



Me pēhea te whakarauora i ngā repo o Ngāti Maniapoto? How do we go about restoring the wetlands of Ngāti Maniapoto?

Kelly Ratana^{1,2*}, Ngahuia Herangi^{3,5} and Tramaine Murray^{4,5}

¹Ngāti Tūwharetoa, Te Arawa

²National Institute of Water and Atmospheric Research, Gate 10 Silverdale Road, Hillcrest, Hamilton, New Zealand

³Waikato/Maniapoto, Ngāti Raukawa ki te Tonga

⁴Ngāti Maniapoto, Ngāti Rahurahu

⁵Maniapoto Māori Trust Board, 49 Taupiri Street, Te Kuiti, New Zealand

*Author for correspondence (Email: kelly.ratana@niwa.co.nz)

Published online: 28 November 2019

Auheke: Kei ngā repo, ngā puna o te rohe o Maniapoto ngā mātauranga no tāukiuki e rere ana. Nō ngā pēhitanga ki runga i ēnei puna mātauranga kua whakatenatena a Maniapoto whānui ki te whakarauora i o rātou repo. 8.9% noa iho o ngā repo e ora tonu ana i roto i a Waikato whānui, e taunaki ana i te orange o Maniapoto whānui, ā mātauranga, ā rawa nei. Ahakoa te hononga o Maniapoto ki o rātou repō, ki tō rātou rohe, kaore noa o rātou hiahia kia rangona ki ngā mahi whakarauora repo. Ko ngā mātauranga, te hiranga o te rohe, ngā uara hoki o Maniapoto tē kite ki ngā mahi whakarauora repo. Ka mutu, ko te nuinga o ngā mahi whakarauora repo e kaha aro ana ki ng āhuatanga ohaoha, hauropi o te rohe. Nā tēnei, i waihangatia a Maniapoto i tō rātou kaupapa whakarauora repo, arā, Ngā Repo o Maniapoto. Ko tā te kaupapa o Ngā Repo o Maniapoto he tōtō mai i ngā mahi tāera mahere hei hanga i tētahi rarangi rawa o Maniapoto whānui. Mā tēnei kaupapa, ka māmā ake te whakauru i ngā hiahia, ngā mātauranga o Maniapoto ki ngā mahi whakarauora repo i roto i tō rātou rohe. Ko te ngako o tēnei tuhinga, he matapaki i ngā rautaki i whakamahia, ā, me ngā hua i puta i te kaupapa o Ngā Repo o Maniapoto. Mā konei, ka kite i te hiranga, ka whakamana hoki ngā mātauranga-ā-hapū, ā -iwi o Maniapoto mo ngā mahi whakarauora repo.

Abstract: With only 8.9% of wetlands remaining in the Waikato, wetland loss and the loss of Maniapoto resources and knowledge systems associated with these critical ecosystems is a distinctive issue for many across the entire Maniapoto rohe (territory). Maniapoto consider puna (springs) and repo (wetlands) to be highly valued traditional resources and an integral component of the ancestral landscape. While restoration and/or preservation of wetland ecosystems often occurs at sites prioritised by economic or ecological drivers, iwi (tribes) and hapū (sub-tribes) have little opportunity to capture, reframe and utilise their mātauranga (knowledge system) to determine their own priorities and/or contribute to decision-making processes. Maniapoto identified that this requires knowledge of locations, values, uses, associations and the importance of these sites. Methodologies for capturing spatially-grounded mātauranga and a strategic decision-support framework for prioritising wetland restoration efforts based on mātauranga were developed in a project called “Ngā Repo o Maniapoto”. Participatory mapping methods using a combination of Geographic Information Systems, interactive mapping eBeam technology, and semi-structured interview techniques provided an effective and efficient way to build a knowledge inventory based on mātauranga ā-hapū (sub-tribal based knowledge). The novel application of eBeam technology together with participatory mapping allowed efficiencies and accuracy with data collection. The inventory was utilised with whānau (broadly a family grouping, but in this regard the hapū participants involved in the project) to build a decision-support framework to enable prioritisation of restoration efforts across their rohe. In this paper we discuss how these innovative methods were used to map, collate and assist Maniapoto whānau to reframe and prioritise their mātauranga to support iwi and hapū-based decision-making.

Keywords: eBeam, participatory mapping, puna

Introduction

Wetlands perform vital ecosystem services such as improving water quality, reducing flood risks and trapping and removing sediment and nutrients (Tanner et al. 2013). Recent work has shown that wetland ecosystems are declining globally (Dixon et al. 2016), and that New Zealand is no exception. Over the past 100 years wetland extent has significantly reduced with 10% nationwide and only 8.9% remaining in the Waikato in 2008, when compared to pre-human extent (Ausseil et al. 2008). While wetland loss is a critical concern because of the value of these ecosystem services, their cultural values are rarely discussed.

Māori, the indigenous peoples of New Zealand, are becoming increasingly aware of the dire state of puna (springs) and repo (wetlands), resulting in many hapū and iwi-led projects focussed on restoring wetlands within their rohe (Taura et al. 2017). Wetlands have been identified by Ngāti Maniapoto (a tribe located in the western central North Island of New Zealand) as important habitats (Tipa et al. 2014; MMTB 2016). However, wetlands are situated within a broader cultural landscape which emphasises the interconnections of ecosystems and the people who live within, and descend from those places. To Maniapoto (used here and throughout as a broad term for those affiliated to Ngāti Maniapoto, the Maniapoto Māori Trust Board, and Regional Management Committees, who were our research partners), the Waipā River is a single indivisible entity that flows from the spring Pekepeke to its confluence with the Waikato River and includes its waters, banks, bed (and all minerals under it) and its streams, waterways, tributaries, lakes, fisheries, vegetation, floodplains, wetlands, islands, springs, geothermal springs, water column, airspace and substratum as well as its metaphysical elements with its own mauri or vital life force (Ngā Wai o Maniapoto (Waipā River) 2012). It is with this cultural context in mind, that we undertook this work not only for the Waipā River catchment, but the broader Maniapoto rohe.

Wetlands include a wide range of habitat types from freshwater stream and lake margins, springs, swamps and bogs, to saltwater marshes, mangroves and estuaries (Johnson & Gerbeaux 2004; MMTB 2016). The effects of land use activities and developments such as the draining of wetlands, nutrient and sediment runoff from land, stock access and contaminants in waterways have been identified as significant impacts on mahinga kai (traditional harvest) areas (MMTB 2016). Wetlands within the Maniapoto rohe, including repo and puna, are highly valued as mahinga kai, including for the harvest and use of indigenous flora and fauna e.g. harakeke (*Phormium tenax*; flax), ducks, tuna (*Anguilla* spp.; freshwater eels), and īnanga (*Galaxias* spp. whitebait species). These wetlands are also a key source of materials and resources for rongoā (medicine), raranga (weaving), and whakairo (carving) and were important places to store and preserve artefacts (MMTB 2016). Protection and restoration of remaining wetlands is paramount to ensure the full range of values are retained, including habitats for taonga (treasured) species, maintenance of cultural use and associations, as well as the benefits to ecological and hydrological function. Given the integral role that wetlands play within the Maniapoto cultural landscape, the ability of Maniapoto to exercise their cultural practices and kaitiakitanga (guardianship) responsibilities and maintain access to and use of the natural resources at these sites is imperative.

The Waikato Regional Council (WRC) recognises Maniapoto holds concerns for wetlands as habitat for tuna fisheries in their Regional Plan (WRC, 2007). However, the issue of declining wetlands has been felt much more broadly by Maniapoto (Tipa et al. 2014; MMTB 2015, 2016), and the continued degradation and loss of wetlands, and lack of wetland restoration is a concern for Maniapoto. The restoration of wetland ecosystems is usually undertaken at priority sites identified by economic (e.g. monetary evaluations of cost/benefit) or ecological (e.g. using ecological quantitative models) drivers at a political level (e.g. Regional Council) and prioritisation is often based on current condition of sites, and easily quantifiable ecological and/or economic data (Kiker et al. 2005; Ausseil et al. 2007; Moilanen et al. 2011). The process of prioritisation provides little opportunity for iwi to determine their own priorities and contribute to decision-making. For example, in the Waikato Region, large high profile wetlands, such as Whangamarino (recognised under the Ramsar Convention as an internationally important wetland), tend to receive the most attention (Ausseil et al. 2008).

In 2014, Maniapoto Māori Trust Board (MMTB) worked with the National Institute of Water and Atmospheric Research (NIWA) to identify the restoration priorities for the Waipā River catchment (Tipa et al. 2014) and identified wetlands as a top priority for restoration. Participants in that work believed it was important to know where wetlands were, and remain, to protect what was left and undertake restoration activities at priority sites where feasible. This was the foundation for two subsequent collaborative projects. In the first, MMTB and NIWA (hereafter, the project team) worked with the Ngā Tai o Kawhia Regional Management Committee (RMC – one of the seven marae clusters within Ngāti Maniapoto rohe established under the Maniapoto Māori Trust Board) to pilot the development of a method to inventory wetlands, and develop a decision-support framework to assist hapū-led decision-making for prioritisation of wetland restoration efforts. This methodology was subsequently adapted and refined in a second project working with the Hauāuru ki Uta and Nehenehenui RMCs (Fig. 1). This paper describes the amalgamated learnings and methodology from both projects with the three RMCs (hereafter, hapū research partners).

The Ngā Repo o Maniapoto project developed out of the urgent need identified by Maniapoto to capture the mātauranga-ā-hapū surrounding wetlands and develop a strategic decision-support framework to help prioritise the order of restoration, given limited resources. The identification of where culturally significant wetlands were/are, what uses were/are associated with them, and how Maniapoto might strategically go about restoring them, was the first step towards enhancing their cultural uses and associations with these sites. The objectives of the project as defined by MMTB were to:

- (1) Inventory wetlands within Maniapoto rohe, including what mahinga kai were supported, the traditional and contemporary associations with these sites, where they are, and how big they are/used to be,
- (2) Create, adapt and refine a process/framework to determine those wetlands of greatest priority to the iwi and hapū for restoration,
- (3) Support the ability of Maniapoto to strategically direct how restoration funding is allocated and advocate/influence restoration funding of external agencies.

Participatory mapping (PM) approaches have long been used in the social sciences to ‘spatially document community knowledge about places’ (NOAA 2014; Brown & Kytta 2018). This can encompass a range of tools including paper maps,

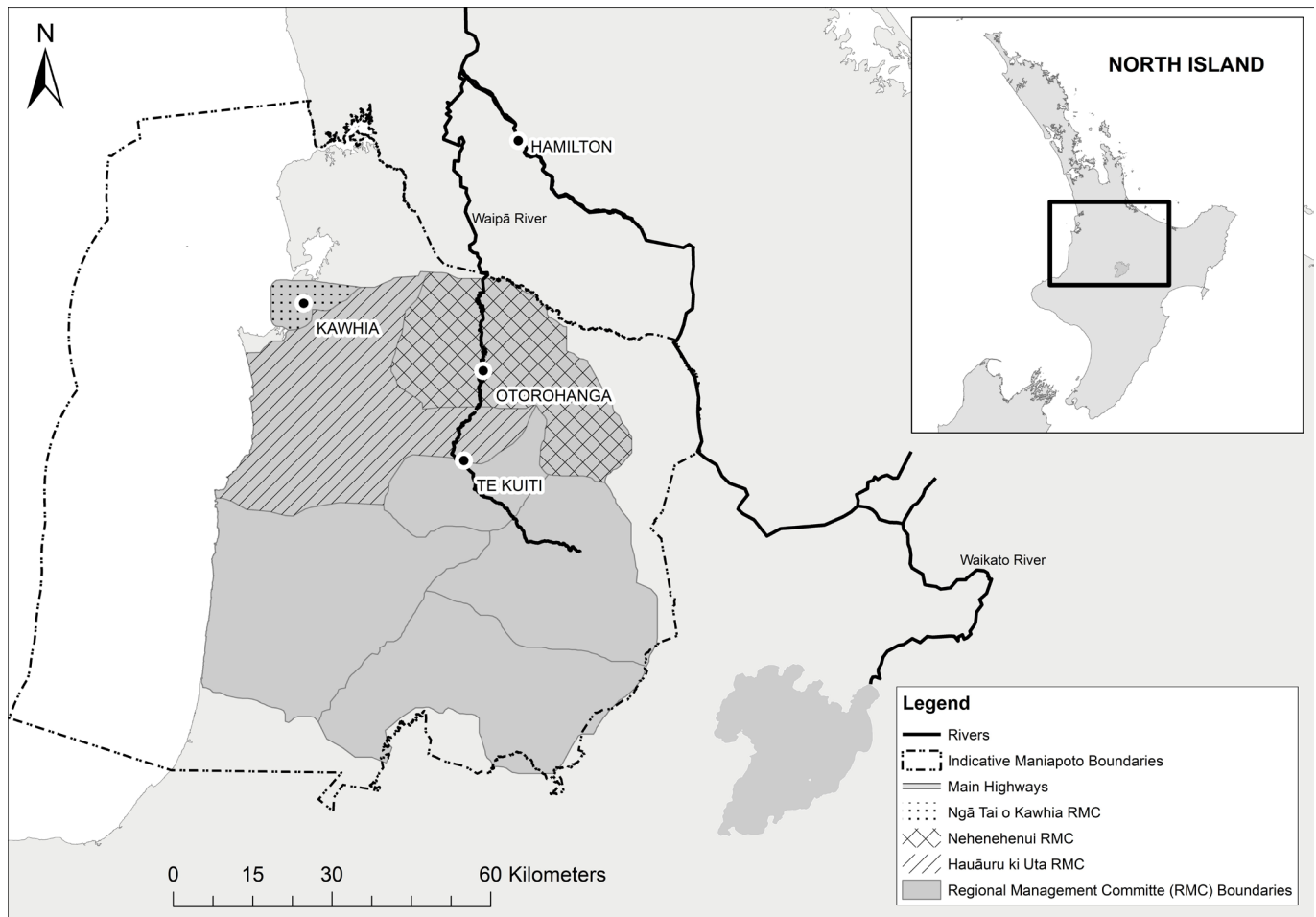


Figure 1. Map of Maniapoto rohe (territory) and the boundaries of the Regional Management Committee's (RMCs) that we worked with during the Ngā Repo o Maniapoto project which were both within and outside of the Waipā River catchment.

aerial/satellite imagery, and Global Positioning Systems to assist in documenting spatial knowledge with participants. Although PM is recognised as a useful means of contributing spatial data to inform understanding of human-environment interactions (Levine & Feinholz 2015), and support decision-making (NOAA 2014, 2015), more modern PM technologies, such as Luidia eBeam™ (an interactive whiteboard technology, hereafter referred to as eBeam) have little known application in New Zealand. The United States National Oceanic and Atmospheric Administration (NOAA) has developed an eBeam method of PM specifically for mapping ocean based values and uses, and note that the process is intended to be flexible and adaptable for any region to address multi-scaled management decisions (NOAA 2014). For the purposes of this project PM refers to the way in which Maniapoto whānau are creating and communicating their knowledge, experience, and aspirations using maps (Brown & Kytä 2018). This paper outlines the methodology and resulting framework developed to support Maniapoto to make decisions about the restoration of their wetlands.

Methods

Engagement phase

Ngā Repo o Maniapoto was a collaborative and iterative project (Fig. 2). The MMTB led the engagement phase using established and mandated forums for communication (as per

the structure and functioning of MMTB) to socialise the project and generate interest from RMCs to participate. Through this process, RMC members were appointed as champions to support logistics, and to engage in the PM phase. Their involvement was integral to the project's success, participating in the PM interviews themselves, helping to maintain momentum with other participants, providing direction to the project team as to the expert knowledge holders to engage and providing critical feedback on the process and method.

The project team was mindful of providing for ethical procedures for working with the mātauranga shared by participants, and agreed with some principals that we would follow from the outset of the project which would also be responsive to local hapū protocols. This included discussing the process of capturing the mātauranga, appropriately handling and sharing of mātauranga, and providing ample check-back opportunities for participants to ensure accuracy. This meant that all participants gave informed consent to participate, that all primary outputs (e.g. voice and/or video recordings) were held securely by MMTB, and that any secondary outputs (e.g. maps produced, Geographical Information System (GIS) files, reports) were held by the project team. We also agreed that sharing of information external to the project participants (e.g., mātauranga regarding the locations of puna with councils) would only occur with appropriate permissions (i.e. decided by participants and MMTB). These guidelines for engagement were reiterated at each meeting and prior to mapping with each interviewee.

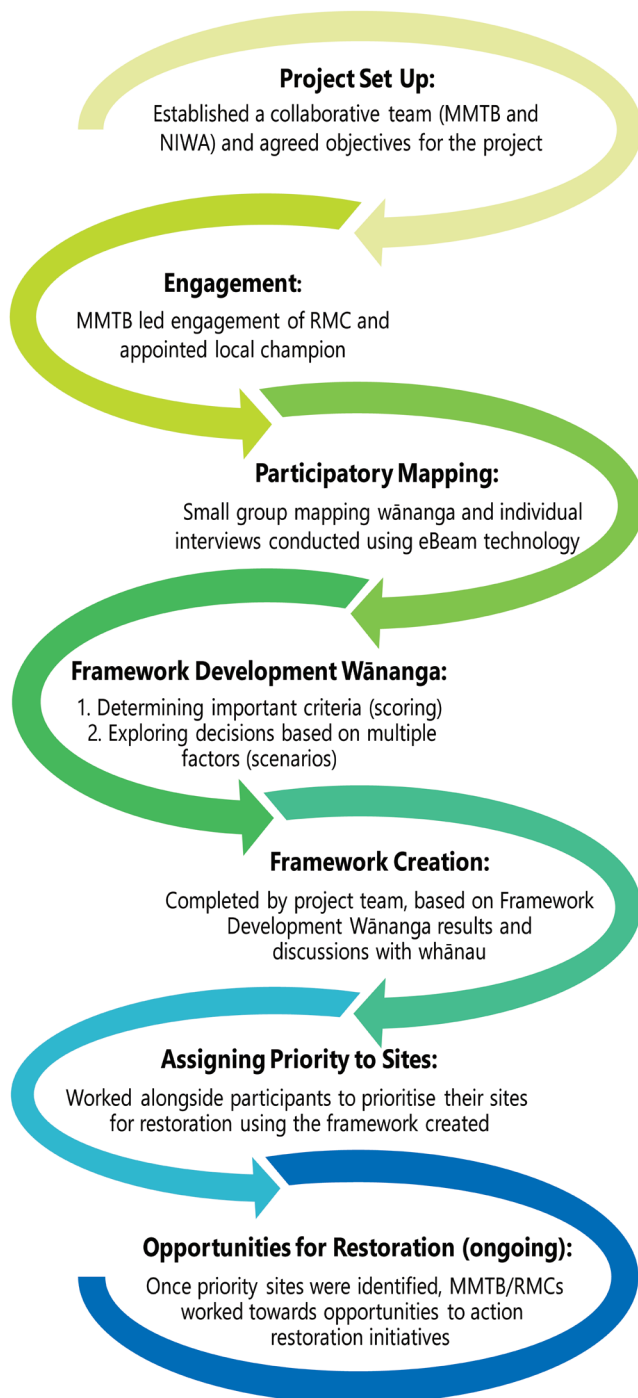


Figure 2. Key steps completed during the Ngā Repo o Maniapoto project.

Data capture

Small group and one-on-one semi-structured interviews (Longhurst 2003; Valentine 2005) using digital and/or paper-based maps (e.g. Rambaldi et al. 2006; NOAA 2014; Levine & Feinholz 2015) were undertaken to gather information regarding the location, size and significance of each site (e.g. fisheries, function, cultural use, names, historic stories) in ArcGIS™ 10.3 mapping software. The mapping interviews were undertaken with knowledge holders, including elders, as identified by the RMCs involved. Twenty-six key knowledge holders were interviewed, most of whom also attended the

framework development wānanga (workshops).

Some of the site data captured were not related to wetlands specifically but represented sites of importance within the broader Maniapoto cultural landscape. Although the interviews were semi-facilitated, the project team did not restrict the mātauranga that was collected during the PM sessions and often interviewees expressed the desire for the broader knowledge being shared to be captured. This approach sought to elicit the mātauranga-ā-hapū grounded in their landscapes by creating a space for a hapū to express their narratives and capture them spatially (Valentine 2005; Doherty 2012; Fredericks et al. 2011).

The eBeam™ interactive whiteboard technology was utilised for the digital PM interviews, which allowed interviewees (active participants) to capture their spatial knowledge ‘on-the-fly’ (Levine & Feinholz 2015). A projected image of the base map (either Topo50 or aerial imagery) in ArcGIS™ 10.3 was used to visualise the mapping area, while a stylus (a pen-like mouse) was used to draw onto the projected surface the location and size of sites by an active participant (Fig. 3; Levine & Feinholz 2015). During the mapping sessions, the project team assumed one of two key roles: (1) the ‘process facilitator’ responsible for controlling the workflow, drawing on behalf of active participants (when required) and guiding interviewees through the semi-structured interview process, (2) the ‘GIS/technical facilitator’ responsible for running the mapping software, guiding participants through the base map (e.g. preparing shapefiles for editing, and using the zoom function), and capturing the information shared by interviewees.

The active participant would either direct the process facilitator, or digitise geodatabase features (map sites) themselves directly into the ArcGIS (Fig. 3; Levine & Feinholz 2015). In an effort to balance the comfort level of our interviewees with the technical elements of the eBeam™ mapping method (NOAA 2015), we ensured time for a hands on demonstration at the start of each session (Levine & Feinholz 2015), and had A0 size printed topographic maps available.

In group sessions, there were active participants (those who are mapping directly with the stylus or through the process facilitator) and ‘passive participants’ who might contribute suggestions, but were not directly mapping or directing the process facilitator. In individual sessions, there were no passive participants.

All sites mapped with interviewees went through post processing checks, corrections of spelling and refining of boundaries by the GIS facilitator. Each site and the associated information was also checked by each interviewee for accuracy in subsequent wānanga which helped build and maintain trust among the project participants (NOAA 2014; Brown & Kytta 2018), and allowed for iterative corrections to occur.

Framework Development

The development of the strategic decision-support framework utilised wānanga (workshops to discuss and deliberate) and social science methodologies, scoring, and scenarios. Scoring, or the pebble distribution method (Colfer 1999; Lynam et al. 2007), required the project team to identify species, practices and associations elicited during the interviews to create categories. The categories for scoring were not considered exhaustive or static, in that participants in the wānanga were able to combine, amend or add any further categories prior to, and during the scoring exercise. The final number of categories for scoring ranged from 32–37 for each RMC. This technique was chosen as it offers a simple but effective methodology to

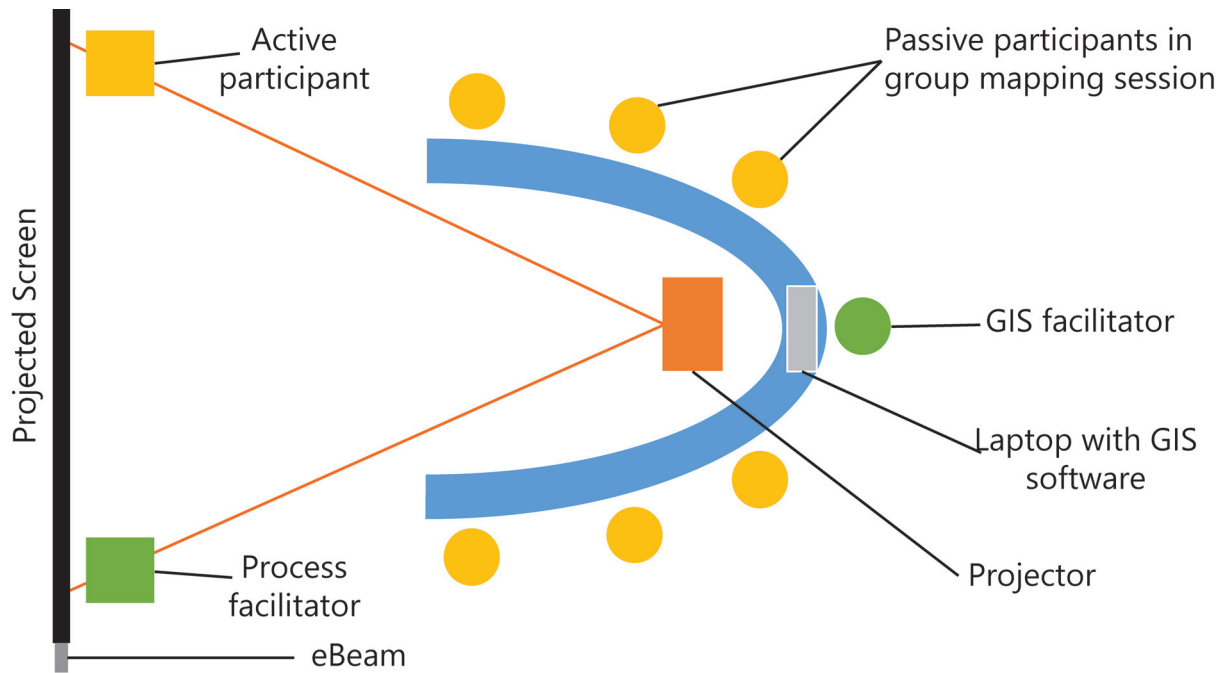


Figure 3. Example of set up for group mapping session; arrangement adapted from NOAA (2014) and Levine and Feinholz (2015).

reveal insights and preferences, while clarifying understandings and values of participants (Sheil & Liswanti 2006; Lynam et al. 2007).

Each participant was given an equal number of ‘dots’ (stickers to attribute to the categories), exceeding the total number of categories available by 10, and asked to actively assign their dots to different categories based on what they valued most (Fig. 4). Excess dots enabled participants to place at least one in each category, and ensured that they placed multiple dots in at least one category. No restrictions were placed on where/how participants assigned their dots to categories. After the dots were assigned, each of the participants were asked to talk about where and why they had assigned their dots to categories (Lynam et al. 2007). This allowed insight into and encouraged discussion about what the key collective values were.

Scenarios are often used as a method to help guide future thinking, are a powerful tool to enable exploration of ‘what if’ questions in uncertain circumstances, and can help to inform analysis and deliberation of possible futures (Schoemaker 1995; Schwartz 1996; Duinker & Greig 2007; Stewart et al. 2013). Scenarios support decision-making and encourage robust discussion of ‘value issues’, where decision-makers need to think through their preferences and values, and can encourage creative thought to frame strategic conversations

(Schwartz 1996; Peterson et al. 2003; Stewart et al. 2013).

Four hypothetical scenarios were used, each corresponding to a fictitious site that could hypothetically exist within the Maniapoto cultural landscape. Four was considered an appropriate number of scenarios to expand participants thinking without too much complexity (Schwartz 1996; Peterson et al. 2003). Each scenario aimed to toggle different levels of four key elements: cultural uses of a site (e.g., harvested resources), access (physical and legal), willingness of land owners to participate/co-operate in restoration efforts, and intangible associations (e.g. sacred sites). In addition to this, one scenario explored if ‘rarity’ might be an influencing factor in deciding priorities (i.e. a ‘Rare Gem’). The scenario narratives used in this exercise are described below.

- (1) Watering Hole – No known past or present cultural uses associated, used to water stock (e.g., cattle), medium accessibility and a willing private land owner,
- (2) Rare Gem – Location of a rare species considered a delicacy, associated stories of taonga storage and preservation, unknown but likely restricted willingness of land owner and difficult accessibility,
- (3) Sacred Hub - Many known uses for gathering cultural resources and associations to sacred places, physically very inaccessible but high willingness from the land owner to provide access,

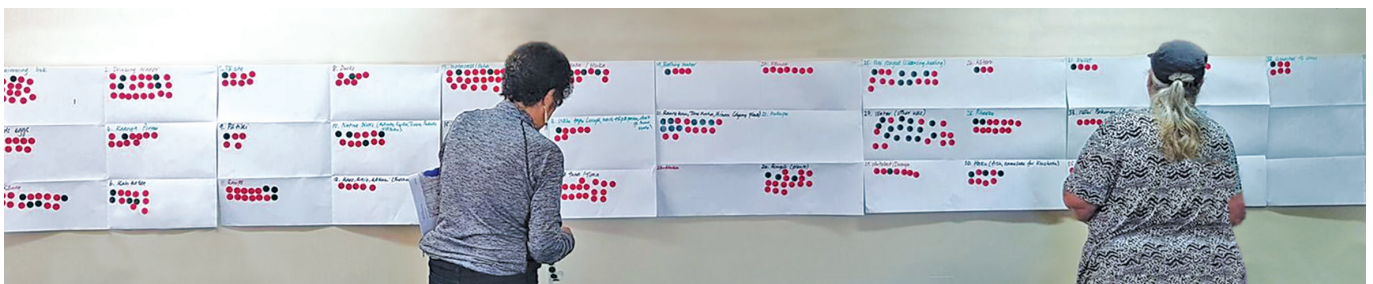


Figure 4. ‘Dots’ allocated during the scoring exercise at the framework development wānanga.

- (4) Chiefly Spring - Important for the use of drinking water, important tribal association with the chiefly lineage and historic battle grounds, very accessible but a land owner unwilling to provide access.

Participants were presented with the four scenarios and asked to order them from first to fourth priority for restoration, imagining five years into the future where funding was available. They were then asked to share their reasoning for the priority order they assigned.

During the framework development wānanga, structured activities explored the criteria (and their relative importance) that might make up a framework and delved into how and why priority order may be decided based on ‘packages’ of information. This unpacked the components considered most important to the participants when prioritising wetlands for restoration. A conceptual framework was developed, drawing on aspects of multiple criteria decision analysis, which “seek[s] to take explicit account of multiple criteria in helping individuals or groups explore decisions that matter” (Belton & Stewart 2002), and grounded theory (Glaser & Strauss 1967) to identify consistent themes from interviews and wānanga.

Ensuring that participants were comfortable with the process, able to alter the framework, could make sense of it themselves and felt their contributions were accurately represented was important. The structure of the framework was presented to participants and they were encouraged to critique, alter or amend its structure or suggest a new structure that better suited them.

Prioritisation Process

Once the framework was confirmed, each of the sites mapped during the eBeam™ sessions were input into the framework, and in groups of 3–5 participants undertook a guided prioritisation process. We used natural groupings of whānau and marae (traditional places for formal gatherings) for prioritising. This approach enabled whānau to direct prioritising while the facilitator explained how to populate the framework, and captured priorities and reasoning provided. Throughout the process, while there was often group discussions about each site, the final assignment of priorities was usually done by consensus, guided heavily by the whānau member/s that the group felt had the strongest mandate to decide.

The framework enabled the prioritisation of wetland sites into four tiers indicative of the priority order of restoration. The four tiers are outlined according to the timing of restoration:

- (1) Priority 1 – as soon as is possible.
- (2) Priority 2 – once one or two actions have been completed (e.g. clarifying access).
- (3) Priority 3 – after multiple or longer-term actions have been completed (e.g. building relationships, gaining access, assessing condition etc.).
- (4) Priority 4 – sites not currently requiring restoration due to existing protections/condition (e.g. in good condition) or unable to be restored (e.g. buried under existing buildings) where maintaining the knowledge of these sites was important.

Results

Data Capture

The Maniapoto inventory of wetlands has to date captured a total of 266 sites, 86 of which are puna and 104 of which

are repo (Table 1). In addition, 76 other sites of significance were mapped, either associated with the locations of the puna and repo, and/or important to the overall cultural landscape of Maniapoto. This represents a substantial contribution to the spatial data surrounding wetlands that is now available to both the RMCs and MMTB. All sites mapped were provided in digital and printed formats to MMTB for distribution to the RMCs.

Framework Development

The highest scoring categories across all RMC groups were water-related uses (e.g. drinking water, medicinal or ceremonial waters, swimming), followed by tuna. Despite the categories pertaining mostly to tangible use values, during the discussion, whānau often mentioned the concept of mauri (vital life force) and manaakitanga (balanced use and giving back) and how a holistic approach to restoration is required.

The discussion following scoring reiterated that all categories were important to participants, but some categories consistently scored higher (e.g. tuna) or lower (e.g. kōtero; fermented potatoes). Across all the uses and associations that were scored, three overarching themes emerged as the key influencing factors for framing the value and therefore priority of puna and repo to participants: (1) ‘Wai’ - water associated uses, (2) ‘Kai’ - food and harvesting associated uses, (3) ‘Mahi’ - other harvesting and practices, for example plants used for weaving or medicinal purposes.

According to the score received, the categories within each theme were then split between two sub-groups, either ‘Mea Matua’ (most important/dominant) or ‘Mea Atu’ (other) species/uses/practices. The differentiation between sub-groups was arbitrary, where any category with a score of ten or over was considered within the Mea Matua sub-group, and all others in the Mea Atu sub-group. A fourth ‘Tāngata’ (people focussed) theme included categories considered to enhance the value of a site for restoration decision-making. This included human associations, stories (kōrero) and significant places (wāhi). This theme also included accessibility of sites. While access (via property rights, relationships with land owners and to a lesser extent physical) was not scored as a category in the scoring exercise, it was repeatedly raised as an important consideration during discussions.

The scenario exercise demonstrated that, on average, across all three RMCs, the Sacred Hub was a higher priority, followed closely by the Chiefly Spring, the Watering Hole and lastly the Rare Gem (Fig. 5). While there was no absolute agreement across all participants, the Sacred Hub was more consistently ranked as a high priority and the Rare Gem lower priority. Many participants referenced their dependence on the harvest from sites like the Sacred Hub and the importance of water during discussions. Contrary to the scoring, the Chiefly

Table 1. Total count of sites mapped across the Maniapoto rohe by type (i.e. Puna, Repo, Other) and RMC.

RMC	Puna	Repo	Other	Total
Ngā Tai o Kāwhia	27	28	31	86
Hauāuru ki Uta	19	34	21	74
Te Nehenehenui	40	42	24	106
Total	86	104	76	266

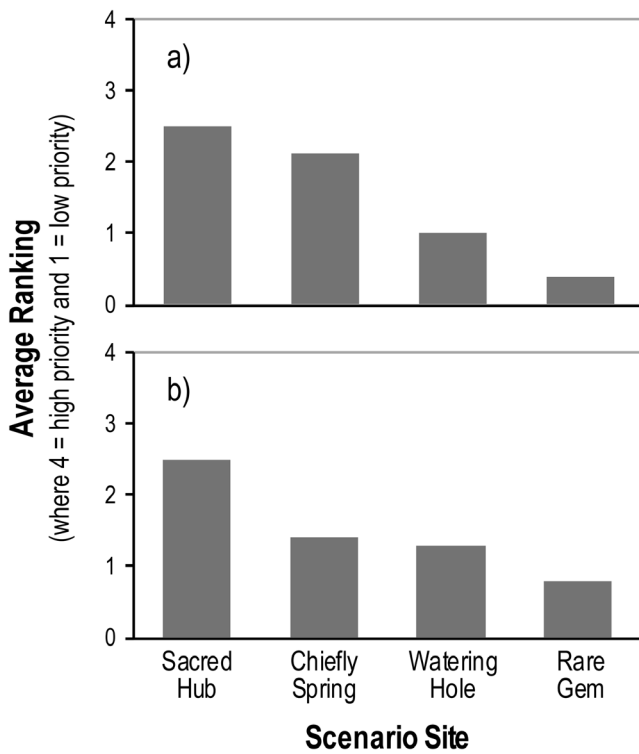


Figure 5. Average ranking of each hypothetical scenario site, prioritised by Ngā Tai o Kāwhia participants (a, n = 8), and Hauāuru ki Ūta and Nehenehenui participants (b, n = 11). Sites ranked with a 4 = highest priority and 1 = lowest priority.

Spring (water focussed) scenario with limited access (i.e. to everyone, including Maniapoto whānau), meant it was less of an immediate priority.

The Framework

A conceptual diagram of the strategic decision-support framework was developed from the wānanga, showing two layers identified in the discussions with participants (Fig. 6). The first layer (key influences) most often determined whether a site would be prioritised for restoration (including the distinction between the most important and other species/uses/practices). The second layer (enhancing factors) which did not determine priority alone, were considered to enhance the priority of a site, all other elements considered equal.

This conceptualisation of the strategic decision-support framework was tested for applicability with participants and subsequently converted into a deliberative matrix (Fig. 7). In this context, we define ‘deliberative matrix’ as a tool to structure the knowledge shared, in a format grounded in the themes and criteria identified by participants. The matrix encouraged deliberation of qualitative information, to support grouping sites into the tiers of priority by participants.

Output Priorities

Prioritising occurred during three separate wānanga involving 20 of the 26 interviewees. A total of 135 of the 190 mapped repo and puna sites were prioritised, and 26 top priority sites were identified across the three RMCs (Table 2).

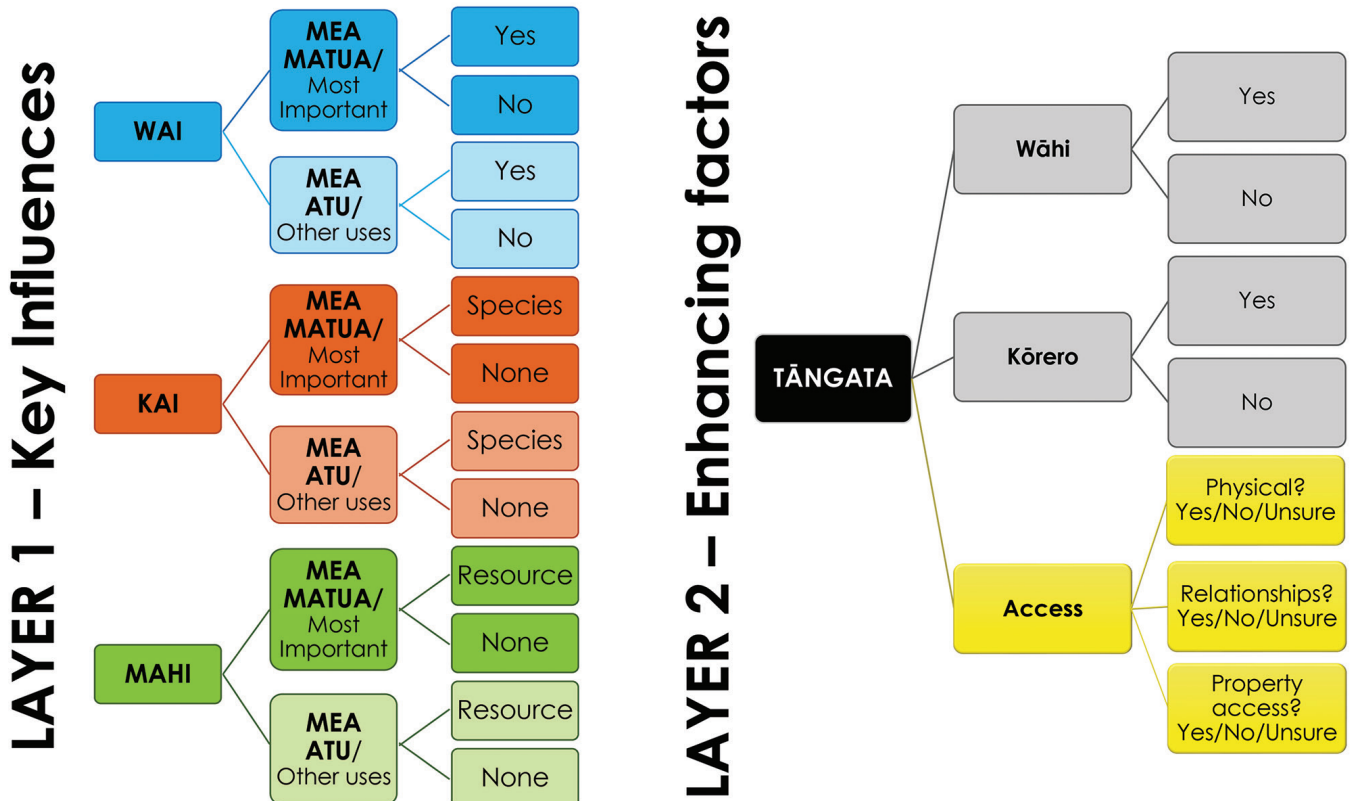


Figure 6. Conceptualisation of the strategic decision-support framework developed by Maniapoto whānau to prioritise wetland restoration efforts (adapted from Ratana et al. 2017).

SITE ID	SITE NAME	DESCRIPTION	WHO?	PUNA/REPO/ OTHER?	WAI	KAI		MAHI/OTHER		ASSOCIATION		ACCESS			CONDITION?	PRIORITY?	WHY?
						MOST IMPORTANT?	OTHER USE?	MOST IMPORTANT?	OTHER USE?	WĀHI TUPUNA?	KŌRERO?	PROPERTY RIGHTS?	RELATIONSHIPS?	PHYSICAL?			
1	Te Puna	Puna used for drinking water, also site where patu was found.	JB	Puna	Āe					Kao	Āe	Kao	Aua	Āe	Poor	3	Drinking water site, relationship with owner unknown, also poor condition, not sure if still present.
2	Te Repo	Repo for harvesting watercress, harakeke and tuna. Mānuka branches used for making hinaki.	JB	Repo	Kao	Tuna, Watercress	Harakeke	Mānuka		Kao	Kao	Āe	Āe	Āe	Ok	1	Important kai and mahi site, accessible through property right, condition ok, able to improve with restoration efforts.

Figure 7. Example of the deliberative matrix developed to input knowledge for prioritising sites for wetland restoration with Hauāuru ki Uta and Nehenehenui RMCs. Hypothetical examples presented.

Table 2. Number of puna and repo sites prioritised by each RMC into the priority tiers.

RMC	Priority 1	Priority 2	Priority 3	Priority 4	Total Prioritised
Ngā Tai o Kāwhia	8	6	31	6	51
Hauāuru Ki Uta	11	13	9	5	38
Nehenehenui	7	10	14	15	46

Discussion

The inventory of wetlands mapped with Maniapoto RMCs across the broader Maniapoto rohe identified significant places, practices, associations, and important species located both within and surrounding wetland sites. This reiterates the broad array of cultural values associated with these ecosystems (MMTB 2016; Taura et al. 2017). Additionally, this process highlighted the participants’ pragmatic approach to prioritising restoration, where they recognised that access and relationships are an important part of any successful restoration project. The scoring exercise highlighted that some categories were more important (e.g. presence of water) than others (e.g. kōtero) when considering wetland sites for restoration. This perhaps reflects the changing society hapū find themselves in, where traditional foods are less available (e.g. through loss of land; Shirley 2013), and/or traditional food and practices are deemed less efficient, contributing to a reduction in some practices (such as fermenting foods) (Pers. comm., hapū participants 2018). However, it also highlights the value hapū place on water, and their understanding of it’s importance to wetland ecosystems, reiterated by comments such as “water is life, without water there are no wetlands, no water to drink or food” (Pers. comm., hapū participant 2018). This pragmatic approach was also summoned when discussing the scenarios, whereby the prioritisation of the scenarios was usually a combination of recognising the cultural importance of a site alongside considerations regarding the feasibility and/

or barriers to restoration (e.g. accessibility).

Maniapoto whānau recognise the on-going importance of wetlands as a significant part of the historical and contemporary Maniapoto cultural landscape and as integral components of healthy land-water ecosystems (MMTB 2016). The wetland inventory created with interviewees, based primarily on mātauranga ā-hapū, provides a wealth of spatially explicit knowledge regarding both puna and repo. This represents a significant contribution to the spatial density of known wetlands across part of the Waikato region, where data is sparse. For example, there are 26 springs documented at a national scale (NZ Spring Points (Topo, 1:50k) see <https://data.linz.govt.nz/layer/50356-nz-spring-points-topo-150k>) across the Waikato Region; while in comparison 86 springs were recorded during this study with only three (of seven) Maniapoto RMCs. This approach to mapping wetlands could be an extremely valuable method for refining our current understanding of the extent and location of wetlands nationally. In addition to spatial data, the inventory process highlighted several resources, practices and associations that are dependent on these wetlands and essential to prioritising protection and restoration of these sites. The inventory has supported MMTB in achieving one of the key objectives of PM techniques world-wide, including the communication of the richness and importance of indigenous landscapes to external audiences (Brown & Kyttä 2018). This is evidenced by the multiple communication methods developed with participants (Fig. 8), and the large maps of their sites provided to support their discussion with agencies.

Our use of the eBeam™ in PM methodologies as a novel approach to data collection in New Zealand was successful in capturing spatially explicit data. The success of this technique encouraged Maniapoto whānau to explore their mātauranga, built on their spatial awareness, and helped to realise the wealth of knowledge each of the interviewees held. The interactivity of eBeam™, ability to zoom, enable or disable different layers of data (e.g. regional council wetland probability layers; Levine & Feinholz 2015), and the more accurate capture of site polygons on the landscape proved invaluable. The accuracy of the shapes captured is demonstrated in Fig. 9 where the same interviewee (on two separate occasions) mapped both using eBeam PM and paper-based PM.

The process of working directly in the mapping software (ArcGIS™ 10.3) enabled participants to orient themselves at a broad scale, and then use the zoom function to focus on where, for example, marker trees could be distinguished and individual puna could be mapped accurately. Our approach highlighted that spatial accuracy can be achieved, and how this approach may be part of the solution to accuracy issues identified by Brown and Kytä (2018). Other key advantages included the efficient capture of data directly into a GIS database, reduction in time for transcription and digitisation from paper maps, and the interoperability of GIS-based data into databases already held by Maniapoto (e.g. Maniapoto Taonga Register).

A limitation of the eBeam™ is that only one person can actively map at a time (i.e. there is only one stylus pen and active participant). In the group or paired interviewing situations, interviewees were usually collectively contributing to the discussion, while the process facilitator conducted the mapping. Our experience suggests that individual or paired interview sessions were efficient (i.e. fewer passive participants), and that small group sessions were also possible, dependant on interpersonal dynamics of the group. We found

that close family relationships between group members allowed robust, but not discouraging discussion, which was helpful to clarify size, location and collective understanding of the importance of sites. While initially many of the interviewees were apprehensive about using the eBeam™ technology and having to orientate themselves from a bird's eye-view perspective on digital maps, they became more comfortable and confident throughout the interview, often remarking on their enjoyment of the process. A recent review suggested that the usability of PM applications can be a barrier (Brown & Kytä 2018); however, we were able to demonstrate a process to overcome this when utilising eBeam™ PM.

The co-development of the strategic decision-support framework facilitated the incorporation of criteria considered important to Maniapoto when prioritising restoration efforts for their sites. This meant that the adaptation of the framework and resulting deliberative matrix resonated with the participants. Multi-criteria decision analyses (e.g. Ausseil et al. 2007) and spatially explicit ecological modelling approaches (e.g. Moilanen et al. 2011) often utilise multiple factors to determine priorities, similar to our framework. These approaches most often use complex aggregation algorithms to rank priority sites (Kiker et al. 2005; Proctor & Drechsler 2006) and are removed from communities. This framework differs in that it requires the user/s to compare criteria within and across sites and deliberate on the level of priority for themselves. Although a subjective approach, it is appropriate given that only Maniapoto can determine Maniapoto's restoration priorities. The successful use of our framework highlights that Maniapoto have their own priorities, despite rarely having the opportunity or a process to define them.

Prioritisation is often based on current condition of sites, and easily quantifiable ecological and/or economic data (Kiker et al. 2005; Ausseil et al. 2007; Moilanen et al. 2011). In contrast, the framework developed in this project utilises mātauranga which

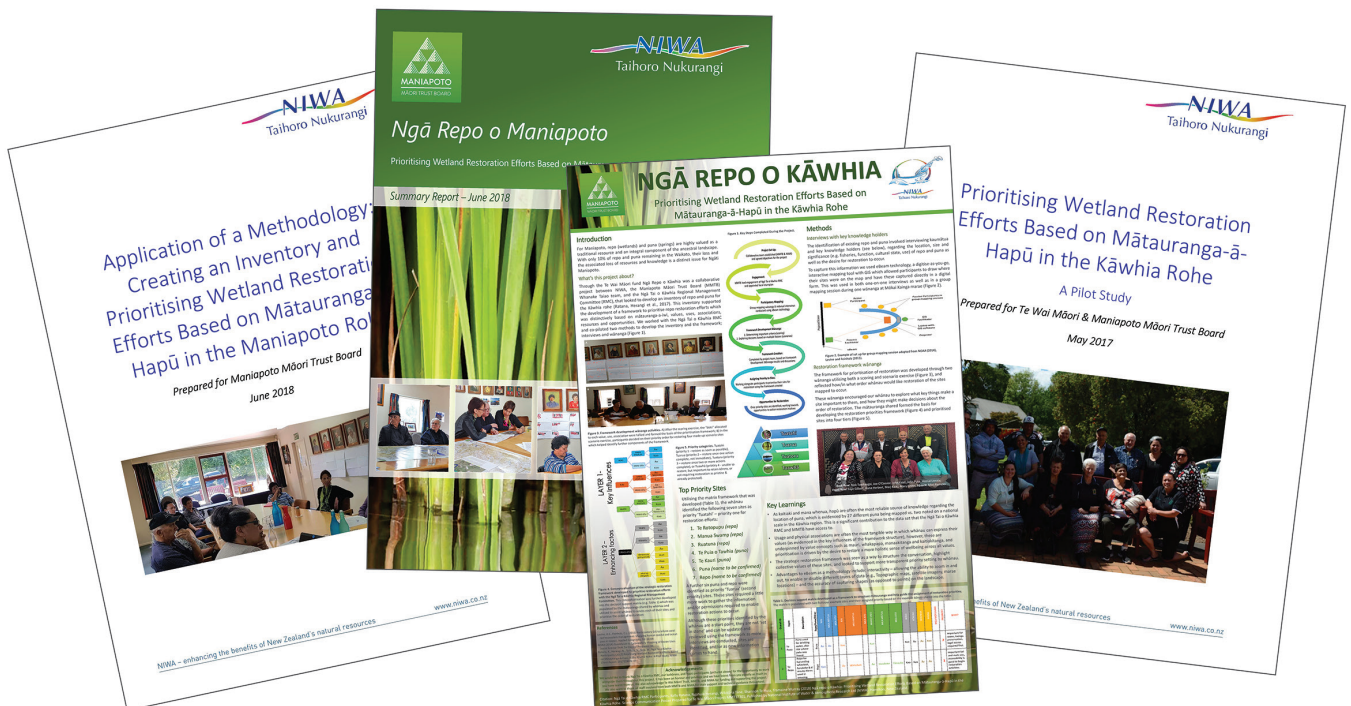


Figure 8. Examples of communication mechanisms (posters, booklets and technical reports). These were created to support MMTB and the RMCs to share their mātauranga surrounding puna, repo and their broader cultural landscape with external agencies.

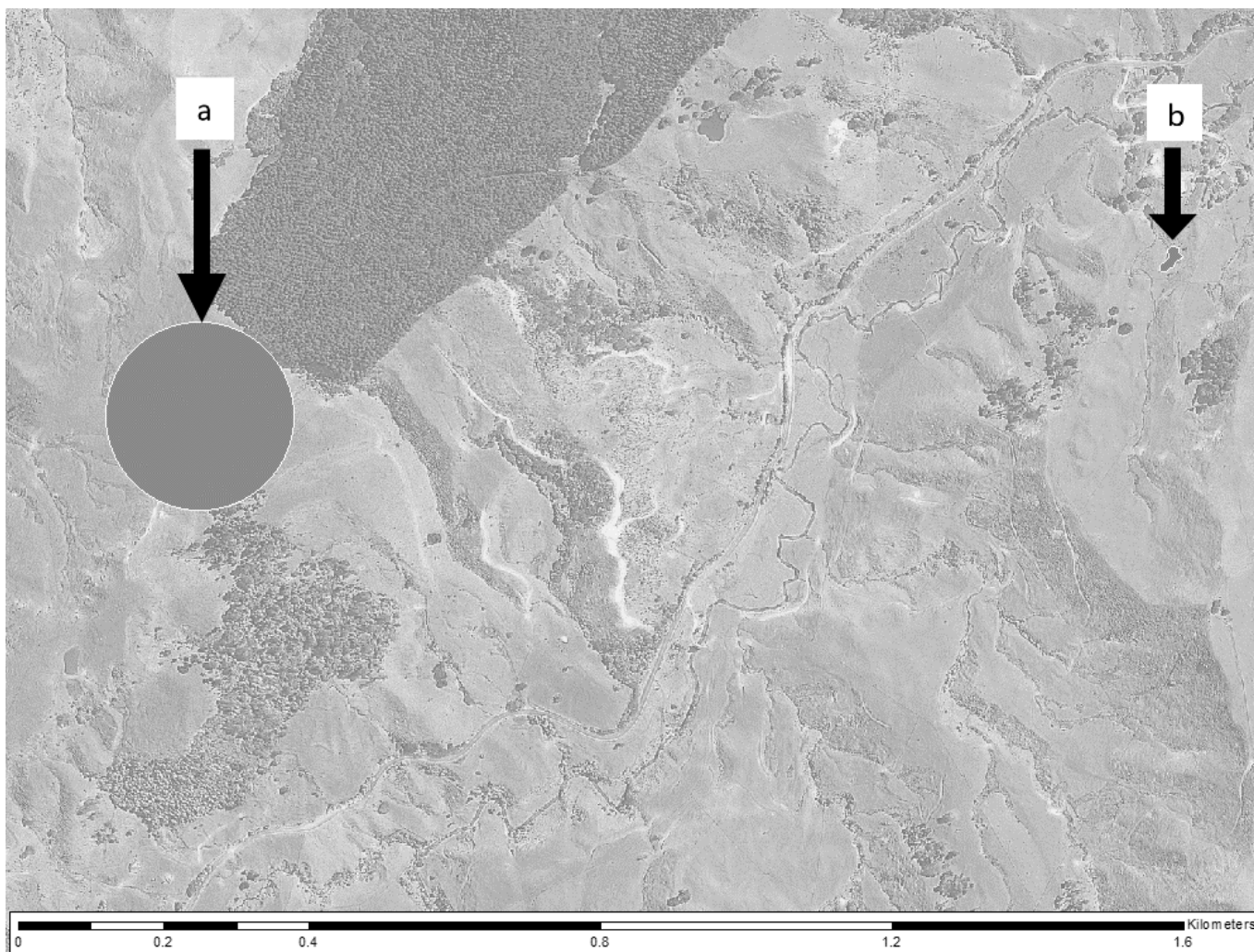


Figure 9. Example of the difference between mapping the same type of site with paper-based maps (a) printed to scale (1:20 000) and with the eBeam™ (b). Both sites were mapped by the same participant demonstrating differences in detail of shape and size achieved using eBeam. Note: Site a was mapped using a topographic map and Site b was mapped using a satellite image.

is often reflective of historical condition, and typically brings the aspirational state of sites into the prioritisation process. While mātauranga, can be both qualitative and quantitative, it often encompasses a much broader and interconnected set of knowledge grounded in landscapes (Doherty 2012). The context provided by mātauranga, enables understanding of the past condition, contemporary concerns and future aspirations of hapū (Tipa 2013).

Much of the focus of the framework was on utility of the sites (e.g. wai, kai and mahi), which may be misleading, suggesting these are the only ways in which Maniapoto hapū value and associate with their repo and puna. While utility and physical structures (e.g. eel weirs) are a tangible expression of how participants value their wetlands, these are underpinned by concepts of mauri (vital life force), whakapapa (genealogical connections), manaakitanga (ethic of care and reciprocity) and kaitiakitanga (ethic of guardianship) (MMTB 2016). While the prioritisation framework has a basis in the described uses and associations to these sites, it is inherently driven by the desire to restore a more holistic sense of wellbeing for Maniapoto. This reiterates the view that to Maniapoto the Waipā River, is a single indivisible entity that flows from the spring Pekepeke to its confluence with the Waikato River and includes its puna

and repo, as well as its metaphysical elements with its own mauri, as acknowledged in the Ngā Wai o Maniapoto (Waipā River) Act 2012.

The inventory and strategic decision-support framework sit alongside, and respond directly to, various other Maniapoto planning documents like the Maniapoto Environmental Management Plan (MMTB 2016), Maniapoto Upper Waipā Fisheries Plan (MMTB 2015) and Maniapoto Priorities for the Restoration of the Waipā River Catchment report (Tipa et al. 2014). Together these work towards and respond to the deep-felt obligation and desire to restore, maintain and protect all waters that flow and/or fall within the Maniapoto rohe, whether the waters are above, on or underground (Ngā Wai o Maniapoto (Waipā River) Act 2012).

The successful establishment and implementation of this research project relied on multiple, purposeful and intentional approaches to the work. This included (1) the co-development of the proposed project, (2) recognising previously identified iwi priorities, (3) co-delivery of all research activities by the research team (NIWA and MMTB) alongside the hapū participants, and (4) the co-design of multiple communication mechanisms that were tailored to the needs and desires of hapū. The research team also recognised that any project working

with mātauranga ā-hapū must be cognisant and actively work to support hapū participants and Maniapoto to maintain control over how that information was recorded, utilised, analysed, documented and communicated. This intentional approach to this project built and maintained trust with participants, and nurtured reciprocal, respectful and mutually beneficial relationships.

This project has made a positive contribution towards documenting and organising Maniapoto knowledge on resources, cultural uses and associations with repo and puna. It has prepared the RMCs and MMTB to be more strategically poised to undergo restoration activities when funding opportunities arise. Outcomes from this work to date have included on-going discussions with local councils to protect priority sites through planning processes (e.g. Significant Natural Areas), a restoration project being funded for one of the top priority sites identified, and the development of MMTB staff technical skills in mapping and prioritising methodologies.

This project has established and tested a new and effective approach for capturing and visualising mātauranga ā-hapū. It has also demonstrated a fit for purpose, co-developed and mātauranga-driven framework that can support iwi, hapū and whānau to identify and action their priorities for wetland restoration. These processes and approaches will have relevance for other indigenous peoples who are entitled to utilise their knowledge to formulate and develop their own decision-making frameworks that direct both the actions and priority order for wetland restoration.

Acknowledgements

Nei te mihi maioha atu ki ngā tini mate kua hao kē i te kupenga o Taramainuku, hoki atu rā ki ngā tūpuna, e okioki. E matua Homai, i ngaro koe i te tirohanga kanohi, engari, kei kōnei tonu o kōrero e mau ana i ngā ngākau o mātou e takahī tonu nei i te mata o te whenua. E kore e mutu ana ngā mihi aroha ki a koutou, ngā kaikōrero, ngā puna mātauranga e pupuri tonu ana i ngā kōrero o neherā, o naianei hoki. Tēnā koutou katoa. We want to acknowledge and thank all RMC and participants in our work, including those who we have lost since we started the project. Thanks also to staff from both MMTB and NIWA for their contributions, comments and suggestions. Thank you to the reviewers for their constructive feedback and guidance. This work was funded by Te Wai Māori Trust Wai Ora Fund, the Ministry of Business, Innovation and Employment Vision Mātauranga Capability Fund (CO1X1531) and the Ngā Kete o Te Wānanga research program (CO1X1318).

References

- Ausseil AGE, Dymond JR, Shepherd JD 2007. Rapid mapping and prioritisation of wetland sites in the Manawatu-Wanganui Region, New Zealand. *Environmental Management* 39: 316–325.
- Ausseil AGE, Gerbeaux P, Chadderton WL, Stephens T, Brown D, Leathwick J 2008. Wetland ecosystems of national importance for biodiversity: Criteria, methods and candidate list of nationally important inland wetlands. Landcare Research Contract Report LC0708/158. 174 p.
- Belton V, Stewart TJ 2002. Multiple criteria decision analysis: an integrated approach. Boston, Kluwer Academic Publishers. 372 p.
- Brown G, Kyttä M 2018. Key issues and priorities in participatory mapping: Toward integration or increased specialization? *Applied Geography* 95: 1–8.
- Colfer CJP 1999. The grab bag: supplementary methods for assessing human well-being. Bogor, Center for International Forestry Research. 64 p.
- Dixon MJR, Loh J, Davidson NC, Beltrame C, Freeman R, Walpole M 2016. Tracking global change in ecosystem area: The wetland extent trends index. *Biological Conservation* 193: 27–35.
- Doherty W 2012. Ranga Framework - He Raranga Kaupapa. In: Black T, Bean D, Collings W, Nuku W eds. *Conversations on mātauranga Māori*. Wellington, New Zealand Qualifications Authority. Pp. 15–36.
- Duinker PN, Greig LA 2007. Scenario analysis in environmental impact assessment: Improving explorations of the future. *Environmental impact assessment review* 27: 206–219.
- Fredericks BL, Adams K, Finlay SM, Fletcher G, Andy S, Briggs L, Briggs L, Hall R 2011. Engaging the practice of yarning in Action Research. *Action Learning and Action Research Journal* 17: 7–19.
- Glaser B, Strauss A 1967. *The discovery of grounded theory: Strategies for qualitative research*. Chicago, Aldine Publishing Company. 271 p.
- Johnson P, Gerbeaux P 2004. *Wetland types in New Zealand*. Wellington, Department of Conservation - Te Papa Atawhai. 185 p.
- Kiker GA, Bridges TS, Varghese A, Seager TP, Linkov I 2005. Application of multicriteria decision analysis in environmental decision making. *Integrated environmental assessment and management* 1: 95–108.
- Levine AS, Feinholz CL 2015. Participatory GIS to inform coral reef ecosystem management: Mapping human coastal and ocean uses in Hawaii. *Applied Geography* 59: 60–69.
- Longhurst R 2003. Semi-structured interviews and focus groups. In: Clifford N, Cope M, Gillespie T, French S eds. *Key methods in geography*. 3rd edn. London, SAGE Publishing. Pp. 117–132.
- Lynam T, de Jong W, Sheil D, Kusumanto T, Evans K 2007. A review of tools for incorporating community knowledge, preferences, and values into decision making in natural resources management. *Ecology and Society* 12(1): 5.
- MMTB 2015. *He Mahere Ika - Maniapoto Upper Waipā Fisheries Plan*. Te Kuiti, Maniapoto Māori Trust Board. 25 p.
- MMTB 2016. *Ko tā Maniapoto Mahere Taiao - Maniapoto Environmental Management Plan*. Te Kuiti, Maniapoto Māori Trust Board. 120 p.
- Moilanen A, Leathwick JR, Quinn JM 2011. Spatial prioritization of conservation management. *Conservation letters* 4(5): 383–393.
- NOAA 2014. *Guidebook to participatory mapping of ocean uses. Social science tools for coastal programs*. Charleston, South Carolina, National Oceanic and Atmospheric Administration Office for Coastal Management. 31 p.
- NOAA 2015. *Stakeholder engagement strategies for participatory mapping. Social science tools for coastal programs*. Silver Spring, National Oceanic and Atmospheric Administration Office for Coastal Management. 28 p.
- Peterson GD, Cumming GS, Carpenter SR 2003. Scenario Planning: a Tool for Conservation in an Uncertain World. *Conservation Biology* 17: 358–366.
- Proctor W, Drechsler M 2006. Deliberative multicriteria

- evaluation. *Environment and Planning C: Government and Policy* 24: 169–190.
- Rambaldi G, Tuivanuavou S, Namata P, Vanualailai P, Rupeni S, Rupeni E 2006. Resource use, development planning, and safeguarding intangible cultural heritage: lessons from Fiji Islands. *Participatory Learning and Action* 54: Mapping for Change: Practice, Technologies and Communication. Pp. 28–35.
- Ratana K, Herangi N, Te Huia S, Tāne W, Ngā Tai o Kāwhia Participants 2017. *Prioritising Wetland Restoration Efforts Based on Mātauranga-ā-Hapū in the Kāwhia Rohe: A Pilot Study*. NIWA Client Report. 47 p.
- Schoemaker PJ 1995. Scenario planning: a tool for strategic thinking. *Sloan Management Review* 36: 25–41.
- Schwartz P 1996. *The art of the long view: paths to strategic insight for yourself and your company*. 2nd ed. New York, Doubleday. 272 p.
- Sheil D, Liswanti N 2006. Scoring the importance of tropical forest landscapes with local people: Patterns and insights. *Environmental Management* 38: 126–136.
- Shirley L 2013. Is Māori food sovereignty affected by adherence, or lack thereof, to Te Tiriti O Waitangi? *Journal on Food, Agriculture and Society* 1: 57–63.
- Stewart TJ, French S, Rios J 2013. Integrating multicriteria decision analysis and scenario planning—review and extension. *Omega-International Journal of Management Science* 41: 679–688.
- Tanner CC, Howard-Williams C, Tomer MD, Lowrance R 2013. Bringing together science and policy to protect and enhance wetland ecosystem services in agricultural landscapes. *Ecological Engineering* 56: 1–4.
- Taura Y, Schravendjik-Goodman CV, Clarkson B 2017. *Te Reo o Te Repo. Connections, understandings and learnings for the restoration of our wetlands*. Hamilton, Manaaki Wheuna - Landcare Research and Waikato Raupatu River Trust. 209 p.
- Tipa G 2013. Bringing the past into our future—using historic data to inform contemporary freshwater management. *Kōtuitui: New Zealand Journal of Social Sciences Online* 8: 40–63.
- Tipa G, Williams E, Herangi N, Dalton W, Skipper A, Iti W 2014. *Maniapoto priorities for the restoration of the Waipā River catchment*. NIWA Client Report. 146 p.
- Valentine G 2005. Tell me about...: using interviews as a research methodology. In: Flowerdew R, Martin D eds. *Methods in human geography: A guide for students doing a research project*. Harlow, England. Harlow Pearson Education Ltd. Pp. 110–127.
- WRC 2007. *Waikato Regional Plan*. Hamilton, Waikato Regional Council. 698 p.

Received 14 June 2019; accepted 16 September 2019

Editorial board member: Tara McAllister