Planned retreat	Managed realignment
Realign*	Relocate*	Relocation	Setback
Set back	Set–back	Adapt	Adaptive management
Abandon	Purchase offer	Purchase	Acquisition
Acquire	Buy	Buy–out	Resettle
Resettlement	Pathway	Strategy	Exit strategy
Soft engineering	Withdraw	Rebuild	Reconstruct
Re–construct	Replace	Damage	
Alter	Addition	Protection	
Remove	Transport	Shift	
Move	Extension	Alteration	

Questions used to guide the kōrero as part of the case study.

- What relocation event occurred in your hapū/iwi history?
    - Can you describe the decision-making process which occurred to enable that relocation event?
- What aspects of that relocation process enabled an easier transition?
- What can we learn from looking to the past (historical events) to help understand how we tackle issues heading into the future?
- What are your thoughts on potential relocation of some pā due to climate change?
- In a broad sense, do you think your hapū / iwi / pā are at risk of climate change across all the potential impacts?

Appendix 3

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Co-Authorship Form

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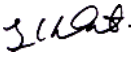
Please indicate the chapter/section/pages of this thesis that are extracted from a co–authored work and give the title and publication details or details of submission of the co–authored work. **Chapter 3/Pages 22–28 – The role of coastal marae in natural hazard response and climate change adaptation.** Published as Bailey–Winiata, A. P., Gallop, S. L., Hikuroa, D., & White, I. (2022). The role of coastal marae in natural hazard response and climate change adaptation. New Zealand Coastal Society Special Publication, 41–44.	
Nature of contribution by PhD candidate	Lead investigator and lead author
Extent of contribution by PhD candidate (%)	80%

CO–AUTHORS

Name	Nature of Contribution
Dr Shari Gallop	Advisor on study design and analysis, and co–author who provided support for paper writing.
Associate Professor Daniel Hikuroa	Co–author who provided support for study design and paper writing.
Professor Iain White	Co–author who provided support for study design and paper writing.

Certification by Co–Authors

The undersigned hereby certify that:
❖ the above statement correctly reflects the nature and extent of the PhD candidate's contribution to this work, and the nature of the contribution of each of the co–authors; and
❖ that the candidate wrote all or the majority of the text.

Name	Signature	Date
Dr Shari Gallop		10/09/2024
Associate Professor Dan Hikuroa		16/08/2024
Professor Iain White		10/09/2024

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Please indicate the chapter/section/pages of this thesis that are extracted from a co–authored work and give the title and publication details or details of submission of the co–authored work. **Chapter 4/Pages 29–49 – Looking Backwards to Move Forwards: Insights for Climate Change Adaptation from Historical Māori Relocation due to Natural Hazards** Published as Bailey–Winiata, A. P., Gallop, S. L., White, I., Wotherspoon, L., Fa'aui, T., Dickson, M., & Ellis, J. (2024). Looking backwards to move forwards: insights for climate change adaptation from historical Māori relocation due to natural hazards in Aotearoa New Zealand. Regional Environmental Change, 24(2), 1–15.	
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Professor Liam Wotherspoon	Co–author who provided support for study design and paper writing.
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Associate Professor Joanne Ellis	Co–author who provided support for study design and paper writing.

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Professor Liam Wotherspoon		17/09/2024
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Appendix 5

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Nature of contribution by PhD candidate	Lead investigator and lead author
Extent of contribution by PhD candidate (%)	80%

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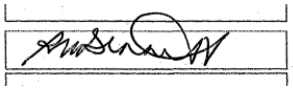
Ryan Paulik		09/09/2024
Hone Winder–Murray		12/12/2024
Anne Billing		20/11/2024
Elva Conroy		02/12/2024
Roana Bennett		1/12/24
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Nature of contribution by PhD candidate	Lead investigator and lead author
Extent of contribution by PhD candidate (%)	80%

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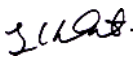
Dr Shari Gallop		10/09/2024
Professor Iain White		10/09/2024

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Nature of contribution by PhD candidate	Lead investigator and lead author
Extent of contribution by PhD candidate (%)	80%

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Professor Iain White	Advisor on paper content, context, and review.
Professor Liam Wotherspoon	Advisor on paper content, context, and review.
Associate Professor Joanne Ellis	Advisor on paper content, context, and review.
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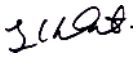
Professor Iain White		10/09/2024
Professor Liam Wotherspoon		17/09/2024
Associate Professor Joanne Ellis		09/09/2024
Dr Tūmanako Fa'aui		09/09/2024