THE BENEFITS AND BARRIERS
TO GIS FOR MĀORI

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by
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Declaration
Abstract of a thesis submitted in partial fulfilment of the requirements for the Degree of M.I.P.D.

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by H. A. Pacey

A Geographic Information System visually communicates both spatial and temporal analyses and has been available for at least twenty years in New Zealand. Using a Kaupapa Māori Research framework, this research investigates the benefits and barriers for Māori if they were to adopt GIS to assist their development outcomes.

Internationally, indigenous peoples who have adopted GIS have reported they have derived significant cultural development benefits, including the preservation and continuity of traditional knowledge and culture.

As Māori development continues to expand in an increasing array of corporate, scientific, management and cultural arenas, the level of intensity required to keep abreast of developments has also expanded. GIS has been used by some roopū to assist their contemporary Māori development opportunities; has been suggested as a cost effective method for spatial research for Waitangi Tribunal claims; has supported and facilitated complex textual and oral evidence, and has also been used to assist negotiation and empowerment at both central and local government level.

While many successful uses are attributed to GIS projects, there are also precautionary calls made from practitioners regarding the obstacles they have encountered. Overall, whilst traditional knowledge and contemporary technology has been beneficially fused together, in some instances hidden or unforeseen consequences have impeded or imperilled seamless uptake of this new technology.

Challenges to the establishment of a GIS range from the theoretical (mapping cultural heritage) to the practical (access to data) to the pragmatic (costs and resources). The multiple issues inherent in mapping cultural heritage, indigenous cartography and, in particular, the current lack of intellectual property rights protection measures, are also potential barriers to successful, long-term integration of GIS into the tribal development matrix. The key impediments to GIS
establishment identified by surveyed roopū were lack of information and human resources, and prioritisation over more critical factors affecting tangata whenua. Respondents also indicated they would utilise GIS if the infrastructure was in place and the cost of establishment decreased.

Given the large amount of resources to be invested into GIS, and the opportunity to establish safe practices to ensure continuity of the GIS, it is prudent to make informed decisions prior to investment. As an applied piece of Kaupapa Māori research, a tangible outcome in the form of an establishment Guide is presented. Written in a deliberately novice-friendly manner, the Guide traverses fundamental issues surrounding the establishment of a GIS including investment costs and establishment processes.

Keywords

Māori, indigenous mapping, Geographic Information Systems, Kaupapa Māori Research, Māori development, indigenous intellectual property rights, mapping cultural heritage
Acknowledgements

The journey that this thesis represents is a testament to the support of many people, to the extent that it could read like the credit screen of a major motion picture. Which in a way it is. A student producing a thesis requires the support of a multitude of participants without which their final product cannot be debuted.

A big thank you to the whānau – my sisters and brother, and the bro-in-laws, who kept the home fires burning and always chipped in to feed and water their sister despite their own very busy lives.

Thanks to Chuckie for those endless cups of coffee and (mostly) intelligent conversations at Mrs O’s and other locations. This journey would have been exponentially harder without your friendship. I also have to thank Hannah who, like Chuckie, could be guaranteed to listen patiently and keep me on track to work hard and take time out every now and then to play a little bit too. Sarah, thank you for showing me how to ‘hold them by the hand’. Cheers e hoa ma.

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My undergrad and postgrad academic journey was also made possible with the assistance of several Land Trusts and tribal organisations. Ngā mihi ki Tuwharetoa Trust Board, Opeke Ahuwhenua Trust, Omataroa Rangitaiki No 2, Te Rūnanga o Ngai Tahu, Te Tapuae o Rehua, Māori Education Trust, Wakatu Incorporation, Ngā Uri o Mangamaunu, Te Papatipu Runaka o Kaikoura, Te Waipounamu MAI network and the Foundation for Research, Science and Technology. All these organisations provided various forms of support which boosted my confidence to undertake university study and in my project.
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Huia Pacey
Te Whare Wanaka o Aoraki/Lincoln University
2005
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Glossary

Māori is an official language of New Zealand. In keeping with that status, Māori words have not been italicised nor are there many within-text translations of Māori words within this thesis. Although the Māori kupu (words) used within the text are used within the common-place context (as opposed to esoteric), this glossary has been provided for any international reader of this thesis. Dialectual differences within te reo Māori (the Māori language) are not distinguished within this thesis.

<table>
<thead>
<tr>
<th>Term</th>
<th>Translation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aotearoa</td>
<td>common name for New Zealand</td>
</tr>
<tr>
<td>awa</td>
<td>river</td>
</tr>
<tr>
<td>awhinatanga</td>
<td>assistance</td>
</tr>
<tr>
<td>haka</td>
<td>form of dance/challenge</td>
</tr>
<tr>
<td>hapū</td>
<td>sub-tribe</td>
</tr>
<tr>
<td>hui</td>
<td>to gather, assemble, a meeting</td>
</tr>
<tr>
<td>iwi</td>
<td>tribe</td>
</tr>
<tr>
<td>Kaitiaki</td>
<td>care-giver, guardian</td>
</tr>
<tr>
<td>Kaitiakitanga</td>
<td>the action of guarding, nourishing, protecting</td>
</tr>
<tr>
<td>kanohi ki te kanohi</td>
<td>face to face</td>
</tr>
<tr>
<td>kaumātua</td>
<td>elder</td>
</tr>
<tr>
<td>Kaupapa Māori</td>
<td>Māori philosophy or purpose</td>
</tr>
<tr>
<td>Kaupapa Māori Research</td>
<td>research undertaken within a Māori epistemological framework</td>
</tr>
<tr>
<td>Kawa</td>
<td>Rules</td>
</tr>
<tr>
<td>kōrero</td>
<td>talk, story/stories</td>
</tr>
<tr>
<td>kuia</td>
<td>elder (female)</td>
</tr>
<tr>
<td>mahi</td>
<td>work</td>
</tr>
<tr>
<td>Mana</td>
<td>prestige, status</td>
</tr>
<tr>
<td>Manaakitanga</td>
<td>the action of assisting</td>
</tr>
<tr>
<td>Manawhenua</td>
<td>customary authority and title over land and other taonga (treasures)</td>
</tr>
<tr>
<td>Marae</td>
<td>meeting place grounds and buildings</td>
</tr>
<tr>
<td>mātauranga</td>
<td>Knowledge</td>
</tr>
<tr>
<td>mātauranga Māori</td>
<td>Māori knowledge</td>
</tr>
<tr>
<td>maunga</td>
<td>mountain</td>
</tr>
<tr>
<td>Mauri</td>
<td>life force, life principle</td>
</tr>
<tr>
<td>Mauriora</td>
<td>life</td>
</tr>
<tr>
<td>Mauriora ki Te Ao</td>
<td>life to the World</td>
</tr>
<tr>
<td>Moko</td>
<td>special facial and body tattoo</td>
</tr>
<tr>
<td>mokopuna</td>
<td>Grandchild</td>
</tr>
<tr>
<td>ngā iwi</td>
<td>the tribes</td>
</tr>
<tr>
<td>ngā tīpuna</td>
<td>the ancestors</td>
</tr>
<tr>
<td>ngā uri o Tūwharetoa</td>
<td>the descendants of Tūwharetoa</td>
</tr>
<tr>
<td>Māori Word</td>
<td>English Translation</td>
</tr>
<tr>
<td>------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>oriori</td>
<td>lullaby/chant</td>
</tr>
<tr>
<td>Pā</td>
<td>traditional Māori community place</td>
</tr>
<tr>
<td>Pakēhā</td>
<td>New Zealand European</td>
</tr>
<tr>
<td>poi</td>
<td>dance form with tight ball with a short string attached to it</td>
</tr>
<tr>
<td>Pou</td>
<td>boundary marker, reference point</td>
</tr>
<tr>
<td>ritenga</td>
<td>custom, habit, practice, value</td>
</tr>
<tr>
<td>rāhui</td>
<td>prohibit, reserve, preserve, sanctuary</td>
</tr>
<tr>
<td>raranga</td>
<td>weave/weaving technique</td>
</tr>
<tr>
<td>rohe</td>
<td>area of occupation</td>
</tr>
<tr>
<td>rongoā</td>
<td>Medicine</td>
</tr>
<tr>
<td>roopū</td>
<td>group</td>
</tr>
<tr>
<td>Rūnaka/Rūnanga</td>
<td>Council, assembly, tribal or hapū organisation</td>
</tr>
<tr>
<td>tāhuhu kōrero</td>
<td>history</td>
</tr>
<tr>
<td>tāhuhu o ngā iwi</td>
<td>history of the tribes</td>
</tr>
<tr>
<td>tangata whenua</td>
<td>person/people of the land</td>
</tr>
<tr>
<td>taaniko</td>
<td>weaving technique</td>
</tr>
<tr>
<td>taonga</td>
<td>treasure/s</td>
</tr>
<tr>
<td>tapu</td>
<td>sacred, having special status</td>
</tr>
<tr>
<td>Te Ao Māori</td>
<td>the world of the Māori</td>
</tr>
<tr>
<td>Te iwi Māori.</td>
<td>Māori people</td>
</tr>
<tr>
<td>Te Puni Kokiri</td>
<td>Ministry of Māori Development</td>
</tr>
<tr>
<td>te reo</td>
<td>the language</td>
</tr>
<tr>
<td>Te Wai Pounamu</td>
<td>common name for the South Island</td>
</tr>
<tr>
<td>tikanga</td>
<td>the right, correct, affirmative action</td>
</tr>
<tr>
<td>tino rangātiratanga</td>
<td>autonomy, self determination, independence</td>
</tr>
<tr>
<td>tohunga</td>
<td>Specialist</td>
</tr>
<tr>
<td>tukutuku</td>
<td>panel weaving technique</td>
</tr>
<tr>
<td>tūpuna/tīpuna</td>
<td>ancestor</td>
</tr>
<tr>
<td>tūrangawaewae</td>
<td>place to stand, home ground</td>
</tr>
<tr>
<td>wāhi tapu/waahi tapu</td>
<td>sacred site or sites</td>
</tr>
<tr>
<td>waiata</td>
<td>song</td>
</tr>
<tr>
<td>waka</td>
<td>canoe</td>
</tr>
<tr>
<td>whakaiiro</td>
<td>carving, inscription</td>
</tr>
<tr>
<td>whakapapa</td>
<td>genealogy</td>
</tr>
<tr>
<td>whakatauki</td>
<td>proverb</td>
</tr>
<tr>
<td>whānau</td>
<td>family</td>
</tr>
<tr>
<td>whānaungatanga</td>
<td>kinship, relation, relationship</td>
</tr>
<tr>
<td>whakawhānaungatanga</td>
<td>interrelationships</td>
</tr>
<tr>
<td>whānui</td>
<td>wider tribal family</td>
</tr>
<tr>
<td>whenua</td>
<td>land</td>
</tr>
</tbody>
</table>
Chapter 1: Introduction

In many indigenous cultures, transmission of cultural spatial elements occur during the oral transmission of stories and history, dance and many other elements that inform and reinforce cultural heritage. Thus the rich heritage of a peoples history, boundaries, landmarks, harvesting and nursery sites, resource rights and use, healing centres, etc are preserved and handed down to successive generations devoid of paper placemarkers. These relationships are preserved through kōrero and are often identified through the expressions of whakataukī.

Ko Pūtauaki te maunga
Ko Tarawera te awa
Ko Tūwharetoa te tangata
Ko Tūwharetoa te iwi

Thus the relationship of Pūtauaki the mountain, Tarawera the river and Tūwharetoa the iwi are linked through the mana of Tūwharetoa i te Aupouri, the eponymous ancestor of the Ngati Tūwharetoa tribe who lived within sight of Pūtauaki (the mountain), next to Tarawera (the River), who died of old age near the foothills of Pūtauaki and was subsequently buried within a few miles of his mountain. The reaffirms the mana of Tūwharetoa i te Aupouri over the maunga and the awa and the rohe, providing pivotal Pou (placemakers) for the identity of ngā uri o Tūwharetoa (the descendants of Tūwharetoa) wherever they venture. Whakataukī such as these have linked people, places, events and history for generations.

Whakataukī are only one method of recollecting and reinforcing tribal kōrero. Cultural cartography in the forms of waiata, haka, poi and oriori to name a few, also commemorate places, people and events that have contributed to the rich tapestry of tāhuhu o ngā iwi. Visual representations of kōrero are also manifested in many mediums. Whakaiiro, tukutuku, pou, moko, raranga and taniko have been used for those same generations as means to celebrate, cement and visualise their link to their tupuna and their tūrangawaewae.

Over many generations Māori have also adopted or fashioned new technology (such as carving implements, weaving and dying techniques) to reinforce this sense of place within Pacifica and later Aotearoa. This thesis discusses GIS; another visual technology that is slowly being adopted by different iwi to (re)confirm and reinforce those same relationships and linkages to their tīpuna and tūrangawaewae.
1.1 Aim of research programme

Māori resource management has evolved throughout the centuries that Māori have occupied Aotearoa (New Zealand). As kaitiaki, they have responsibilities for both biophysical and metaphysical resources within their rohe. The challenges of our contemporary world require tribes to adopt (or adapt) various tools to meet their needs if they want to continue to fulfil their role as kaitiaki.

As will be shown in this thesis, Geographic Information System (GIS) is widely recognised as a useful tool in tribal development planning. The addition of a GIS to the development toolkit can offer distinct communication advantages against the written word. The overlay theme capability of a GIS for resource inventory or location mapping can enhance and speed up the decision making process through its inherent visual output. The old maxim "A picture is worth a thousand words" is often borne out when using GIS as a communication tool. The spatial and temporal analyses capability of GIS makes it a valuable tool for communicating complex plans including the modelling of ‘what if’s’, ‘what about’s’ and ‘should we’ scenarios underlying most planning and development issues faced by Māori.

GIS technology has been available for several decades. Preliminary enquiry has shown that an increasing number of Māori organisations are considering or buying a GIS. There are also clear indications that the majority of existing users are underutilising the programme capabilities due to a lack of skills, training and infrastructure. For some, the use of GIS has come to a complete stop once trained users have moved on. For others, access to training or insufficient training has compromised the efficient use of GIS within their organisation. Still others have found developing GIS capacity to be far more onerous than first anticipated or have found critical time sensitive projects abandoned because of inefficient modelling.

My view is that access to the technology and efficient use of its capabilities can be assisted by developing an establishment guide for GIS that considers the theoretical as well as applied use of GIS.

The theoretical implications of this research include a range of issues surrounding the initial adoption of GIS as a tool, from the philosophical - should mātauranga Māori be mapped?, to the pragmatic - can we afford this new tool?, to the practical - how can it be used?. It also contextualises these issues by noting what Māori development is, what its goals are, and the tools that can be adopted to assist meeting those goals. It will primarily focus on the possible benefits and barriers of using GIS.
Enquiry also revealed that projects undertaken by Māori and other indigenous peoples utilising GIS, have assisted tribal planning and development in areas such as housing, health, conservation, water restoration, wildlife repatriation, species management and agriculture. The international implications for indigenous use of GIS were also explored to compare other indigenous people’s experience with GIS.

A key focus of this research is the applied use of GIS. To facilitate this, a resource Guide to assist tribal organisations establish or improve their GIS capacity was developed.

### 1.2 Research objectives

The specific objectives of my research fell into several categories:

1. Investigate the Māori cultural and epistemological issues concerning mapping mātauranga Māori (Māori knowledge), intellectual property rights, Māori development, and its applications within a Māori specific context.

2. To evaluate the theoretical issues surrounding the development and implementation of a GIS such as:
   - Should we - establish a GIS unit within the tribal organisation?
   - Could we - afford to in terms of economic and human resource cost?
   - Would we - be able to efficiently maintain the GIS?

3. To analyse the pragmatic range of applied issues surrounding the development and implementation of a GIS such as:
   - Where is the information?
   - Who needs to hold/secure the information?
   - Will it be useful as a decision making tool?

4. To develop a resource guide using checklists and options for developing a GIS. [The guide was intended to be field tested by groups identified during the research through open hui and specific workshops with the aim of testing the hypothesis that a guide would assist informed decision making processes so as to answer the question – whether and how to establish a GIS.]
Chapter 2: Research Design – A Kaupapa Māori Approach

Interest in Geographic Information Systems (GIS) is increasing within the indigenous community of New Zealand. A short study undertaken in 2003 for a postgraduate assignment, identified various Māori organisations or roopū who were interested in the opportunities provided by GIS but were unaware of or unable to explore those opportunities.\(^1\) Subsequent discussions with other GIS users and tribal development practitioners supported the conviction that there was a potential benefit to an identifiable audience. They also supported the notion that a research project of this nature might be useful for tribal development initiatives. This chapter describes how a Kaupapa Māori Research framework underpinned the research design and commences with a description of the framework. It then outlines principles that several knowledgeable Māori academics and writers have articulated in various publications before focussing on two aspects that were found to be particularly relevant; the reciprocity principle and the notion that Kaupapa Māori Research has two juries. The chapter then gives an overview of a similar, although culturally neutral research framework - Participatory Action Research. Kaupapa Māori Research characteristics are then discussed to provide a reference point for identifying the four design elements of this research project. The four design elements (literature review, survey, discussions with practitioners and a how-to Guide) are then described. The chapter concludes with a summary of points to position the research as appropriate to conduct within a Kaupapa Māori Research framework.

2.1 Kaupapa Māori Research

Kaupapa Māori Research ethics emerged from the cultural revitalisation of the late 1980’s and early 1990’s. Since then several writers have articulated various principles of Kaupapa Māori Research (KMR) which together forms an overarching framework that can be used in research methodologies.

My perspective is drawn from experience as a practitioner who has been involved with research projects both as a researcher and as a research participant. From my perspective, Kaupapa Māori Research means research undertaken by Māori, for Māori, within a specific cultural framework that adheres to the fundamental tenets of Māori society.\(^2\) It is all about respect and enablement.

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\(^2\) For a description of various authors opinions and deliberations on what constitutes Kaupapa Māori Research, see Powick, K. (2002). *Nga Take Matatika mo te Mahi Rangahau Māori, 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*. Hamilton: University of Waikato
KMR enables a researcher to investigate an issue in a practically oriented manner that enables the Māori community to respond and participate appropriately. Having been the subject of research for generations, Māori (and many other indigenous peoples) are long past being irritated at receiving little or no discernible benefits from research. Furthermore, given the economic, environmental, social and cultural position that Māori occupy within New Zealand society today, practitioners are just as concerned with the ‘how’ as well as the ‘what’ and ‘why’. Thus, practical and tangible benefits to the research community form an integral part of the research objectives.

### 2.2 Principles of research

Ngahuia Te Awekotuku articulated the first set of principles (ethics) that Kaupapa Māori researchers followed.³

These principles can be summarised as follows:

1. Responsibility to the research community which transcends sponsors;
2. Acknowledgement and protection of the rights, interests and sensitivities of the people studied;
3. Wherever possible, consent of the people studied must be acknowledged and protected;
4. Clear communication of aims and anticipated outcomes of the research project;
5. The absolute right of the research community to know the use and application of their information;
6. The exercise of absolute control over the information volunteered by the research community;
7. Genuine consultation over the use of culturally sensitive information;
8. Informants rights to anonymity; and,
9. Non-exploitation of the research community, in particular for personal gain or aggrandisement.

Linda Tuhiwai Mead (now Smith) identified five working principles of Kaupapa Māori Research (KMR) in her 1996 PhD thesis “Nga aho o te kakahu matauranga: the multiple layers of struggle by Māori in education”. This PhD was not sighted. Powick, however, provides a useful summary.⁴

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The methodological principles that Mead traversed are whakapapa, te reo, tikanga, rangatiratanga and whānau. The principle of rangatiratanga most clearly elucidates the requirements for this applied piece of research.

The principle of rangatiratanga has a crucial impact on the way in which the following questions are answered:

- What research do we want to carry out?
- Who is the research for?
- What difference will it make?
- Who will carry it out?
- How do we want the research to be done?
- How will we know it is a worthwhile piece of research?
- Who will own the research?
- Who will benefit?

A positive answer to these questions affirms a position of power and place for Māori people within a research project.

In addition to the methodological principles explained by Mead, Bishop’s theoretical and methodological framework ‘whakawhanaungatanga’ emphasizes the pivotal role of whānau in KMR. Again, a précis of Powick’s useful summary is used.5

Bishop’s three elements of whakawhanaungatanga are; the establishment of whanau relationships as an integral part of the research process, participant driven approaches to power and control, and that research is a lived experience.

Powick summarises whakawhanaungatanga by stating that researchers should “ensure that research outcomes are in line with the aspirations and wishes of the participants.”6

Russell Bishop also considers that Kaupapa Māori Research should benefit all research participants and their agendas.7 Linda Smith takes this one step further by asserting that Kaupapa Māori Research should set out to make a positive difference for the researched.8

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The principles outlined by these writers' articulate critical boundaries and pathways to negotiate when undertaking KMR. These principles provide the overview. There are two elements of Kaupapa Māori Research that were [are] relevant to my research and are important to explain, namely, reciprocity and the notion that this work will have two juries.

2.2.1 Reciprocity

The (un)conscious adherence to tikanga, in particular the values of whānaungatanga and manaakitanga, compel a Kaupapa Māori researcher to approach and undertake any Māori research project with these obligations in mind. Russell Bishop positions whanaungatanga as an integral and ongoing constitutive element of Kaupapa Māori Research. Essentially, researchers enter their research with the knowledge that the support base that whānaungatanga offers is a ‘two way street’. Whānaungatanga and its implicit responsibilities and obligations are enduring. The researcher is well aware that any relationship they form or reinforce during their research will endure long past the timeframe of a simple research project. Any benefit the researcher may acquire through either an action undertaken on behalf of a researcher (such as facilitating or attending a meeting for the researcher) or time that an interviewee allows a researcher, has an inherent obligation to reciprocate. This obligation continues long past the hand in date of a thesis or a completed research project.

Bishop also refers to this aspect of Kaupapa Māori Research by reminding researchers that what is of crucial importance to indigenous (Māori) research is that, “reciprocity is not just a political understanding, never an individual act, nor a matter of reifying and/or challenging the paradigms within which researchers work. It is the very world-view within which the researcher becomes immersed that hold the key to knowing.”

2.2.2 Two juries

Another characteristic of Kaupapa Māori Research is the notion that researchers face two juries.

In positioning Kaupapa Māori Research alongside the more historically Western influenced or adopted approaches, a Kaupapa Māori researcher intuitively understands that they will face two juries. The value of their work will ultimately be decided not only by the academic fraternity, but also by their Māori community.

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10 ibid. 153
An academic jury might be considered distant, and their responses or judgements posited as *objective*, based on a non-indigenous, theoretical framework. Academia is also remote, in that the research problem, issue or response (research output) is able to be distanced from the researcher’s personal life and landscape.

The other jury - the researcher’s Māori community - is much, much closer. Relationships are committed not only to the research question and its potential outcome, but more fundamentally to the researcher themselves. The intertwining of relationships epitomised in whānaungatanga extend outward from the researcher to their whānau, their hapū and their iwi. Where research has the ability to affect pan-tribal interests, a research method or output might be judged by te iwi Māori.

The effect of an academic jury’s verdict might be a difference in grade that could affect a person’s academic profile. The effect of a whānau or iwi verdict is felt in all facets of life, regardless of whether it is a professional or personal endeavour.

The characteristics of KMR are normal, fundamental, implicit and expected as a *matter of course* by Māori communities who engage in research projects. This applies whether the research is purely historical in nature or developmental in scope. The ethics that underpin Kaupapa Māori Research apply across the entire spectrum of research endeavours. That is not to say that Māori will only engage in KMR research projects. Māori communities are pragmatic and understand that it takes time to train mainstream researchers and that it is often better to be sitting at the table than standing outside the door. Nor are Māori likely to reject outright researchers who are unfamiliar with the ethics of KMR. If anything, the researcher will be given an opportunity to learn appropriate tribal protocols and clarify their position with regards to the research ethics needed to fulfil the basic requirements of culturally appropriate Māori research.

Teariki, Spoonley and Tomoana\(^\text{11}\) describe basic requirements of Māori research as:

- **Research as a partnership** - whereby the research process and outcomes are fully explained; ensuring Māori input; identifiable outcomes that do not impact negatively on the communities participating, and that clearly identified accountability procedures are established.

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\(^{11}\) Teariki, C., Spoonley, P., & Tomoana, N. (1992). *Te Whakapakari Te Mana Tangata. The politics and process of research for Māori*. Massey University, New Zealand: Department of Sociology
Accountability - especially report back processes and technology transfer opportunities

Self monitored research – the responsibility for appropriate and sensitive research which produces a partnership in the research (between the researched and the researcher) rests primarily with the “social scientist”. Citing Akeroyd, they stress that it is still not “clear that commitment to the paramountcy of the interests, rights and sensitivities of those studied is the universal norm”.

The products of research, including the establishment of ownership of the research material, including any on-selling of information and transfer of skills to the participating research community, are negotiated and made clear prior to undertaking any research.

Many of these basic requirements are extant in other research methodologies. Another methodology that researchers adopt is the similar, although culturally neutral, method known as Participatory Action Research.

2.3 Participatory Action Research

“Participation is now widely touted as an essential component of development.”

Development research initiatives involving community research programmes or enhanced participation by communities affected by research programmes have crystallised into models of research called Participatory Research or Participatory Action Research.

The point of difference between PR and PAR research methods and those methods adopted by more traditional hegemonic or eurocentric methods, is that they intentionally endeavour to empower the community by being emancipatory and collaborative in nature. Thus the subjects become the participants.

Greenwood et al consider full collaboration by the researcher with research participants to be a critical factor in PAR. They define 6 key features of PAR that can be summarised as:

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1 – Collaboration: between members of the organisation being studied and a professional social researcher taking place across a whole research process from problem formulation to application and assessment of the results.

2 – Incorporation of local knowledge into the research process.

3 – Eclecticism and diversity, mobilizing theories, methods and information from whatever source the participants jointly believe to be relevant.

4 – Case orientation: attempts to learn general lessons from specific cases, to operationalise concepts to develop comparisons and the like through repeated case applications.

5 – Emergent process: emergent, intensifying process that is able to gain increased dimension and depth throughout the entire research process.

6 – Linking scientific understanding to social action – as participants in the research are from within the organizations under study, the research results reflect their understanding of their own system better than the work of external professional researchers alone could. These understandings are also conditioned by organisation member’s rights and obligations to act within their own system.

PAR endeavours to match the aspirations of the community with the specialised knowledge of the scientists and academic/technical experts, whilst recognising the value and importance of local knowledge. The logical rationale underpinning the emancipatory and collaborative mechanisms adopted by PR and PAR advocates, is that for the long-term effects of research to be beneficial and for the community to have ‘buy in’, the community who is impacted upon must be involved at each step of the research process. As Flora et al succinctly remind us, “Citizens, after all, will still be there after the engineers, scientists, agency managers and academics have moved on to new projects.”

The same aspect of longevity applies to the Māori community who are impacted upon by any research, if not more so.

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2.4 Research characteristics and design

Graham Smith identifies a number of characteristics of Kaupapa Māori Research.\(^\text{16}\) He finds that it,

- is related to ‘being Māori’,
- is connected to Māori philosophy and principles,
- takes for granted the validity and legitimacy of Māori, the importance of Māori language and culture, and
- is concerned with the struggle for autonomy over our own cultural well being.

These characteristics are not ‘new’ although they might have only just recently been articulated. From experience, I would also argue that these characteristics are applied by many indigenous peoples such as the Saami, Mindanao, Suquamish and Oglala Lakota peoples.

Kathie Irwin has also described other characteristics of Kaupapa Māori Research as: being culturally safe, culturally relevant and appropriate while satisfying the rigour of research.\(^\text{17}\) Given these characteristics and those previously detailed, the question arises as to what research design would satisfy KMR and achieve the objectives of the research project?

2.4.1 Design elements

The research design had four constructive elements. Three of the elements were: a literature review, discussions and contact with Māori practitioners, and a survey of Māori organisations to canvass their capacity and opinions on GIS. Interactions between these elements often occurred simultaneously with information and feedback often overlapping and feeding off each other. These relationships can be easily illustrated in a simple venn diagram.

\[ \text{Figure 1: Research Design Elements} \]


2.4.1.1 Literature Review

The literature review used both publications and internet searches. Simple keyword searches were used within the University library catalogues including other university thesis catalogues and the academic database search engines that the University subscribes to (e.g. Proquest, Te Puna, Expanded Academic ASAP, etc). Basic search keywords (e.g. “Māori” and “GIS” or “Geographic Information Systems”) returned less than 10 hits. Broadening this search query to include “New Zealand” increased results exponentially as did a query for “indigenous GIS”. The search identified very few publications that discussed or focussed on Māori GIS use or opportunity. The most relevant publications were theses although a few journal articles were found. Interestingly, McDowall’s thesis (reported within this work in Chapter 4, pp 34-41), did not have “Māori” or “indigenous” as a keyword, although the thesis focuses on Māori GIS initiatives. The research for publications therefore took into account the potential that Māori focussed publications were hidden within GIS related publications.

Internet searches were conducted using the same keywords including “ethnocartography” and “indigenous mapping”. The literature review found that Māori GIS is an emerging field with very few publications and there are a far greater number of international indigenous GIS publications. International publications have concentrated on both internal and external perspectives of GIS (i.e. indigenous peoples discussing and reporting their GIS initiatives as well as agency or mainstream research and discussion on indigenous GIS initiatives).

2.4.1.2 Surveys

Surveys were considered to be a useful method for answering basic parameter setting questions. An internet search of Māori organisations was conducted using Māori specific web sites (e.g. FOMA (Federation of Māori Authorities), Indigenous knowledge basket, Te Puni Kokiri, Ngai Tahu, Tainui, Tūwharetoa, Māori.com, etc) and formal entities such as Rūnanga or Trust Boards were identified. The rationale was that, given the overall cost of running a GIS, it was more likely that larger entities such as Rūnanga or Trust Boards would have the capacity to engage in GIS.

Emails introducing myself in a culturally referenced and appropriate manner were then sent out with a brief outline of my project, a request for information and an offer to provide further information if necessary. Responses to email requests were logged and, if further information or comment was requested, these were responded to. If requested, a commitment to relay further information where possible and to forward a copy of the final research product was also given.
2.4.1.3 Practitioners

Practitioners were contacted to discuss their experiences of GIS. The intention being that flaxroots, 'real world', experiences would provide additional perspectives to the literature review. Some practitioners were already known to me while others were contacted either as a result of referrals, from names identified in the literature, or from survey respondents. Two mini case studies were to be undertaken with roopū to provide specific examples of operational Māori GIS.

Mini case studies were considered useful for real life situation feedback from practitioners with experience of a Māori GIS unit ‘in action’ as it were. Questions to be put to practitioners were qualitative rather than quantitative. Questions such as;

- Why did you develop your GIS?
- How did you develop your GIS? (e.g. how did you choose your software, hardware, data, people, management, cost, etc)
- What risks and opportunities did you encounter? (e.g. data and people management; previous, current and future projects; internal and external assistance, etc)

Discussions with practitioners occurred for the most part by telephone or via email communication, although several kanohi ki te kanohi (face to face) discussions were held. Neither telephone discussions nor personal discussions held with practitioners were recorded at their request. During these wide-ranging discussions, a practitioners’ experiences with GIS and their opinions on GIS application within a Māori development framework was canvassed. Overall, practitioner feedback was intended to identify issues and experiences surrounding the development and implementation of a GIS including capacity, governance, economic efficiencies, risk management, system management and maintenance and use of the GIS as a decision making tool.

As with any research, its direction and shape was continuously informed by feedback. The relevance, usefulness and appropriateness of this research was supported by practitioners. They also supported the fourth design element – the construction of a guide to establish GIS, originally called a toolkit. The toolkit would signal the risks and opportunities offered by GIS use, and strategies to maximise those opportunities while managing the risks. It was envisaged that it would also incorporate checklists and options for developing a GIS.
Based on feedback and research, the title of ‘toolkit’ became something of a misnomer as the specificities of each roopū precluded a one size fits all approach. Institutional and legal frameworks were different for many roopū as were their in-house processes, protocols, priorities and aspirations. As such, the “toolkit” tag, implying step by step instructions for establishing a GIS unit, was changed to the more generic term “guide”.

2.4.1.4 Including a Guide in the research design

As the research will show, the empowerment that development plans and tools provide, is a key motivating factor behind the uptake of a technology such as GIS. The concepts of empowerment and facilitation, were therefore an integral part of the research design.

Feedback from the literature review, discussions with practitioners, survey results and case studies were all intended to inform the research and provide further validation (or otherwise) of the research objectives. The theory-praxis relationship would be tested by the inclusion of a Guide as a tangible outcome. The Guide was constructed with the aim of providing useful information for those who wished to establish a GIS. This tangible product also fulfils key KMR objectives discussed earlier.

For this reason, the thesis body primarily answers the questions “So what?” (has happened, could happen, is important), and, “Why?” (is it important). The “How?” (do we go about gaining and using the information), and, “So that?” (informed decision making can occur) questions are traversed within the Guide which is included as the Appendix in this thesis.

Figure 2: Overall Research Design elements

Although some elements of the Guide may be of use to mainstream groups, this research work is focussed on a Tribal/Māori development opportunity that is distinctive and relevant to Māori. My tribal development and resource management experience, supported by the
feedback from practitioners, informed the Guide. This experience also informs the style of the Guide which blends academic research with ‘real speak’. ‘Real speak’, where less formal descriptions or scenarios are imprinted throughout the text, enables sensitive topics to be navigated without judgement. It also attempts to break down any textbook or manual connotations that the Guide may have acquired. As one who has read many technical/how-to Guides, the style attempts to offer information in as dynamic a fashion as can be constructed given the small student research budget available.

It was intended that workshops about the Guide would be conducted once it had been constructed. The workshop participants were to be groups: one group who were aware of GIS but inexperienced, and another who had little awareness of GIS and no experience at all. It was anticipated that these two perspectives would inform both the Guide and the research. The Guide’s usefulness and relevance could also be assessed with this feedback.

2.5 Conclusion

Kathie Irwin describes Kaupapa Māori Research as culturally safe, relevant and appropriate while satisfying research rigour. Russell Bishop considers KMR research to be oriented toward benefiting all research participants and their agendas, and defined and designed with some idea of likely short-term or longer term benefits. Graham Smith views KMR as related to being Māori and connected to Māori philosophy and principles.

Kaupapa Māori Research objectives are similar to Participatory Action Research (some may say exactly so). However, while PAR is culturally neutral, KMR is clearly not. While a researcher who undertakes PAR research disengages after a project is completed, clearly, KMR researchers may not.

This research is Māori centred, Māori focussed and Māori relevant. It has anticipated long term benefits as an applied piece of research with two tangible outputs; a thesis that describes the emergent field of Māori GIS, and, a Guide that might be of immediate use to research participants.

Being Māori, being aware of development issues that impact on Māori, and being at a place and point in time that allowed me the opportunity to conduct research of possible benefit to Māori, I conclude KMR to be the research methodology most appropriate to both researcher and project. Moreover, given the fundamental characteristics of relevance, usefulness and appropriateness that KMR demands of researchers, I also believe that the research design fits well within the Kaupapa Māori Research framework.
Chapter 3: Māori Development

This chapter begins with a brief introduction to Te Ao Māori by paying attention to several of the core values that underpin Māori epistemology and contemporary practices of kaitiakitanga. It then moves on to describe contemporary Māori organisations and their place and role in contemporary Māori development. Development goals are also discussed, and Iwi Management Planning is introduced as an opportunity to promote positive development. Finally this chapter discusses another tool, a new form of technology called Geographic Information Systems and where it may sit within the development framework.

3.1 Te Ao Māori

There are many descriptions of Te Ao Māori. In this work my description of Te Ao Māori is intended to provide a sense of foundation from which to view development opportunities.

Te Ao Māori or the Māori worldview can be described as an whollistic worldview. It encompasses both biophysical and metaphysical elements, integrating cultural values and mores that are intertwined between, within, and dependent upon, all elements.

Environmentally, this interdependent worldview is founded on a multi-generational association with the whenua that traces back over centuries of occupation in Aotearoa. Tribal members of contemporary New Zealand Māori society still trace their whakapapa to the tangata whenua prior to the arrival of the migration fleet approximately 500 years ago. Some are able to whakapapa back further, to Archaic Māori ancestry.

Constructed over many generations, Te Ao Māori is an intricate set of values and rights, meshed with observations based on multi generational experiences that established customary law or tikanga (the right, correct and affirmative action). This customary law related to people, land and resource management rights. Each code and law was developed in keeping with the sustainable management of the resource. Indeed, “sustainable management” is a modern catch phrase for something that has been fundamental to Māori for generations upon generations – tikanga.

Underpinning the tikanga which hapū and whānau exercise within their rohe is the presence of mana. This authority is manifested in the term “manawhenua”. Having manawhenua is pivotal to the role of being a kaitiaki. Kaitiakitanga or the action of guardianship itself is an intrinsic

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18 Readers will note my use of the word “whollistic”. The word “whollistic” conveys the meaning of something ‘wholly’ (or whole), different to ‘holy’. The sidelining of the Māori worldview to a religion-based appellation was common when the word ‘holistic’ was first applied in the 1980’s. One of my primary tribes, Tūwharetoa ki Kawerau, has never used ‘holistic’ because it has never conveyed the appropriate meaning we wished it to. I have therefore continued to use the spelling (and underlying meaning) in this thesis.
aspect of maintaining manawhenua and is fundamental to the wholistic worldview of Māori. You cannot just assume the rights of a kaitiaki, you have to have the right of manawhenua. Both manawhenua and kaitiakitanga confirm boundaries and rights, privileges and responsibilities to resources within those boundaries. Each distinct aspect of the world surrounding people, including those people themselves, were taonga – special or prized possessions.

All three – tikanga, kaitiaki and taonga – are used to protect Mauri.

Each element within the environment is considered to have Mauri. Mauri has been variously described as life force, potential, the life essence which is present in all living things that binds the spiritual and physical, or the spiritual power that enables each thing to exist in itself. The mauri of each tangible and intangible resource was supported and its regenerative capacity protected. Hirini Matunga has developed a framework visualising the strength and relationship that each of these elements gives to the protection of Mauri.

Figure 3, Conceptual framework from Matunga, 1994

Stokes description of traditional land tenure identifies a key aspect of kaitiakitanga. “Relationships between people and the land, the allocation of occupation and use rights, also implied balance and reciprocity in obligations to each other...”\(^\text{20}\) This notion of reciprocity includes the relationships between people just as much as between people and resources. The pragmatic nature of the culture is manifested in the relationship. Without care of the environment and its resources the ability of the tribe to harvest, consume, trade and store resources to provide for their people would be severely compromised. When mistakes were made or resources came under stress, appropriate ritual and remedy including the invocation of tapu and rāhui, were set in place.

Long, multi-generational association with their whenua, gave Māori time “to find a rhythm that is respectful of the natural environment and realistic about what can be achieved...Pakeha, by


comparison, have had only some 160 years to acclimatise, environmentally and spiritually, and to trim back their own inheritance of vastly overstated expectations." \(^{21}\)

The ideology of a ‘pastoral paradise’, the ‘English’ idealisation of the New Zealand countryside envisaged by many colonists in their early and mid settlement phases\(^{22}\) conflicted with the Māori worldview. Coupled with an unrelenting drive to overthrow the Māori nation, this transplanted English ideology created tensions, war and finally programmes of assimilation and integration. Despite this, the struggle to fulfil the responsibilities inherent in the role of kaitiaki has continued throughout the nearly overwhelming hegemony that Pakehā have imposed over Māori since colonial occupation.

Te Tiriti o Waitangi (the Treaty of Waitangi) signed in 1840 was supposed to bind two nations in a Treaty of Governance.\(^{23}\) In effect, however, subsequent “[l]and wars, land confiscation and resettlements through the Native Land Court removed land and places for gathering kai (food) out of tribal control. Furthermore, government regulations intruded into all aspects of tribal life, similarly Māori tribes were excluded from participating in the management of environmental resources...”\(^{24}\) Having survived attempts to eliminate and sublimate their culture, Māori became increasingly vocal and active about their right to exist throughout the late 1960’s. The 1970’s proved a watershed for Māori development. Charismatic personalities like Whina Cooper, Pita Sharples, Matiu Rata, Rangi Walker and many others emerged with messages disseminated via the media whose views both supported and criticised the ‘Māori’ message for self-determination. Not only were there a growing number of Māori leaders, academics and supporters vigorously pushing for increased participation in New Zealand society but a range of other events helped shift the course of Māori development onto a new platform. The Land march, Bastion Point, challenges to the State Owned Enterprise Bill, higher tertiary level participation and completion rates, the Kohanga Reo movement and indigenous rights scrutiny at an international level also helped mobilise Māoridom and finally brought changes to government inaction.

These changes, manifested primarily in the Treaty of Waitangi Act, the establishment of the Waitangi Tribunal and requirements of responsiveness from government agencies, were also tested in judicial review.


The Treaty of Waitangi has never been officially ratified. Despite this, its status in New Zealand constitutional law evolved so that it has been described as New Zealand's founding national charter. Because the Crown assumed certain powers and duties over Māori and their resources, it was held to be legally accountable for the performance of its self-assumed commitment. The Crowns' fiduciary obligation to honour the guarantees made to Māori in the Treaty of Waitangi has been iterated in a range of judgements requiring the Crown to actively protect Māori interests and ensure a reasonable degree of preference in decision-making. The Crown also has an obligation to consult with its Treaty partner. These concepts – that of partnership between the Crown and Māori, and that of the fiduciary obligation owed by the Crown to Māori - have become the cornerstone of Treaty law in New Zealand.

Historically, the individualisation of land title and appropriation of hapū/whānau control of resources, debilitated and disenfranchised Māori. However, Māori never abrogated their fundamental kaitiaki responsibility. Even with little or no control over the maintenance of their cultural heritage and ‘ownership’ of the land, the kaitiaki responsibilities and duties to the people, environment and each resource within it remained.

The form and practice of kaitiakitanga changed after contact, as traditional Māori culture adapted and evolved in order to survive. Traditional beliefs and practices were reshaped and redefined in response to changes in the physical landscape and the people who have inhabited it. Inherited British attitudes and political systems, urbanisation, geological and ecological changes over time, legal entanglements and even internalisation of european values all caused changes in the way Māori have been able to practice kaitiakitanga.

The ability to be Māori by being Māori within contemporary New Zealand society has moved forward from the days where legislation was specifically enacted to remove Māori rights to one where recognition of the Treaty rights of Māori were acknowledged in some shape or form. Over twenty pieces of legislation now refer to the Treaty of Waitangi or its principles. This has by no means been a smooth progression however. The recent protest of the Foreshore and Seabed legislation where the views of 30,000 Māori participants drawn from all rohe in the nation were ignored, is a backwards step to decades of a begrudging but slowly maturing journey for the nation-state. Recent political exhumation of assimilist rhetoric is also problematic. However, it is still possible to say that the circumstances that Māori find themselves in today - while being a far

cry from the idealised two nations that was promoted through the Treaty of Waitangi in 1840 – is such that Māori focus has finally been able to shift from survival to development.

### 3.2 Development

In essence, Māori development is about acknowledging, recognising and protecting cultural values that confirm and enhance an intergenerational obligation to tupuna and mokopuna and both biophysical and metaphysical resources.

Durie phrases it more specifically when he writes,

> “Māori advancement is about the better self-management of natural resources, greater productivity of Māori land, the active promotion by Māori of good health, a sound education, enhanced usage of Māori language and decision-making that effects Māori realities and aspirations.”

A Te Puni Kokiri commissioned report by the New Zealand Economic Institute of Economic Research on Māori economic performance or placement within New Zealand highlighted the strides Māori had made in contemporary development. According to the report, Māori not only had higher net savings than the NZ economy but were more profitable by 2%. The net result was they received less ($2.3m) than they actually contributed ($2.4m). This healthy contribution to the New Zealand economy comes at a time when the average Māori unemployment statistics are still well above both national statistics and international Organisation Economic Development statistics (12%, 5.4% and 6.7% respectively).

Positive development has expanded in some respects due to the increasing number of Treaty of Waitangi settlements that have either been reached or are in the midst of being negotiated. For the twelve year period from 1992 to end of 2004 redress figures totalled some $681.7 million (including the three ‘biggies’ of $170 million each for the Fisheries, Ngai Tahu and Tainui settlements). This figure will undoubtedly rise as other claims are settled. During 2004 there were 25 tribal groups fully engaged with the Waitangi Tribunal or Office of Treaty Settlements to settle claims involving Crown forest land. In the Central North Island and Northland districts alone there are approximately 350 claims being negotiated. Once settled these claimants will join the seventeen (17) claimant groups who have reached settlement since 1992.

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Most Waitangi Tribunal settlements have included negotiated areas of land to be returned to claimants either as part of the package or on a first-option basis. These negotiated land returns will augment the approximate 1.5 million hectares of current Māori Freehold land. It is not known to what extent however, because the Office of Treaty Settlements does not have any readily available figures for the hectarage that has been recovered in Treaty Settlement Claims.

This development progress has usually been initiated within the contemporary organisational structures that address an increasingly diverse range of activities involving Māori. Although some of these structures are informal committees which are usually associated with hapū or marae, most have been established by New Zealand legislation.

### 3.2.1 Contemporary structures

Some tribes, for example, have legislated bodies like the Trust Boards established under the 1955 Māori Trust Board Act. Some like Te Runanga o Ngati Porou and Te Runanga o Ngai Tahu had legislation specifically enacted for them. Others have new governance entities established in order to proceed post-settlement. Included too are Tribal/Māori sectoral organisations such as Charitable Trusts, Incorporated Societies, Urban or Iwi Authorities, and pan-Māori organisations, such as the New Zealand Māori Council and Federation of Māori Authorities. Still others continue to use Marae Trusts as their preferred vehicle. All these entities, regardless of what or how or when they were established – continue to have cultural aspirations as core development drivers.

These aspirations have been a long time fermenting. Despite the impressive economic statistics NZIER have reported, most tribes have been under-resourced for many years. Many initiatives have been (and continue to be) undertaken by volunteers. Processes adopted on an ad-hoc, case by case basis have been inefficient in the past. That is not to say, however, that they haven’t been effective. Many tribes would not be able to participate at all if volunteers had not secured table seats on many of the committee or consultation forums.

Moller et al., (2000) found that, aside from a small number of tribal or land trust organisations, tribal resource managers in many cases operate unfunded or are short of funds; have not had an opportunity to train in European management styles; have frequently learnt ‘on the job’ and have limited access to technology. Positive development in many cases has occurred largely as a result of some particularly astute volunteers. This situation is rapidly changing, however, as more tribal members undergo tertiary education or further training, or engage in development planning with outside agencies. Despite this, many New Zealanders continue to fail to recognise that contemporary Māori tribal organisations still suffer from the negative effects of post-

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colonialism. As Matunga points out, contemporary Māori socio-economic development “has an underlying historical context of arrested Māori development, caused by a lack of capital, infrastructure and planning autonomy to develop what resources remained in Māori ownership. In other words there is a lot of catching up to do.” This ‘catching up’ becomes apparent when others’ timeframes are not met by tribal organisations. Often this is due to the sheer multitude of issues that need to be considered, and the strain on limited tribal resources that is often unrecognised by or underappreciated by outsiders.

Māori governance committees are regularly faced with multiple tasks that stretch their resources and at times capacity. In my experience, they are akin to mini governments. It is not unusual for a single committee meeting to deliberate on matters ranging from national policy to local conditions. These can include deliberating on the intricacies of a proposed piece of legislation; examining the effects of a regional health research programme; assessing the education standards in the local high school or negotiating the environmental benchmark performance from the neighbouring fish factory.

In reality, the workload for a single committee encompasses fields usually addressed by multiple, dedicated and well resourced entities. The committee is responsible for researching, analysing, evaluating and framing appropriate tribal/hapū responses in all these fields. They are required to carry this out within time-frames that do not recognise their enormous workload, and which often does not acknowledge Māori methodologies.

3.2.2 Māori referenced planning aids

Such workloads can frustrate committee members whose preference is to be at the front end of planning instead of reacting to proposals. In order to be proactive and concentrate on strategic planning and development issues, committees adopt or adapt new tools to meet these needs. Planning tools are being selected, strategic wananga are being held, and new technology is being utilised. Historically, these toolkits and tools have been referenced from a western methodology or paradigm. Over the last decade or so there have been a number of Māori referenced and focussed aids that have been developed using existing conduits such as Public Science Funding or agencies such as Te Puni Kokiri. A recent example is another report commissioned by Te Puni Kokiri to ascertain some of the key drivers of a successful Māori organisation. Positive development examples of ten Māori entities were showcased in a joint Federation of Māori Authorities and Ministry of Māori Development (TPK) publication, “Hei Whakatinana i te Tūrua Pö”, where each of the organisations offered insights into their business,
core purpose, governance and management systems and structure frameworks.\textsuperscript{35} With an increasing land-base, financial and societal recognition of past injustices and a slowly maturing New Zealand society, Māori development can now start enabling their cultural aspirations.

3.3 Development Goals and Tools

Notwithstanding the continuous struggle against an increasingly reluctant New Zealand government, it is clear that if the previous decades were all about cultural affirmation, (reaffirming Māori identity, culture and right to existence) contemporary development is about focussing on cultural integrity. An approach that enables cultural integrity ensures the focus remains on genuinely expressing intrinsic cultural values while successfully manoeuvring within the equally complex legislative and commercialist frameworks of contemporary New Zealand society. In other words; ‘we’ve talked the talk, now we should walk the walk’.

This future-oriented but past-cognisant approach to development is described in Loomis’ work,

\begin{quote}
“Māori are conscious that the richness of their retained values, customs and institutions (e.g. extended family, reciprocity, needs of future generations) are more rather than less relevant as they explore avenues toward more holistic, self-determined development.”\textsuperscript{36}
\end{quote}

Durie believes it is better to focus on adding value to Māori lives, Māori knowledge and Māori society.\textsuperscript{37} This proactive and aspirational direction is articulated in many new plans that have been adopted as development tools.

Strategic visionary plans such as the Ngai Tahu 2025 document and the Ngati Tūwharetoa “Ngā hapu o Ngati Tuwharetoa Strategic Plan 2000” are indicative of the planning statements used by tribes to communicate their development goals in a manner that is consistent with and resonant of their tikanga. Ngai Tahu’s introduction to their vision document outlines their requirements and aspirations;

\begin{quote}
“Ngai Tahu 2025 is about tino rangatiratanga. It is about the ability to create and control our destiny. It is our tribal map that in the year 2025 will have carried us to the place where we are empowered as individuals, whanau, hapu, Papatipu Runanga and iwi to realise and achieve our dreams."\textsuperscript{38}
\end{quote}


Sometimes referred to as iwi management plans, hapū resource management plans, strategic plans and tribal policy statements, these plans represent perhaps the most significant Māori development in environmental planning in the last 20 years as articulations of tribal thought.³⁹

Iwi Management Plans (IMP) can range in size and depth from volumes comparable to District or Regional Plans to comparatively slender plans with a basic structure and layout. There are comprehensive policy IMPs, and briefer articulations containing key elements of whakapapa, manawhenua, tikanga, issue identification and an explanation of desired outcomes. Each IMP is distinctive in that it articulates a ‘personal’ statement particular to that tribe. While it may be convenient to homogenise ‘Māori’ issues as if ‘Māori’ were one grouping, in reality ‘Māori’ are a range of groupings. Though interrelated, they are also distinct, autonomous, discrete and separate. Values, tikanga, kawa, aspirations and requirements can vary from tribe to tribe and even hapū to hapū. ‘One size does not fit all’, and the range of IMPs being developed reflects this.

Ngati Te Ata described their decision to develop an IMP thus,

“*We chose to break out of the cycle of reacting and being controlled by others to a state of control over our own affairs, defining our preferences and laying the ground rules for any interaction between ourselves and others.*”⁴⁰

Many IMPs have a distinct focus on environmental management. It is in this forum that many gains have been made in terms of the participation and articulation of tribal aspirations within New Zealand’s legislative framework. The Ministry for the Environment Sustainable Management Fund underwriting of “Te Raranga a Mahi”, a toolkit designed to assist Iwi Management Planning, illustrates this point.⁴¹ Setting out frameworks, templates, case studies and resources for the preparation of an IMP, this toolkit ranges from why (plan) to how (to do) phases. The project team responsible for creating it consisted of two Māori entities (Te Runanga o Ngai Tahu and the Wellington Tenths Trust) and one corporate entity (Beca Carter Hollings and Ferner Ltd). Between them they wove together a toolkit closely focussed on ensuring that the groundwork is done, that planning is inclusive, clear and well prepared, and that the resulting plan is both accepted and acceptable.

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A natural resource management plan, Kai Tahu ki Otago, has been produced by the combined Rūnanga from the Otago region of Te Wai Pounamu. This plan characterises many of the aspirations for IMPs. Kai Tahu ki Otago is,

“an umbrella statement for prioritising and directing Māori efforts in environmental protection through the Resource Management Act. It sets up a mechanism to coordinate and facilitate better integration of iwi needs in processes and functions undertaken by DoC, the Regional Councils and several minor local body authorities.”

Harmsworth describes the way different Māori representatives articulated and characterised their own values during a planning hui at Waiapu.

“Representatives from different iwi provided a wide cross section of views on Māori values, and how they should be recorded. At the detailed level, each iwi had a variable set of environmental and planning issues to contend with. Other subjects discussed at hui included the suitability of this type of information on planning databases, Māori value classifications and inventories, cultural and intellectual property rights, iwi and hapu management plans and planning issues for each iwi/hapu.”

The Ngati Tuwharetoa Environmental Iwi Management Plan also sets out their own personal tribal stamp of authority over the direction and purpose of their management planning,

“The hapu of Ngati Tuwharetoa assert their custodial and customary right of tino rangatiratanga over their respective taonga, and Tuwharetoa collectively, will sustain and protect the life force of all tribal and inherited taonga.”

The creation of an Iwi Management Plan or Environmental Plan also has implications in the Resource Management Act. Section 61 (2)(a)(ii) provides that a regional council shall have regard to any “relevant planning document recognised by an iwi authority affected by the regional policy statement”. Section 74 (2) (b) (ii) of the Act also provides that a district council should have that same regard.

Having created their own specifically focussed plan provides iwi with a highly specialised tool when interacting or negotiating with consent authorities. As the Ngati Tuwharetoa EIMP points


out however, if working only within the resource consent ambit the tribal ability to effectively manage natural resources/taonga may be constrained.\textsuperscript{44}

### 3.3.1 Cultural resource inventories

Another Māori development tool that is increasingly being utilised are cultural resource inventories. Planning toolkits such as “Hapu and Iwi Resources and the Quantification” (Winiata 1986), “Mauriora Ki Te Ao, an Introduction to Environmental and Resource Management Planning” (Te Puni Kokiri, 1993), “Strategic Planning, A framework for practitioners” (Henare based on Hines, 1998) and the aforementioned “Te Raranga a Mahi, Developing Environmental Management Plans for Whanau, Hapu and Iwi” (Te Runanga o Ngai Tahu, Wellington Tenths Trust, Beca Carter Hollings and Ferner Ltd, 2000) provide insight, frameworks and references from which to develop relevant and pertinent planning documents. Within these documents, resources that are valued as integral to the tribal collective are quantified, assessed and evaluated. Whether the resource is tangible or intangible, biophysical or metaphysical, owned or leased or just important to the tribe, the inventory typically allows priorities for protection or enhancement to be assessed.

Mentioned increasingly within these plans and reports is a technology called Geographic Information Systems (GIS). GIS is recognised both internationally and within New Zealand as a tool that stores, analyses and communicates spatial data. A fundamental aspect of GIS is not only its analytical power but also its output – a map communicating specific placement and character of spatial and temporal data.

### 3.4 Mapping and GIS

Using maps as a means to communicate is by no means new.

Mapping methods have evolved as new technology emerges and are often utilised contemporaneously. As mentioned in the Preface, kōrero and other aural transmitters of cultural cartography have been used for generations to reinforce relationships to tīpuna and tūrangawaewae. In this manner, the rich heritage of a people’s history are preserved and handed down to successive generations devoid of paper placemakers. Referring to Canadian First Nation peoples, Tobias writes of this phenomenon - “First Nation peoples carry maps of their homelands in their heads. For most people, these mental images are embroidered with intricate detail and knowledge, based on the community’s oral history and the individual’s direct relationship to the traditional territory and its resources.”\textsuperscript{45}


\textsuperscript{45} Tobias, T.N. (2000). Chief Kerry’s Moose, a guidebook to land use and occupancy mapping, research design and data collection, Vancouver, Canada: Union of BC Indian Chiefs and Ecotrust Canada joint publication. p1
Through the centuries, relationships to space have also been physically mapped. The media used has ranged from 6th century mosaic tiles to sealskin paintings to papyrus to jewelled collars to sticks to terracotta to maps picked out on building reliefs and also paper. The subject matter traversed both celestial and terrestrial features. A Chinese star chart from the Tang dynasty (618 – 906 BCE) depicted the night sky and was divided according to the stations of the planet Jupiter into 12 sections.⁴⁶ A Babylonian world map thought to have dated from 600BC depicted relationships between legendary regions beyond the ocean.⁴⁷ The man-made world also featured in early mapping efforts as illustrated in the Aztec map of their capital city Tenochtitlan which depicted the city's social layout.⁴⁸

Over the centuries, paper maps have ranged from rough drawn sketches identifying geographical landmarks, trading routes and national boundaries to full-blown cartographic maps detailing natural and man made features at a micro-level. They have been used to illustrate more than just peoples perceptions of the spatial elements of their world. Over those centuries, the map has come to hold an ‘authority’ or a ‘power’ that transcended its’ intrinsic value. The power of the map was controlled by those who controlled the map. The map consequently, often became a tool of colonisation (as for example, in the Americas, Scandinavia, Africa, South East Asia and of course New Zealand).

3.4.1 Geographic Information systems

In that context, the suggestion to use a mapping programme for indigenous development may appear paradoxical. However, as noted previously, development tools are often adopted or adapted to meet development goals. The same applies to Geographic Information Systems.

Descriptions of Geographic Information Systems (GIS) vary. It can be described as a computer mapping tool that shows the co-relationship between different attributes. Harmsworth describes GIS as being “highly suited for generating ‘visual’ spatial information which helps people understand relationships between information, concepts, and ideas.”⁴⁹

ESRI (Environment Sciences Research Institute), the creators of ArcInfo, has a more technical description - “A geographic information system is a system for management, analysis, and display of geographic knowledge, which is represented using a series of information sets such

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⁴⁷ ibid. 22
⁴⁸ ibid. 43
as maps and globes, geographic data sets, processing and work flow models, data models, and metadata".50

Palminteri et al. (1999) describe GIS as a system that “combines computer software with hardware to access, view, manipulate, and display a wide range of geographically-oriented information, such as land uses, soil types, vegetation types, rainfall, elevation contours, human infrastructure or species distributions – anything that can be mapped.”51

The mapping and predictive modelling programmes bundled under the Geographic Information Systems nomenclature has widespread use within New Zealand. As will be shown in later chapters, the advent of GIS technology has also found favour with several Māori roopū who utilise it for tribal development initiatives.

3.5 Summary

This chapter has outlined the foundation from which the use of GIS can be viewed. Its discussion of Te Ao Māori makes it clear that as an inherent aspect of Māori epistemology, kaitiakitanga and its responsibilities will remain critical as Māori development proceeds. Increased Waitangi Tribunal settlements have and will, see more whenua returning to tribes who are using an increasing number of planning tools to achieve development goals. There is also expectation that the land that is returned will be of greater use than that currently owned (see Table 2: Māori Land Use Capability, p37). Tools such as Iwi Management Plans, whereby development goals are being articulated from an iwi perspective, are being used to signal, plan and achieve those development goals.

As will be discussed in subsequent chapters, technology such as GIS has been adopted by some roopū here in New Zealand and many indigenous peoples internationally so as to achieve development goals. In order to better assess the growth of indigenous mapping52 and the efficacy of GIS it is necessary to investigate it further through published records which the next chapter does.

50 http://www.esri.com/getting_started/index.html
52 variants of which are called participatory mapping and ethnocartography
Chapter 4: Indigenous GIS

This Chapter reviews GIS use within New Zealand. Beginning with a description of a general study conducted to ascertain the decision making effectiveness of GIS within NZ organisations, it moves on to studies that describe Māori GIS use. As the number of publications on Māori GIS is still very low, a number of indigenous studies from international sources are also described. These studies are then used to position my work within the small but growing body of studies for Māori GIS.

The descriptive approach adopted for this Chapter serves two purposes. The first is that as a new tool, Māori GIS has very little written about it. This means that the initiatives and the manner by which the tool has been adopted are of interest as they have not been collated in one piece of work. Secondly, the problems associated with the adoption of this new tool that have been identified by other writers illustrate the barriers to efficient uptake of new technology, and so are very pertinent to the objectives of this research.

4.1 Lien, 2001, GIS is an effective decision making tool

Lien investigated the decision making effectiveness of GIS within New Zealand organisations. Survey results of 60 respondent organisations using GIS (from an initial pool of 285 questionnaires and 65 responses) showed that GIS is considered to be an important decision support tool that improved decision performance and is useful and easy to use for decision making.

On the whole Lien found that decision makers mostly used GIS to support data integration, environmental and resource planning, site location selection and territory or neighbourhood mapping as well as to support what-if questions and strategic planning. The study concluded that both tangible and intangible benefits accrue to GIS use.

Overall, Lien found that decision makers perceived GIS tools to be easy to operate, and made it easy to achieve the required outcome. They found interactions with GIS to be clear and understandable and found it easy for them to become skilful at using GIS for decision support.

However, although the study found that decision makers found GIS easy to use for decisions of low and medium complexity, once those decisions became more complex, ease in using GIS decreased. This is unsurprising given that full blown GIS are highly technical software programmes able to perform complicated analysis. Thus the higher the degree of complexity of decisions, the higher the degree of skill required to undertake the analysis. This facet is common to several of the following studies.

### 4.2 Payne, 1991, cost effective spatial research for Waitangi Tribunal claims

Vaughn Payne’s 1991 study of the information needs for Waitangi Tribunal claims also identified decision making issues and spatial information problems affecting the parties’ efficiency and ability to conduct rigorous claims hearings and negotiations.\(^{54}\)

Payne surveyed respondents involved to some degree in Waitangi Tribunal claims. Officials, claimants and researchers all recognized spatial information problems associated with claims.\(^{55}\)

Twenty one different types of perceived problems, causes and impacts were identified by Payne during his survey. Seven causal sub categories were identified\(^ {56}\).

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\(^{55}\) Ibid. 81
1 Coordination of research, funding and resources;
2 Spatial information was expensive, poor records were held, lack of awareness of what
was available;
3 Procedural, organisational and ad hoc nature of Crown responses;
4 Crown only supplies spatial information on request;
5 Complexity of claims;
6 Lack of communication and understanding;
7 Research logistics.

Payne was of the opinion that, not only did claims inherently involve spatial and temporal
information but that the spatial representations of such information were a common language
between all parties. He observed that people of diverse backgrounds more easily understood
claims by way of spatial representations (e.g. maps) than by way of aspatial representations of
the facts (e.g. reports). Accordingly Payne concluded that spatial information could help
reduce the complexities surrounding Waitangi Tribunal claims. He also concluded that claims
needed to be communicated not only between decision makers, but to others, including the
general public.57 Spatial information therefore was a common, natural and simply understood
medium for communicating issues between parties, thereby enhancing understanding and
ultimately finding resolutions.58

When considering decision making issues, Payne maintained that quality decisions depended
on reliable information and informed decisions were vital for the claims process. As Lien finds
in her later study, Payne concluded that,

“Spatial information, like all information, simply supports or aids decision
making. Accordingly, the objective or potential objective of using spatial
information, regardless of the user, can be defined in terms of the information
cycles:
  i. an aid to data collection and organisation
  ii. an aid to extraction and formatting
  iii. an aid to analysis and problem solving; and
  iv. an aid to prediction and projection59

To help eliminate primarily administrative causes of spatial and aspatial information
deficiencies, Payne proposed a digital national database of basic spatial information applicable
to claims be established.

57 Ibid. 63
58 Ibid. 64
59 Ibid. 83
Payne recommended that the Waitangi Tribunal [and tribes] build up a chronological and statutory picture of land confiscations. Spatial and temporal information would then be related to assist an understanding of the claim and the realities in which it is addressed. Obvious questions that could be answered by a digital national database included:

- What and where are the traditional land rights of the claimants?
- Where, why and by whom was land confiscated?
- Was land used for the purpose it was taken?
- Was any land returned to the claimants and
- What Māori and Crown land holdings currently exist in the tribes' traditional area?

The Waitangi Tribunal and later the Crown Forestry Rental Trust would eventually provide much of this information in a regional format.

Payne concluded that “while implementation of the proposed solution may involve some ‘expense’, coordination with existing processes would reduce this cost. Moreover, the long-term benefits of cost-effective spatial information research to the claims process and other processes cannot be overstated.”

4.3 Jackson, 1997, GIS supports and facilitates complex textual and oral evidence

Echoing many of the problems and benefits identified by Payne, Moira Jackson’s study also found that GIS facilitated understanding and enhanced presentation of complex textual and oral evidence. Jackson’s research centred on claimant use of GIS within Te Uri o Hau o Te Wahapu o Kaiparas’ Waitangi Tribunal Claim. Identified by Jackson as the first time GIS had been used in such a way, the Claims Committee employed GIS for its descriptive functionality. This enabled a series of maps to be created depicting relevant information to complement the various reports presented at hearings and to facilitate understanding and enhance presentation of the complex textual and oral evidence being presented.

GIS coverages constructed for the claim consisted of –

- Digitised hydrological and soil type coverages
- Database construction of cultural and physical data. The cultural data consisted of land partition data, traditional history of locations and travelling and archaeological data. Physical data consisted on lakes, rivers, soil types, land contours, vegetation and coastal changes on Pouto Peninsula

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60 Payne (1991), p. 110
62 ibid. 128
Land partition data created using land block map coverages, Māori Land court maps and cadastral maps.

Data and information used to construct the cultural and physical datasets was obtained from numerous sources. Traditional datasets consisting of place names on the peninsula used information supplied by kaumātua. Coverage relating to the trails people used for harvesting was drawn from oral discussions and a written questionnaire. Archaeological data was sourced from the New Zealand Archaeological Association Site Record inventory, archaeological reports and also early geology reports on which pā sites were marked. Physical data coverages were sourced from DOSLI.63 Coverages consisted of the current coastline, 20m land contours, lakes, rivers, soil types and vegetation of Pouto Peninsula.

Several factors influenced how data from the NZ Archaeological Site database were able to be used. Errors were found to have occurred during the initial recording of sites and out of date location grid references (based on the pre-metric system NZMS map series) were used. Archaeological site records were also found to be inconsistent in describing archaeological sites. At times individual sites were recorded, and at other times clusters of sites were recorded as one record. Spatial dimensions of pā sites were also not consistently or accurately recorded. There was a need therefore to check the actual site record to ensure accuracy and to use the NZ Historic Places Inventory to overcome site record co-ordinate issues.64

Claimants also found that a cluster of pā marked on early geological maps were not included on NZAA site records, and that archaeological records did not always correspond with known or traditional pā sites. Some prominent pā were not recorded and some pā were recorded but found to be inaccessible (due to privately owned pine forestation on the land blocks).

Difficulties also arose with inconsistent or unequal scale issues when preparing data for digitising. Some difficulties arose using old (1982) cadastral maps obtained from DOSLI. These hardcopy maps were used because digital cadastral maps were considered too expensive at that time. Another reason cadastral maps from DOSLI were used was that “it proved impossible to accurately digitise direct from the MLC maps in a form suitable for GIS analysis.”65 Eventually comparison of GIS acreages for land block size and MLC land blocks size were able to show a strong correlation in most cases for the Pouto blocks except two blocks where extensive geomorphological changes had occurred.

63 Department of Survey and Land Information – now Land Information NZ/Terralink
64 Jackson, (1997), p. 101
65 Jackson, (1997), p. 130
Claimants also linked map types for investigation into the temporal changes in their land base. The process involved working from the most recent printed cadastral map back through time. Data from earlier 1961 maps were utilised to create a coastline map. Detail from some early geology reports were able to produce a coverage of the early twentieth century coastline. Coverages showing multiple land partitioning (showing temporal and physical change) made it possible to visualise cultural and historical loss.

Ultimately 49 maps were produced to accompany claimant evidence to the Waitangi Tribunal using various combinations of the coverages. The use of GIS enabled a comparison of the archaeological data with other data, including the land block data to support claimant arguments emanating from iwi land alienation. Although difficulties with acquired data proved vexing and problematic during the construction of the necessary coverages, Jackson concluded that all in all, GIS facilitated understanding and facilitated presentation of complex textual and oral evidence.

4.4 McDowall, 1999, GIS assists negotiation and empowerment

The opportunity to show geo-spatial relationships as a negotiating tool in Waitangi Tribunal claims is also highlighted within McDowall's work. McDowall used two case studies (a Taranaki Treaty claim and Te Puni Kokiri’s Māori Land Information Base project) to explore the usage and experience of GIS technology and the manner whereby the tool mediated the objectives of social groups.66

McDowall's first case study investigated the adoption and use of GIS by Taranaki Iwi as a technology to assist in negotiation processes between iwi and the Crown. The second case study examined the integration of GIS technology into Te Puni Kokiri to assist empowerment of Māori.

In the first of his case studies, McDowall examined the way in which the Taranaki iwi collective of Ngati Tama, Te Atiawa and Ngati Mutunga cooperatively used MapInfo GIS as a Treaty settlement negotiation tool. The ability to locate and define various geographic entities, to show the spatial elements of land confiscation and to prove a credible history of ownership was obviously beneficial at the Tribunal Hearings. Moreover, the benefits GIS could bring to Treaty settlement negotiations were readily apparent to claimants. These included managing the vast amounts of spatial and aspatial information accumulated throughout the hearings and negotiation phases. Post-settlement, GIS could also be used as an economic development

and resource management tool. Overall, GIS assumed a range of focal applications that McDowall summarises.\(^67\)

- The creation of a spatial database for land information. This was achieved through associating information pertaining to the attributes of land, with a spatially referenced geographic location – or linking the ‘what’ with the ‘where’
- Query and analysis of aspatial and spatial entities (e.g. analysis of relative amounts of land confiscated in the North compared with that of the South)
- Description and visualisation of land and its qualities
- Assessment (for themselves) of the claims of the Crown relating to Crown land, so as to provide grounding and evidence for argument

The Tribes found that this technology provided a strategic means with which to argue their position, enabling them to identify land they wished to receive as part of the settlement. The negotiators found that as much of the data was sourced from Crown entities (such as Terralink and the Māori Land Information Base) it was difficult for the Crown negotiators to dispute it. This gave claimants a clear advantage during negotiations. They were able to “take the Crown’s evidence, make their own interpretations and then (re)present it back to the Crown in support of their own arguments.”\(^68\) In fact the negotiators found they were at times better informed than the Crown negotiators - “Its main value in the claims process has been to work out what the Crown has got. So we’ve been one step ahead of them and been able to argue about things that they don’t even know that they own.”\(^69\)

Using another inherent functionality of GIS, claimants were able to challenge the Crown’s assumptions about land loss in their region by showing that a proportionately larger amount of land was confiscated in North Taranaki. This supplied the iwi with evidence to argue for a greater share of land in the settlement. They also produced outputs (hardcopy maps) that were able to visually illustrate spatial patterns to enhance overall comprehension of the data.

Like Jackson, McDowall identified the acquisition and translation of digital data as two barriers encountered by the Taranaki collective. Acquired data was found to be inaccurate at times and at other times it was in a format unable to be interpreted by the MapInfo software programme. This required it be sent away to be ‘massaged’ or reformatted by the vendor. Quality data was fundamental to providing a credible case and maintaining and updating the data proved costly in terms of time and dollars. Training proved to be another barrier. Three copies of MapInfo were purchased; one copy located with the central member of the negotiation and research team, the other two copies to the Tribes’ Treaty claim lawyers. The

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\(^{67}\) McDowall (1999), p. 59  
\(^{68}\) McDowall (1999), p. 59  
\(^{69}\) Te Atiawa negotiator and GIS user, cited in McDowall, p. 55
training new users received (two to four days) proved to be too superficial and insufficient for their ongoing needs.\(^7^0\)

These barriers reflect Liens findings that the more complex the decision making the less easy it is to use GIS. In this instance, although users were working within decisions of low and medium complexity they were unable to optimise the technology due to project infrastructural issues relating to data quality and training.

For the Taranaki claimants McDowall concludes that the application was empowering. It facilitated their ability to manage geographic information and their capacity to interpret, visualise and communicate evidence. However the barriers such as those mentioned for data acquisition and training issues mediated their interactions, funnelling them into particular courses of action.\(^7^1\)

In McDowall’s second case study, land was also the central theme that led Te Puni Kokiri (TPK) towards utilising GIS.

In 1994 Te Puni Kokiri’s internal Economic Development Branch implemented a desktop GIS programme in order to acquire quality information regarding the amount of Māori land, the administrative structure of Māori land blocks, the number of owners for each block, an estimation of capital value and to create a perception of accessibility and cost effectiveness. This would assist them in their responsibilities to write policy and make recommendations to Ministers and Cabinet on Māori land issues in a manner not solely reliant on anecdotal evidence where Māori land was a central focus. There were also longstanding organisational links between TPK and the Māori Land Court (MLC) who administer Māori land, succession records and title records. A tangential but mutual benefit could accrue to both agencies by adopting a GIS.

A Māori land dataset, created from MLC records, was integrated with the capital value and total value data from the Valuation New Zealand property data roll. It was then referenced to the Digital Cadastral Database to provide a spatial dimension to the data. The resultant data coverage enabled TPK to calculate the total and relative Māori land area by region for New Zealand and to summarise the number of Māori land blocks and the average land area per land block. It also allowed the precise location and calculation of Māori land cadastral boundaries. A second overlay with the Land Resource Inventory coverage also produced new

\(^7^0\) McDowall, (1999), p. 63
\(^7^1\) Ibid. 64
information that reformed opinion on Māori land arability. The overlay result clearly showed that Māori land was considerably less arable than TPK expected.72

<table>
<thead>
<tr>
<th>Māori Land Use Capability</th>
<th>% of Total Land</th>
<th>% of Māori Land</th>
<th>Description of Land Use Capability</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.71%</td>
<td>.40%</td>
<td>Most versatile multiple-use land - virtually no limitations to arable use</td>
</tr>
<tr>
<td>2</td>
<td>4.55%</td>
<td>2.69%</td>
<td>Good land with slight limitations to arable use.</td>
</tr>
<tr>
<td>3</td>
<td>9.22%</td>
<td>5.75%</td>
<td>Moderate limitations to arable use restricting crops able to be grown.</td>
</tr>
<tr>
<td>4</td>
<td>10.31%</td>
<td>9.81%</td>
<td>Severe limitations to arable use. More suited to pastoral and forestry.</td>
</tr>
<tr>
<td>5</td>
<td>.79%</td>
<td>.038%</td>
<td>Unsuitable for cropping - pastoral or forestry.</td>
</tr>
<tr>
<td>6</td>
<td>27.98%</td>
<td>34.04%</td>
<td>Non-arable land. Moderate limitations and hazards when under a perennial vegetation cover.</td>
</tr>
<tr>
<td>7</td>
<td>21.45%</td>
<td>32.19%</td>
<td>With few exceptions can only support extensive grazing or erosion control forestry</td>
</tr>
<tr>
<td>8</td>
<td>22.10%</td>
<td>13.28%</td>
<td>Very severe limitations or hazards for any agricultural use.</td>
</tr>
<tr>
<td>Other</td>
<td>2.97%</td>
<td>1.43%</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>100.00%</td>
<td>100.00%</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Māori Land Use Capability


TPK officials also applied the ‘new’ information to support their contention that geothermal developers were wrongfully excluding Māori from consultation rounds. The TPK analysis indicated that approximately one third of the Taupo volcanic area was Māori freehold land. While this would not (re)secure ownership of the resource, the analysis enabled groups to effectively negotiate for inclusion in the consultation round and bargaining process since they had a measure of control over access to the resource. 73

72 McDowall, (1999), p. 70
73 ibid. 72
TPK also considered what to do with their GIS and how to make their ‘public-good’ information widely available in order to publicly fulfil aspects of their designated governmental role as well as maximising the terms on their investment. They decided to make copies of the data sets free of charge for those organisations that were GIS capable and would institute an internet site with free access. Several roopū prior to February 1999 took advantage of the free dataset initiative. Authority for the dataset distribution now resides with the Māori Land Court. 

Figure 4. Māori land and geothermal fields in the Taupo volcanic zone (central North Island)


75 At the request of the Māori land owners forum the spatial data is not now available for distribution until policy is established on the access and use of digital data. Justice Department communication, March 2005
TPK then moved to provide a free of charge online service on their website. TPK’s GIS and Information Technology team developed an online MLIB spatial server project. This innovation was the first time in Australasia that indigenous spatial data, stored in an online database could be interactively visualised. Basic search, location, zoom and centre functions were able to be used by any internet user anywhere in the country (or world). This would enable users to visualise the local context of Māori land blocks and allow them to display limited information for any land title block that the user selected.

![Thematic map](image)

**Figure 5, Example of a thematic map detailing number of Māori owners per Māori Freehold Land Block, Te Puni Kokiri, 1995**

McDowall found that the TPK project encountered barriers similar to those affecting Taranaki users. These tended to occur around issues of data and training, although the TPK situation was further complicated by their desire to initiate the free internet site. Decision makers within the TPK economic development branch had an unrealistic perception of how financially consuming GIS could be, and also underestimated the cost in terms of human resources. Training needs required the use of external specialists, and senior management were also sceptical as to the need for an internal GIS specialist.

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76 McDowall (1999), p. 74
78 McDowall (1999), p. 76
Again, as in the Taranaki experience, new users were frustrated with training that focused on developing ability with only limited emphasis on conceptual explanation of GIS. They pointed out to McDowall that “the ability to perform meaningful, flexible analysis with a GIS cannot be attained from a series of specially tailored training exercises”. Users ultimately felt that they were largely incapable of driving the GIS to examine ‘real life’ data and situations - commenting that “MapInfo is still ten to twenty times more difficult for the average layperson to understand than Microsoft Word”.79

McDowall summarises their dissatisfaction when he writes,

“As a consequence of the users’ underdeveloped understanding of MapInfo’s structure and the concepts employed, accompanied by the lag between training and the application of knowledge, non-expert users felt that they were incapable of using GIS for applications beyond the viewing of spatial data. In-house staff were largely incapable of dealing with GIS operations beyond the most simple spatial queries.”80

A facet of GIS output that McDowall also canvasses is how Western cartography standards impact on indigenous map makers. He maintains that GIS is a non-neutral tool for map-making, and data acquisition (in terms of quantity and quality) can ‘weight’ the production of maps. Drawing on Curry, Rundstrom and Harley, McDowall posits that,

“the creation of digital geographies is neither neutral nor innocent. The sources, selection, and structures of the data represented; the methods of analysis and visualisation used to extrapolate information; and the means employed to communicate tailored graphic and tabular information to an audience are subjective expressions of knowledge and power.”81

He concludes that “although the end data sets may appear neutral, they are expressions of the values and politics arising from the struggles between interest groups, and are reflective of patterns of dominance.”82 Moreover GIS, like any technology, possesses “the potential to marginalise and assimilate alternative systems of knowledge.”83

To illustrate his point, McDowall uses examples of Rundstrom’s work. Rundstrom uses two examples (the Zuni and Hopi nations) to support his assertion that GIS can be or has been

79 McDowall. (1999), p. 76
80 ibid. 77
81 Ibid. 31
82 Ibid. 25
83 Ibid. 26
used to assimilate indigenous peoples into “a white way of living and thinking” by converting linguistic landscapes into English.\textsuperscript{84} In the Zuni example, Rundstrom reported that Zuni residents,

\begin{quote}
“were solicited for Indian names, but other names were substituted in some cases because the original name was declared too humorous for a 'proper’ road name. All were translated into rough English equivalents.”\textsuperscript{85}
\end{quote}

Rundstrom also highlighted the Hopi nation experience where neither the cartographic process nor the design characteristics could accommodate Indian placenames. In the Hopi example diacritical marks for the Hopi language were unacceptable to United States Geographic Names Information Systems (GNIS) cartographers. There was no allowance for field markers indicating linguistic origin for names. Toponyms, often much longer than typical English placenames, were also unsupported by GNIS systems.

McDowall singles out a New Zealand work, the 1997 Historical Atlas of New Zealand, as a New Zealand contribution that challenges this cartographic status quo.\textsuperscript{86} The 1997 volume makes a significant contribution to indigenous cartography depicting a Māori cartographic account of New Zealand geography and history in several plates found within the volume (see further, page 62).

The final facet that McDowall traverses within his study that is relevant to this study is data collection and information management issues relative to wāhi tapu. Acknowledging that GIS is incapable of fully reflecting or capturing the relationship Māori have with the whenua, McDowall reminds us there are also possible beneficial outcomes if GIS is adopted. The potential loss of kōrero relating to wāhi tapu (alongside other meaningful traditional kōrero) through the aging and passing of our kaumātua can perhaps be mitigated by ‘capturing’ some of this kōrero in a GIS system.

The potential change in storing and transmitting traditional kōrero aside, access issues emanating from storing sensitive information within a technical database were also central to issues faced by Whakatohea during investigation into a joint venture GIS project with the Opotiki District Council.

\textsuperscript{84} Rundstrom, cited in McDowall (1999) pp. 25 - 26
\textsuperscript{85} Rundstrom, cited in McDowall (1999) p. 25
\textsuperscript{86} McDowall, (1999) p. 39
4.5 Kamau, 1999, GIS and local government, a mutually beneficial opportunity

The Resource Management Act 1993 and its subsequent Amendments place a firm responsibility on local authorities to give regard to sites of significance to tangata whenua as a matter of national importance (Resource Management Act 1993, Section 6(e)).87 However, there is widespread concern amongst tangata whenua that sensitive information about wāhi tapu sites and their location information are not operationally secure within a local authority organisation. They are accordingly reluctant to share that information.

Nevertheless, this reluctance need not necessarily remain a barrier for local authorities to fulfil their obligations or for mutually beneficial relationships to be formed or enhanced with tangata whenua. Rawinia Kamau in her 1999 thesis describes one such mutually beneficial relationship opportunity between local government (the Opotiki District Council) and iwi (Whakatohea).88

The focus of Kamau’s study centred on what she considered to be “one of the most contested areas of local authority; iwi interaction, resource allocation and resource use.”89 A proactive joint project, initiated by Council and carried through to its IT (Information Technology) and GIS policy formulation stage, was then picked up by Iwi who initiated a proposal to design and implement a GIS application capable of storing and managing Waahi tapu information. The Opotiki District Council (ODC) and Whakatohea spent a considerable amount of time investigating the establishment of a joint GIS project that was intended to culminate with the lodgement of a wāhi tapu application with the ODC. This application would be constructed in a manner that not only preserved and supported iwi requirement for information about sensitive wāhi tapu being protected but also supported local governments compliance with the Resource Management Act.

Overall Kamau found that, while there may have been a history of imposition, an imbalance of power between local government and tangata whenua, and a clear difference in ‘culture’ between the two entities - “the exploration of GIS as a medium for an interaction between local government and tangata whenua worked well”.90

During hui and interviews it became clear that there was a basic need for a general upskilling of understanding of GIS (by both parties) and a much wider appreciation of its capacities (on both sides). It was also clear that there was a need for local authorities and tangata whenua

87 This responsibility is now also directed in Section 77 (1) (c) of the Local Government Act 2002.
89 Ibid. 59
90 Ibid. 79
to become better acquainted with the legislative framework within which each entity operates (in this case a local authority and Māori Trust Board). Concomitant to this better acquaintance was a need to better understand each others operating and management processes.

The proposal that eventually emerged from significant dialogue and meetings between the ODC and iwi entities established a joint data management project where local government would sponsor a wāhi tapu application by providing technical mechanisms and initial training and tangata whenua would be responsible for housing and maintaining the project. Agreed data transfer protocols would need to be built but overall control over sensitive information management and access would remain with iwi. This would remove some of the iwi’s fears while the local authority would have robust and agreed precision information thereby assisting the local authority fulfil its legislative requirements.

Within the proposed joint project were recommendations to implement a number of agreed security levels and a range of security measures. Access to actual location data and its aspatial information would be restricted, dependent on agreed protocols. It was anticipated that these mechanisms would allow privacy and security of culturally valuable and sensitive information.

Three levels of data protection for layers were proposed:

- Level 1, designated as “Private”, where information private to Iwi/hapu was housed;
- Level 2, designated as “Sensitive”, where information was available to the Council but not the public and
- Level 3, designated as “Public”, where information was available to public.

Kamau also mentioned the development of fuzzy maps for wāhi tapu locations as an additional mechanism to provide added security for information. GIS applications have an inbuilt function that enables buffers to be calculated. These buffers are calculated at a user-prescribed radius from a centre point (or line or polygon). Wāhi tapu have often been located as a buffered point location in a GIS. The centre point (wāhi tapu) is therefore easily discerned if standard buffering techniques are used. One simple method to overcome this problem is to construct circular buffers whose centre point is off-centre the actual location of a wāhi tapu. Another method is the construction of random polygons that are dropped over sites of significance, centre offset (for example see Appendix Guide, page 44 and 45). The building of these fuzzy maps therefore helps to preserve sensitive wāhi tapu locations.

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91 Kamau (1999), p. 77
92 Ibid. p. 56 and p. 95
93 Laituri also discusses this, “Two mechanisms for security and privacy of sensitive information is the use of silent files whereby the appropriate groups holds the silent file (with attribute information) and the land titles containing wahi tapu are marked in local authority plans whilst the exact location of the sites is concealed. Alternatively, the GIS
The iwi/council joint venture project created an opportunity for congruent capacity building for both Council and tangata whenua. Both were able to learn more about GIS, each others respective legislative, operational and management processes and increased the Councils’
capacity to interact with tangata whenua. Although the proposal was supported by key people
within both organisations the project was ultimately not finalised during Kamau’s research
period. This is a common phenomenon for research projects and is not limited to those
involving local authorities and iwi.

The study increased awareness between local government and iwi of their differences and
similarities and also focussed on the management of information, in particular the importance
of information management for sensitive knowledge such as wāhi tapu.

In his 1998 thesis Hauiti Hakopa also discusses the complexities of using GIS as a modern
technology without compromising traditional customs.94

4.6 Hakopa, 1998, benefits from integration of GIS technology

Commenting that “Computers, LIS/GIS technology are sweeping through several countries of
the world, influencing the way that Indigenous cultures use their knowledge to interact with the
demands of the modern world.”95, 96 Hakopa urges Māori to be not “merely entertained by the
wizardry of new technology”, but to, “take control and dictate what is appropriate technology
and what are the appropriate methodologies for implementing and using it without
compromising traditional values. It is absolutely essential, that GIS is created by Māori for
Māori needs.”97

Using both Māori and other international indigenous examples to support his assertion, he
states that,

“Māori can benefit immensely from the integration of GIS technology and the
like as demonstrated by other Indigenous peoples without compromising their
values that make them unique. The primary reasons are the preservation of
their traditional knowledge, the continuity and link to the generations that follow,

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95 Hakopa (1998). p. 59
96 ibid. p. 67
that is, the reacquisition, retention and management of their land, their resources, and their tikanga.”

The Māori GIS examples Hakopa discusses (Ngati Porou, Tainui and Te Ika Whenua in particular) have all used GIS as a means to negotiate Waitangi Tribunal claims processes. All, at that time, either intended or had established post-settlement development projects, Land Consolidation Schemes, Hapu Resource Inventories, Social Services, Health Services, Forest Management and 3D terrain models. They also intended to use GIS to communicate claims progress to iwi members in remote areas.

Hakopa summarises the motivating factors for Ngati Porou, Te Ika Whenua and Tainui use of GIS as the “preservation and protection of Māori knowledge and the active control and maintenance of the use of technology with their matauranga within a Māori paradigm; that is, the exercise of tino rangatiratanga, kaitiakitanga and mana whenua.”

4.7 Summary of Māori GIS

It is clear from the studies and reports reviewed in the preceding sections that despite problems with data and human capability, GIS as a tool that manages, analyses and displays spatial data can be beneficial to Māori.

- Lien identified GIS as having positive benefit to the decision making processes
- Payne observed that spatial information was an inherent part of claims, in particular those that had a strong emphasis on natural and physical resources and GIS was a natural connection.
- Jackson pointed out the benefits GIS brought to the Te Uri o Hau o Te Wahapu o Kaipara’s Waitangi Tribunal claim to complement and enhance textual and oral evidence
- McDowall concluded that GIS proved useful to empower Māori in particular with claims negotiations and contemporary/post-settlement development opportunities
- Kamau considered the explorative use of GIS as a medium for an interaction between local government and tangata whenua worked well and was mutually beneficial
- Hakopa argued the complexities of using GIS as a modern technology did not necessarily compromise traditional customs, could in fact preserve

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98 Ibid. p. 68
100 Ibid. p. 56
traditional knowledge and urged Māori to take control and dictate what is appropriate technology and methodologies for implementing it

Internationally, surveys of indigenous GIS projects have also found a number of beneficial applications in a variety of contexts.

4.8 International experience with GIS

This section continues the review of indigenous GIS projects. As in the previous section, I commence with a description of a desk top study conducted to ascertain to what extent and how well mapping technologies were being adopted in various communities. I then continue with brief snapshots of indigenous GIS use, drawing on their experiences in order to further illustrate the benefits and barriers of GIS adoption.

4.8.1 World Wildlife Organisation

Mapping technologies are becoming cheaper, more user-friendly and more versatile. They are widely accepted as having extensive potential for environmental monitoring and management. One of the purposes of a desktop study undertaken by the World Wildlife Organisation was to examine the ways in which indigenous communities were using maps and advanced mapping technologies for local purposes and in their transactions with external agencies. A key question addressed in the study was how well those technologies work in community-based applications.

The report was based upon a desktop study of 63 projects worldwide (see Appendix page 71). The projects were selected according to two criteria: 1) they represented a local application of mapping and 2) they were locally initiated or managed. Cases included those using advanced technology and others using Participatory Rural Appraisal (PRA) methods to draw ephemeral maps in the sand. The essential source of information was local knowledge.

People-land ratios varied widely: between 10,000 hectares per person in the Amazon and entire communities with a few hundred hectares in Southeast Asia. In the former, mapping tended to be used as a methodology for managing such large areas. In the latter, mapping tended to be used as an instrument for local communication to discuss environmental issues and resolve land conflicts. The study found that informal maps met local needs while technical maps tended to be used in transactions with external agencies. Local mapping applications fell into five categories corresponding to the efforts of indigenous and land-based communities to regain or exercise control of their lands.

Generally the survey found that one application precipitated another in the following sequence:

Recognition of land rights $\rightarrow$ Demarcation of traditional territories $\rightarrow$ Protection of demarcated lands $\rightarrow$ Gathering and guarding traditional knowledge $\rightarrow$ Management of traditional lands and resources.

The survey also found that traditional cartography was being supplemented by contemporary information science (e.g. GPS, satellite imagery, GIS). Local mapping, however, remained a significant and effective instrument. Several projects were reported as being able to achieve their goals without reliance on external technology.

The survey identified five levels of technical activity:

1) sketch maps;
2) geocoding with GPS;
3) applying imagery from external sources;
4) generating own imagery and
5) GIS

The first three were found to be locally sustainable, while the last two generally needed continued external support and advice. The survey concluded that there were five potential objectives for local mapping:

- Conserve and reinforce local/traditional knowledge
- Amplify community capacities to manage and protect lands
- Raise and mobilise local awareness of environmental issues
- Increase local capacities to deal with external agencies and
- Enable local and global groups to play reciprocal roles in global programs for biodiversity conservation.

The study also found evidence of a mismatch between GIS capabilities and local capacity in that only a few groups used the technology to its fullest extent. Another mismatch that was identified was one between GIS techniques and local applications. The report noted that some users did not need to compare and analyse a series of layered data sets, but only required accurate maps, or the capacity to enter incremental or sequential data onto existing maps.

Many groups with interests in mapping expressed a need for information; including how to decide which technology to select; how to avoid being misled by vendors; how to make the most of technology they already possess, and how to increase local mapping capacities. The issue of outside control of information previously controlled by indigenous communities was also raised by several communities surveyed.
4.8.2 Deh Cho First Nations

The Deh Cho First Nations people of Canada also reviewed both the methods and results of their land-use and occupancy studies.\textsuperscript{102} These studies were conducted to develop a rigorous and legally defensible database to support their lands and resource negotiations, their land use planning/protected area designs, their environmental impact assessments and their natural resource management. Using data collection techniques developed by Terry Tobias, traditional knowledge was gathered from harvesters and elders. Individual maps were then compiled and added to existing natural resource data.

The Deh Cho collected and mapped their traditional knowledge alongside historical and often forgotten or neglected scientific reports. This information was supported by current natural resource data providing the Deh Cho with additional leverage during negotiations with federal authorities to negotiate a series of significant land withdrawals in the Deh Cho area. The land withdrawals represented an inter-connected protected area network covering 48.4\% of the Deh Cho area. These land withdrawals legally prevented the issuance of any new land sales, land leases, mineral rights, or timber authorizations.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{Deh Cho Land Withdrawals.png}
\caption{Deh Cho Land Withdrawals\textsuperscript{103}}
\end{figure}

\begin{flushright}
\textsuperscript{102} Grand Chief Herb Norwegian and Cizek, Petr (2004). \textit{Using Land Use and Occupancy Mapping and GIS to establish a Protected Area Network in the Deh Cho Territory}. Canada: Deh Cho First Nations
\end{flushright}

\begin{flushright}
\textsuperscript{103} Adapted from \textit{Deh Choh Land Withdrawals}, Grand Chief Herb Norwegian and Cizek, Petr (2004). \textit{Using Land Use and Occupancy Mapping and GIS to establish a Protected Area Network in the Deh Cho Territory}. Canada: Deh Cho First Nations. p. 10
\end{flushright}
The quality of the land use and occupancy data was crucial to the Deh Cho First Nations’ success at the land withdrawal negotiations. Adversarial and often acrimonious negotiations would consume almost two years of monthly meetings before resolution. Deh Cho negotiators assumed control of the agenda by using a laptop computer and digital projector to display GIS maps at each session. By displaying the raw land use and occupancy data overlaid on density analyses, Deh Cho negotiators rapidly convinced their federal counterparts to consider all the areas ranked as “high” and “very high” in the 10,000 metre (100 sq. km) quadrat analysis as a minimum starting point for the land withdrawal. In the end, all documented ecologically significant areas and critical wildlife habitat were withdrawn.

The value of indigenous GIS was clearly demonstrated by the protection of 48.4% of the Deh Cho lands from unwanted sales, leases and mineral or timber extractions. This protection assisted the Deh Cho First Nations in a common indigenous struggle for self-determination regarding lands and resources.

4.8.3 Kivalliq Inuit Association

The Kivalliq Inuit Association is responsible for managing over 83,000 km$^2$ of land. To facilitate their use of geo-spatial technology, the KIA undertook a GIS capacity building training programme that now enables them to assess land use applications in two days rather than two and a half months.\(^{104}\) Land organisation administrators and coordinators completed GIS training in both spatial data management and GIS using data from the Kivalliq and Nunavut region. Training topics ranged from:

- fundamental file management,
- basic GIS systems components,
- spatial data management and organisations issues,
- practical data retrieving and viewing,
- metadata issues and FGDC (the Federal Geographic Data Committee who approved the Content Standard for Digital Geospatial Metadata) and
- how to publish interactive maps to the internet using a SDM, a fully integrated module of SDM-geo (a free data retriever)

Covering such a wide range of training topics also led to the improved level of information able to be passed on to their community. The KIA Director of Lands commented that “Sometimes

it’s difficult to fuse traditional information with modern, scientific knowledge. The GIS has allowed us to do that so that we can pass it to the community. …With this system, we’ve demonstrated that we can do it better in less time and with more information.”

4.9 Summary

This chapter has provided a close, detailed examination of the literature that has been produced on Māori GIS within New Zealand. It has also provided several examples of the opportunities that GIS has provided for indigenous people internationally. Overall, the benefits and barriers to indigenous GIS appear to be relatively even. However, given the relatively small number of Māori GIS projects that are reported in this chapter, it is beneficial to continue the examination through investigating surveys and conference reports to fully appreciate the efficacy of indigenous GIS projects.

Chapter 5: The efficacy of indigenous mapping/GIS

The description in the previous chapter provided a detailed examination of the various barriers and benefits to indigenous GIS that have been identified by international and New Zealand writers. It is clear that there are many benefits to adopting GIS as a complementary tool for tribal development. It is also clear that there have been barriers to seamless adoption of this tool. A summation of surveys and conferences outlining the nature and extent of current indigenous/Māori GIS practices are provided in this chapter. It then examines emergent discussion points, mapping mātauranga, indigenous cartography and intellectual property rights. While not obvious, these issues all have important implications to those considering adoption of GIS.

5.1 Surveys and conferences

The aforementioned World Wildlife Organisation global desktop survey found that mapping often corresponded to indigenous efforts to regain, exercise control of and manage their lands and resources. This is borne out in other studies and highlighted in the previous Chapter via the Deh Cho and Kivalliq Innuit summaries.

A March 2001 survey of First Nations use of GIS provides an overview of indigenous GIS at a regional level which enabled trends and experiences from all ranges of the spectrum to be assessed.\(^{106}\) The survey reported that, overall, GIS was found to be useful to First Nations organisations for resource management and land claims. It was also used as a decision making tool to help develop resource management strategies by, for example, modelling land use, suitability, environmental impact assessment or timber harvesting potentials, and to weigh different criteria for land selection processes. Of the 109 First Nation organisations surveyed most either had GIS capabilities or had mapping work done by external agencies. Those with internal GIS capabilities commonly used ESRI (Environmental Sciences Research Institute) products and GIS was being used for a wide variety of tasks including resource management and mapping for Traditional Use Studies. The survey found that nine of the organisations had used GIS but had abandoned their GIS operations for a number of reasons. These included lack of funding to maintain GIS operations, maintaining personnel, insufficient work to justify the expense and consolidation of GIS operations with other organisations. The biggest obstacle to implementing GIS was seen to be the financial cost (both start-up and maintaining on-going operations). The next biggest were difficulties in obtaining training and the time taken to learn GIS. Obtaining usable data; finding and keeping the right personnel; insufficient

infrastructure within the organisation to support operations and having enough GIS work to justify the expense were also identified as obstacles.

In addition to the survey results, a number of quotes from respondents were included in the publication to provide “Insight and Advice” directly from indigenous practitioners. They include:

- “Get someone with 5-10 years experience to do a user needs assessment. Do your homework first!”
- “Start with a long term, well documented plan for GIS implementation. This will help overcome the problems of staff turnover.”
- “You need to build depth in the community to support a GIS installation. Make sure that there is enough support, and that the GIS installation is not just contingent on a few trained people.”
- “Plan carefully to make sure the data you are gathering will do the job, that you are not just throwing money at the problems.”
- “Be aware of the learning curve of the software you are considering. Stick with the simpler packages unless you intend to get very intensely into GIS.”
- “GIS is great technology, but it is just a tool and shouldn’t be relied on too heavily especially for predictive models.”
- “Get training first so you don’t have equipment sitting around for months while you try to find someone to run it.”
- “For small bands, it may not be worth keeping people trained and software and hardware updated. It is more cost effective to use contractors.”

Like the Canadian First Nations study findings, an eight month needs analysis and feasibility study undertaken by the Jemez Pueblo also identified numerous opportunities. It concluded that there were benefits to be attained by integrating GIS into the indigenous toolbox.107

Both Māori and international writers identified a number of practical issues facing indigenous peoples who wished to use or who had implemented GIS.

An indigenous communities conference entitled “Mapping for Communities: First Nations, GIS and the Big Picture” was held in British Colombia in 2003. A significant range of the practical, pragmatic and philosophical issues that revolve around indigenous GIS were reflected in four interrelated discussion themes:108

How to get data into use in the community including whether GIS investment improves decision making and issues surrounding combining traditional and scientific knowledge;

The technical issues of GIS and Mapping including data quality, accessibility and cost and the challenge of shifting between base maps with different scales and maintaining accuracy; education and capacity building including how to maintain a GIS through shifts in funding priority and building and maintaining human capacity;

Making mapping belong to the community by putting a human face on data including how to gain the trust and confidence of elders so that they feel comfortable not only about talking but also that their knowledge will be valued, and

Keeping technology and social processes connected and balanced by supporting (or sometimes threatening) traditional cultures, knowledge and wisdom through maps and mapping and mapping to bring back culture

5.1.1 Discussion
The benefits of GIS and some of the practical issues consequential to the use of the technology as seen by international writers/reporters have been established in the preceding discussion. Indigenous mapping/GIS discussion fora are well established internationally, while domestic discussions of Māori GIS and its efficacy are also gaining momentum.

The growth of Māori GIS is being reflected in the slowly increasing number of studies documenting this emerging field. It is also evident in the number of New Zealand conferences with Māori GIS practitioners presenting papers on Māori GIS projects and opportunities. The number of conferences where indigenous/Māori GIS held its own focus is also increasing. Two national hui in 1996 and 1999 were convened to discuss Māori mapping Māori Land and Resource Aspirations (Wellington 1996) and Developments in Information Technology and Communications (Otaki 1999) respectively. A Federation of Māori Authorities conference in 2003 had a number of indigenous/Māori GIS papers presented. At a 1995 international Indigenous Knowledge’s Conference in Wellington, papers were presented ranging from the use of indigenous toponyms in Australia; a local government/iwi joint venture mapping wāhi tapu in the greater Wellington district; Hawaiian cartographic projects; a paper encouraging cartographic literacy in indigenous communities, and a challenge issued to GIS software developers to extend the functionality of their programmes to better serve indigenous cartography.
5.2 Efficacy

Both Laituri and Engle have considered the efficacy of indigenous adoption of the GIS technology. Laituri comments that,

“The challenge is in combining indigenous knowledge with western technology to devise alternative strategies that may be more efficient as well as being culturally sensitive… The recognition and acknowledgement of local knowledge within the reality of information technology is a promising avenue of empowerment in decision-making. Supporting the alternative knowledge systems of indigenous people may allow them to access foreign techniques as they choose. This is an essential caveat in the use of GIS by indigenous people – that the GIS is used by them for their own needs.”

Engle’s 2001 paper, Negotiating Technology – (Re)considering the Use of GIS by Indigenous Peoples, also offers another evaluative voice to the discussion. He cautions that it is not only crucial that indigenous groups ask whether the technology merges with, and improves upon traditional systems that are already in place but also that “GIS use will only be effective if adapted to those existing social, cultural and institutional contexts.”

He sums it up by commenting that,

“…groups must carefully evaluate their symbolic representation in, and physical access to GIS before investing in the technology. It is only when groups negotiate for themselves the wider implications of GIS use can they, in the short term, evaluate the appropriateness of investing in GIS and over the long term add their own cultural imprint to existing applications”

Morgan expresses similar sentiments, finding it necessary that information technology and exchange should simply be put into context, that GIS isn’t the be all and end all, and that face-to-face is still, and always will be, necessary.

Young-Ing adds to this when he writes,

“Indigenous Peoples have adapted into their various unique and distinct contemporary forms by adhering to two important cultural principles: 1) that

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111 ibid
incorporating new ways of doing things should be carefully considered in consultation with community and Elders and according to Customary Law; and, 2) if it is determined that a new technology or institution goes against fundamental cultural values and/or might lead to negative cultural impact, or breeches Customary Law, then it should not be adopted.”

Harmsworth also offers numerous reasons why Māori can incorporate GIS technology.

- Improving the effectiveness of land-use planning by helping to identify Māori values within a spatial context.
- Assisting with land use/resource management conflict resolution by helping to identify Māori values within a spatial context.
- Improving conceptual frameworks showing what Māori values are and where they are.
- Trying to quantify in some way the term Māori values.
- Incorporating a Māori dimension/perspective into environmental planning so that land is not just looked at in the ‘market’ sense as illustrated by the terms unproductive land, marginal land, high value land, highly productive land.
- Giving an intrinsic value to land through expressions of taonga, mana, mauriora, and tapu.
- Needing to link biophysical, economic and social information with Māori values to provide information which helps define changes in land ownership, land tenure, landuse and demographic patterns through time.
- Spatially referencing Māori value information to portray community values, and assist future planning scenarios.
- Quantifying different community values to identify the type of, where, and the magnitude of the values.
- Understanding cultural basis of value.
- Allowing informed decisions to be integrated into policy.
- Helping plan socially acceptable uses of Māori land.
- Establishing impact of European values on Māori values.
- Helping focus monitoring activities towards locations of high cultural value/threat of degradation or loss.
- Facilitating adoption of GIS based planning technology and intellectual property rights among the Māori community.

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A recent example of a Māori GIS focussed project illustrates an opportunity to use GIS analysis for Māori development.

GIS was used to identify ‘Kyoto eligible’ Māori land on the East Coast.\textsuperscript{115} The research has indicated that the total Māori land in the Gisborne-East Coast (GEC) eligible under the Kyoto 1990 baseline was estimated as being 25,000 – 35,000 ha or 20% of Māori land in the GEC. By combining vegetative cover (1996 and pre 1990), land use capability, and Māori land for the Gisborne East Coast, using the MLIB, VCM, NZLRI and LCDB,\textsuperscript{116} the Kyoto eligible Māori land on the East Coast can be quantified, visualised and analysed.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{Figure_7.png}
\caption{Kyoto Areas on Māori land within the Gisborne-East Coast\textsuperscript{117}}
\end{figure}

Another Manaaki Whenua product is the Land Environment New Zealand (LENZ) dataset. This dataset, an environment based classification product, uses fifteen data layers to describe various aspects of New Zealand climate, landforms and soils such as lowest temperature, highest winter solar radiation, drainage etc. According to Shaun Awatere, not only was the dataset able to assist in ecological management but could also be applied to Māori Resource Management needs as well.\textsuperscript{118} Further to this opportunity was the potential to identify alternative horticulture opportunities (and therefore economic opportunities). Using maps prepared by Daniel Rutledge and company for the Lake Taupo Land Use Summit, Shaun Awatere illustrates the GIS opportunities that Māori can also tap into.

\begin{itemize}
\item \textsuperscript{116} Māori Land Information Base, Vegetative cover, New Zealand Land Resource Inventory and Land Cover Data Base
\end{itemize}
Before drawing conclusions as to the efficacy of GIS as a tribal development tool however, it is timely to consider three discussion points that do not have obvious implications. The first discussion point to be traversed in this section is that of mapping cultural heritage. The potential impact or benefits for changing traditional methods of transmitting mātauranga are addressed before the second point of indigenous cartography is discussed. This chapter ends with an examination of the third and most problematic discussion point - intellectual property rights for mātauranga Māori.

5.3 Mapping mātauranga (or cultural heritage mapping)

As in the international experience, the literature, conference papers and discussions on Māori GIS include some precautionary discussion on the adoption of GIS. The discussion is from both a practical and theoretical point of view. Papers reviewed in the previous chapter identify concerns over the possible replacement or relegation of traditional knowledge or culture by the adoption of new technology (e.g. Kamau, Hakopa). This is a somewhat disquieting proposition. The original purpose of using new technology is to support traditional knowledge or culture. This legitimate concern can be balanced by adopting a precautionary approach. This approach dictates that when an issue is identified as a threat, measures are put in place to ensure that threat is not realised or the effect is minimised. Harmsworth reasons that, if adopted judiciously, the use of technology really only allows,

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“the development of complementary information systems, rather than ones (e.g. electronic) that replace the other (e.g. written or oral). The result is that GIS can only store, at the most, a small proportion (<10%) of the total indigenous knowledge held by kaumatua, for a particular iwi or hapu.”

To recap on previous discussion (see Chapter 2, Te Ao Māori) the whollistic nature of Māori epistemology recognises the interconnectedness, interdependence and interrelationship of the natural world, understanding humans to be part of the natural world, not separated from it. Mauri as the life essence or potentiality of both the tangible and intangible requires protection. This protection in turn protects humankind. Tikanga (the right, correct and affirmative action) is continuously evolving as more experiences and observations are accumulated. These cultural values are expressed through kaitiakitanga. Māori resource management is founded on the reciprocal obligations and responsibilities of kaitiakitanga. Outsiders may wonder why Māori would feel compelled to know the extent and status of resources and what stresses were occurring. But where they believe that mainstream organisations and agencies are responsible for such issues, for Māori it is a question of how to fulfil their responsibility as kaitiaki. It is a question of prioritisation - what to do first - rather than whether to do it at all. Furthermore, Māori have a Treaty based right to execute their kaitiakitanga without having to apologise or compromise those responsibilities.

As a form of cultural affirmation, practicing kaitiakitanga ensures the continuation of indigenous knowledge that has been centuries in the making. Throughout those centuries Māori have discovered, adopted and adapted to new technologies. Historically, the successful retention and application of this traditional mātauranga has, in many tribal areas, been compromised or subsumed or very nearly been lost in the aftermath of post-colonial expansionism and cultural disenfranchisement. If knowledge is to survive in this busy contemporary world, it is imperative that it be kept safe, nurtured and grown.

This ‘survival of knowledge’ imperative can be complicated by tribal members concern over the restrictions in knowledge transmission. There are still many kaumātua, kuia and tohunga who hold repositories of knowledge that came to them via exclusive oral transmission, and selective site visits whereby chosen members of a tribe/hapū/whānau were shown the secret locations of taonga. Their responsibility lies not only in holding that knowledge, but also in protecting it by deciding when and where and how much to pass it on. At times the reluctance of these tribal members to share their knowledge within the tribe may become difficult for other members to accept. Overarching fear of tribal loss of mātauranga, not only by untimely death but missed

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opportunities to pass on tribal knowledge, can prompt tension when debating the issue of mapping sensitive information. Often these debates are conducted on a thin edge where knowledge that is part of a collective continuum and necessary to secure or reinforce the collective strength of an iwi is balanced against the traditional, ancestral responsibilities of those knowledge holders to ensure that knowledge is not squandered or cheapened.

It is of critical importance that tribes assess the potential impact of mapping mātauranga Māori (in this instance - cultural heritage). On one hand, transmission methods of tāhuhu kōrero - oral, aural, visual and experienced - may be altered. There is a risk that, originating as a tool or an aid to reinforce or reaffirm kōrero, incorrect maps of boundaries, events and markers may become elevated or privileged over and above the real kōrero. Challenges to the veracity of oral kōrero are undertaken kanohi ki te kanohi, often allowing vigorous debate and response. Mapped cultural heritage however, could open a pathway to disempower kōrero and tohunga if not rigorously constructed.

On the other hand, the mapping of cultural heritage is an opportunity to safeguard mātauranga for future generations. It provides the opportunity to reaffirm tribal kōrero and convey their own story about what is and what was. It also provides a mechanism for distributing or transmitting that kōrero in a manner more accessible to some members of the iwi in these contemporary days where we are busier and do not or cannot live 'back home'.

5.4 Indigenous Cartography

An emerging facet of indigenous GIS use is its cartographic output. The representation of indigeneity on the products of GIS – the symbols and orthography presented on maps in itself requires attention by indigenous mapmakers. These cartographic issues, touched upon in the Hopi and Zuni examples (page 40), are not only technical in nature. They also reflect the dominance of non-indigenous or mainstream geographic authorship of maps and the changes that will need to be accommodated by nation-state geographic boards or their equivalent agency. Louis, an indigenous Hawaiian cartographer, has also investigated these linguistic control issues as well as some of the practical issues relating to indigenous Hawaiian cartography. One that has obvious relevance to Māori cartography is the treatment of place names with geographic features as a component in their Hawaiian names. The tautological example given by Louis, was the treatment of Ka Lae Point (lae meaning point in Hawaiian). Thus, Ka Lae Point would translate as Ka Point Point. For Māori cartography, similar discussion would need to be made by those considering the cartographic, linguistic and

orthographic treatment of the Waimakariri River (River Cold River), or Lake Rotoma (Lake Lake Warm).

Consider too, the placement on a map of some of the original, and much longer, Māori place names - such as Te Moana i kaitaina a Te Rangitakaroro, (Lake Okataina) and Te Rotorua nui a Kahumatamoemoe (Lake Rotorua). These corrected place names have recently been approved for change in principle by the Government although they remain subject to final approval from the NZ Geographic Board.  

![Figure 9: Rotorua place name changes](image)

The cartographic focus will inevitably shift from how can the software programmer increase the number of characters available for the label text string or what will be accepted/acceptable by the New Zealand Geographic Board to the more fundamental one of scale - how can we fit it all on the map? Consider how those of Takitimu would choose to represent “Taumata whakatangihanga koauau o Tamateapokaiwhenua ki tana tahu”, or another version, “Te Taumata whakatangihanga koaua o Tamatea ure haea turi pukapihi maunga horonuku pokaiwhenua a ki taarahu”. A solution could be as Louis offers - to use ellipses to indicate there is a fuller name than that indicated on the map (e.g. “Te Rotorua...”). Using GIS properties, technicians are able to choose at which scale more of the name becomes visible in the layer. The following series of figures illustrate the use of ellipses.

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123 Te Arawa Lakes Deed of Settlement: Cultural Redress Schedule, Part 4: Place Names. p. 96
125 Renee Pualani Louis, pers comm, Wellington, 24 June 2005
Figure 10: Lake Rotorua/ Te Rotorua...
Base map: 1:500,000 Topomap, Crown Copyright

Figure 11 shows the output at 1:250,000 scale.

Figure 11: Rotorua/Te Rotorua nui a ....
Base map 1:250,000 Topomap, Crown Copyright

The final figure in this series shows the output at 1:50,000 scale where the entire placename is able to be viewed.
Toponomy, the study of place names, also needs to be considered in this context. There is a growing field of interest in toponomy. The United Nations Group of Experts on Geographic Names (UNGEGN) regularly run conferences and training programmes in toponomy.\(^{126}\) Correct place names and the correct spelling of those place names can be problematic for indigenous and non-indigenous peoples. There are also times when there is tension between indigenous peoples themselves. Neighbouring hapū, for example, have disagreed about name changes to shared boundary markers such as mountains or rivers or towns. Usually these disagreements have occurred in a forced climate of compromise with one hapū typically disgruntled with the negotiated outcome. Again, using a potential solution offered by Louis for an Australian Aboriginal instance, a successful outcome could be to not choose one preference over the other but have both names drawn on the map using colour to differentiate hapū preference.\(^{127}\)

As indicated by McDowall (page 41) and Louis (see above) the possibilities for indigenous cartography to personalise their representation of landscapes, to change or ignore standardised western cartographic map representation are increasing.

Three examples are provided to illustrate the changes that have begun to emerge in indigenous cartography. The first map depicts the epic Lenni Lenape journey of almost one hundred generations of migration from central Siberia to what is now known as the east coast of North America. The second and third maps illustrate the changes the Māori contribution

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\(^{126}\) A September 2005 UNGEGN training conference in Indonesia will discuss the UN role in the standardisation of geographical names amongst other subjects.

\(^{127}\) Renee Pualani Louis, pers comm, Wellington, 24 June 2005
has to the indigenous cartographic pallet. Both maps communicate an ancient narrative in a non-cartesian representation.

Map 1: Wallum Olum

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Map 2: Te Ika a Maui, Te Waka o Maui\textsuperscript{129}

Map 3: Ngā Whakairo o te Whenua

As evidenced from the preceding maps, the portrayal of an oral narrative that is unconfined spatially or physically is another element that can be entered onto the mapmaking desktop.\(^{131}\)

### 5.5 Intellectual Property Rights or Securing mātauranga

The last of the three discussion points to be examined may not be the most obvious, but it is one which should be assessed the earliest when considering the establishment of GIS protocols. Mention has already been made by McDowall, Kamau, Hakopa and indigenous surveys of the security of mātauranga /traditional knowledge\(^{132}\) emanating in part from the purposeful construction of an end product (a database or map) that can specifically detail the location, type, variety and quantity of sensitive traditional knowledge. There are many insertion points along the GIS process pathway that could allow unauthorised or accidental exposure of sensitive and potentially lucrative traditional knowledge. This section discusses factors that influence indigenous intellectual property rights decisions.

Internationally, the impact of global challenges to indigenous intellectual property has arisen through the mechanisms of intellectual property markets and patents, collectively called Intellectual Property Rights (IPR). According to the World Intellectual Property Organisation (WIPO) there are two key issues. The first is the recognition of the rights of traditional knowledge holders relating to their traditional knowledge. The second concerns the unauthorised acquisition of IP rights over traditional knowledge (TK) by third parties.

Indigenous Peoples knowledge’s are at risk from bio-piracy, in which biological theft occurs via patenting and copyright legislation or agreements that fail to recognise indigenous people’s rights. Many indigenous intellectual property rights abuses have been documented involving corporate or academic plundering of biological resources.

As Ruiz points out,

> "Indigenous knowledge (IK) is for many groups a valuable cultural, social and religious asset. More recently, it has come to be seen as an important economic asset as well, since elements of IK are being used to create new pharmaceutical or agricultural products. The direct or indirect use of IK in this...

\(^{131}\) Other non-cartesian –although more conventional ‘looking’ – maps in the Bateman Historical Atlas depict Maori historical settlement from a waka perspective

\(^{132}\) Readers will note that variants of “traditional knowledge” or TK used within this section will be Traditional Ecological Knowledge (TEK) or Indigenous Knowledge (IK) or mātauranga. All terms are used interchangeably.
way is now widespread. Generally, however, it is unauthorised, and it is almost always uncompensated.”

Two brief examples are provided to illustrate this point. Merck, an American transnational pharmaceutical company, patented a Mexican soil fungus for making the hormone testosterone used in a lucrative acne treatment. Dupont attempted to patent all maize varieties - including traditional maize varieties - with higher oil and oleic acid content. Greenpeace, Miseror, the Mexican government and other concerned parties received 2004 Captain Hook awards for their successful defence against Dupont in the European Patents Office (although Dupont has applied for the same patent in more than 30 other countries).

Indigenous concern for protection of indigenous knowledge and intellectual property rights on a global scale drove the July 2003 third international conference and exhibition on traditional medicine in South Africa. The conference’s main purpose was “to address the protection of traditional healers’ rights to medical knowledge and discoveries against biopiracy”.

Two forms of Intellectual Property (IP) related protection have emerged, and have been applied in different countries in different ways with different success.

The first – positive protection – provides Traditional Knowledge holders with the rights to take action or seek remedies against certain forms of misuse. For example, The Act on Protection and Promotion of Traditional Thai Medicinal Intelligence, B.E. 2542 protects formulas of traditional Thai drugs and “texts on traditional Thai medicinal intelligence” meaning the “basic knowledge and capability concerned with traditional Thai medicine”. The Act confers on the rights holder – “those who have registered their intellectual property rights on traditional Thai medical intelligence under the Act” – “sole ownership on the production of the drug and research and development.”

The second form of protection – defensive protection – involves safeguarding against illegitimate IP rights taken out by others over Traditional Knowledge subject matter. For example, Peru’s 2002 sui generis Law No 27, 811, has an objective to protect TK, to promote the fair and equitable distribution of benefits, to ensure that the use of the knowledge takes

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135 http://www.captainhookawards.org

136 WorldWide, April 2003. p. 4


place with the prior informed consent of the indigenous peoples and to prevent misappropriate use. A growing number of countries, including Brazil, Costa Rica, India, Panama, the Philippines and Portugal, have all adopted some form of traditional knowledge protection aimed specifically at protecting at least some aspects of TK.\footnote{http://www.captainhookawards.org}

There are calls within New Zealand for the formulation and adoption of national sui generis laws. One option from Māori academic Aroha Mead, is to see Māori exempt from existing IP laws and a comprehensive, Māori-specific mechanism developed.\footnote{Mead, A. (2003). The Case for Sui Generis Protection for Māori Cultural & Intellectual Property. Powerpoint presentation, Call of the Earth Llamado de la Tierra, August 2003. Retrieved from \url{http://r0.unctad.org/trade_env/test1/meetings/tk2/Sui%20Generis%20Protection%20Awatope2.ppt}} These calls are being answered to some extent.

Other recent positive initiatives may provide benchmarks by which negotiated outcomes beneficial to traditional knowledge holders can be compared. For example, traditional agricultural knowledge of the Bela peoples led to the identification of a disease resistant gene in wild rice. The gene was isolated and patented by the University of California who entered an agreement to provide for benefit-sharing with the source country. This agreement will ensure that a certain percentage of sales of products for a specified number of years will be paid to a fund established to provide capacity building fellowships in the country providing the resource.\footnote{World Intellectual Property Organisation (n.d.) Intellectual Property and Traditional Knowledge. p. 26} Similarly, the Samoan contribution to the development of proposed HIV drugs based on traditional knowledge of the Mamala tree will be acknowledged via a royalty share agreement.

Article 8 (j) of the international 1992 Convention on Biological Diversity (CBD), ratified by the New Zealand government the following year, contains the best language for protection of traditional knowledge holders rights.

"8(j) Subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of benefits arising from the utilization of such knowledge, innovations and practices\footnote{United Nations. (1992, June 5). Convention on Biological Diversity Concluded at Rio de Janeiro. Available from \url{http://www.cbd.int/convention.shtml}}"
Notionally, the CBD will not answer all indigenous complaint nor provide automatic forms of protection for traditional knowledge. However, it is providing a starting point for nation-states (and indigenous peoples) who are grappling with internationalism, globalism, world trade, bio-prospecting and bio-piracy.

The New Zealand Government is acting on some aspects of the responsibility they signed up to in the CBD. While New Zealand does not have any specific legislation outlawing or regulating bio-piracy or bio-prospecting to date, changes to the Trade Marks Act in 1992 have seen a move to protect inappropriate registration of Māori words and symbols as trade marks domestically.

In July 2004 the Ministry of Economic Development also announced a three stage work programme on intellectual property and traditional knowledge. The issues will traverse a wide range of TK, including weaving, carving, songs, tribal stories, traditional medicine and environmental knowledge. The Ministry acknowledges that the development of options is likely to straddle a range of policy areas, including intellectual property, cultural heritage policy, conservation and environmental concerns, access to genetic resources and benefit sharing. The Ministry will therefore also encourage cross-government and interdepartmental responses to the options paper prior to recommending policies.

For Māori, the 1993 Mataatua Declaration and the Indigenous Flora and Fauna Waitangi Tribunal Claim (WAI 262) will also contribute to the New Zealand debate over indigenous intellectual property rights. To date, the Waitangi Tribunal has commissioned several background research reports on aspects of mātauranga. The Tribunal released a report clarifying the issues the enquiry would traverse. The hearings are intended to clarify forms of Māori intellectual property rights.

Also worthy of note, is the fact that there are already extensive repositories of mātauranga that have been documented ever since Pakehā first encountered Māori. Consequently there is ample opportunity for open perusal by any bio-tech company who is interested in spring-boarding their research on the back of indigenous knowledge. Some authorities such as patent attorneys and scientific academies such as the AAAS, conclude that the

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143 The CBD Bonn Guidelines for Access and Benefit Sharing was given a Captain Hook 2004 Biopiracy “worst smokescreen” award “For creating the illusion that equitable benefit-sharing is being addressed while facilitating biopiracy and promoting intellectual property. "Capacity building” proposals for indigenous peoples will enable them to become partners in the piracy of their own resources”


145 Trade Marks Act 2002, Pt 1, s 4f and Pt 2, Subpart 2, s178 - 179


interpretation of current laws and conventions is - that if it is documented, it is in the ‘public domain’. On the other hand, the issues of personal consent for information to be published or non-informed consent are also being raised. These healthy discussions will undoubtedly continue for decades. As one academic investigation across the Tasman has suggested:

“The dilemma of protecting indigenous knowledge resonates with tensions that characterise intellectual property as a whole. The metaphysical dimensions of intellectual property have always been insecure but these difficulties come to the fore with the identification of boundaries and markers that establish property in indigenous subject matter…. Key elements in Australia that have pushed the law to consider expressions of indigenous knowledge in intellectual property can be located in changing political environments, governmental intervention through strategic reports, cultural sensitivity articulated in case law and innovative instances of individual agency. The intersection of these elements reveals a dynamic that exerts influence in the shape the law takes.”

In the meantime there are issues to be considered by Māori who wish to develop innovations that have a genesis in mātauranga Māori.

5.5.1 Dichotomoy

A particular dichotomy exists whereby to protect indigenous knowledge, indigenous people are encouraged, and in some respects forced, to patent it. While engaging with the current patenting and intellectual property markets (including research contracts) there are however, additional factors for them to consider, aside from the legal, technical and scientific. Adding further complexity to the issue is the fact that two aspects of indigenous knowledge fall outside basic criteria for current patent laws: indigenous knowledge is both ancestral and collective in nature. Ancestry and collectivism limit patenting opportunities according to some schools of thought. However once you add fundamental values such as whakapapa, manaakitanga, awhinatanga, ritenga and tikanga (to name a few) the complexities increase exponentially. Therefore, the cultural integrity of the decision needs to be considered.

The questions facing Māori become – if I or we apply for a patent – do we have a right to do so? Mātauranga is a distillation of many generations of our ōpuna’s collective wisdom that is held in trust for future generations. Is it exclusive to our whānau, our roopū, our hapū, our iwi,
our waka? Is it a geographical, district wide mātauranga? Is this mātauranga so widely known that just the question of who holds the mana behind the mātauranga provokes dispute amongst the whānui. And if we do protectively patent our mātauranga - what happens when a patent runs out and becomes available for public exploitation? Will patents contribute to our responsibilities as kaitiaki?

Some roopū have already investigated intellectual property and patent issues as part of development initiatives that have their genesis in Mātauranga Māori. What, however, does intellectual property rights have to do with mapping mātauranga?

5.5.2 Connecting intellectual property rights with mapping mātauranga

Consider the recording and documentation of traditional knowledge of the location of biological resources or anthropological artefacts. Perhaps the best fishing grounds or eel harvesting sites are mapped, or perhaps the location of a particular rongoā is mapped during a tribal resource inventory. What could happen to that mātauranga? The benefits are self evident. The knowledge is not lost and it can be shared within the whānau /hapū/iwi. The documentation project could provide a mechanism for bringing together more tribal kōrero and rekindle or strengthen whānaungatanga. The output could be used to provide vigour for negotiations in and around a physical location if it is threatened. There could be internal development opportunities. The map could be used as a biodiversity and resource protection tool to ensure it (the resource) is not lost. Conversely, is the potential misuse of the knowledge – perhaps someone gains access to the map and uses the information inappropriately, or it is taken out of context. It could be used against the wishes of the kaitiaki, or an outsider (perhaps a biotech company or individual researcher) could springboard their research from the information found on that map.

It is clear then, that the benefits and potential problems that arise from mapping mātauranga need to be considered before mapping to ensure that appropriate levels of security are in place both during collection and post mapping. This ensures that informed discussion drives the decisions on whether (and what) mātauranga could be mapped. This will inform the type of mapping project that is developed, what security levels of information are required and ultimately whether GIS will be adopted.

It is apparent that Indigenous Intellectual Property Rights are inadequately protected by current IPR mechanisms, both internationally and domestically. On the whole, indigenous peoples are unable to block appropriation of mātauranga by others except by preventative

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patenting or by publication (which in itself creates several issues). The Lego case where Māori pressured Lego into recalling inappropriately named ‘supertoys’, and the Samoan agreement where 50% of the profits from a potential anti-HIV drug derived from the bark of their indigenous Mamala tree will be shared with the Samoan Government - are two examples of indigenous ‘wins’. There are however hundreds of other examples where Indigenous Peoples mātauranga was commodified, commercialised and appropriated by corporate bio-pirating.

There is also an immediate need to discuss Māori use of IPR mechanisms. Some roopū have already ventured into the intellectual property and patent arena as part of development initiatives that have their genesis in mātauranga Māori (for example - Manuka oil and essential oils from Pikopiko or Horopito). While Māori are still arguing for indigenous rights to IPR there appears to be no robust or widely participated discussion on what standards of behaviour Māori must adopt themselves.

This internal issue aside, the debate about outsiders being privy to a tribes cultural values and especially their indigenous knowledge - culturally sensitive information - is the most problematic when developing a GIS. The commercial world has already shown that information is both a power and an economic tool that can be used for both positive and negative purposes. The intellectual property rights of indigenous peoples and their knowledge have been hotly debated for several decades now. The corporate world is increasingly manufacturing rights to tangible and intangible resources. The assault on traditional knowledge is global in extent. It is not hidden behind the prose that information [local knowledge about local biodiversity or traditional medicinal practices for instance] should be shared before it is lost. It was under this auspice many indigenous peoples participated in the collection of mātauranga. Those who ‘get in first’ to register domain names; gene markers; tradenames; native food species; logos using indigenous symbology and the like represent the negative nature of information ‘sharing’. Thus it is not so much the acquisition of information, it is the use and dissemination of that information that defines whether the knowledge will be beneficial for one or all. And therefore, whether knowledge should be broadcast or opened up for perusal by outsiders.

Harmsworth summarises the issues thus;

“Potential issues related to storage of Māori values information on GIS included control of information, where the information should reside, ongoing maintenance and development of a dataset, intended end use of information, potential for bypassing the consultative process; cultural and intellectual
property rights and ownership rights of the information, [and] potential impacts on tikanga Māori."  

Te Runanga o Moeraki, having considered the adoption of GIS, nevertheless believed that there were too many significant issues revolving around mapping culturally significant information. Their response is provided in full to illustrate the critical appraisal used to formulate their decision not to establish a GIS.

"Some of the reasons for not doing so include:- Issues of ownership and accessibility of information constrain use e.g. Much of the information on sites of interest to iwi are bound up with whakapapa and whanau histories. This is their intellectual property and the production of a GIS database can then take the effective ownership out of the whanau/hapu control. It’s a bit like publishing a book. The information then becomes part of the public domain. Further to this is the information contained in the GIS takes on a higher level of creditability. i.e. if it’s not recorded on the GIS it is not an ‘authentic’ site and has no ‘real history’. Other people start defining what is authentic by whether or not it has been recorded rather than acknowledging the knowledge passed down through whanau."

5.6 Summary

As described in the previous passages of this Chapter, the efficacy of indigenous GIS is typically positive. There are however, several barriers that need to be considered when assessing the capacity and capability of indigenous peoples to uptake this technology. The cultural implications of transferring indigenous knowledge by technological means instead of traditional; the sensitivity and confidentiality of knowledge; and the protection of that knowledge - all need to be taken into account when deciding whether to employ GIS as a tool in tribal development.

The next Chapter briefly discusses the experiences and opinions of those who are interested in, who have participated in or led Māori GIS projects. These opinions were gathered from a 2003 survey and informal but focussed discussions with a number of Māori GIS practitioners to directly canvas their experiences. The pool of Māori GIS practitioners is very small at this stage of development. Mindful of the huge demands on their time (made clearly evident by the topics under discussion throughout this thesis), the abundant generosity of all those who took time out to discuss aspects of Māori GIS is very much appreciated. Ngā mihi mahana ki a koutou.

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152 Te Runanga o Moeraki Incorporated, Palmerston, North Otago, email communication, 20 May 2003
Chapter 6: Practitioners

This Chapter discusses kōrero held with Māori GIS practitioners and those whose work intersects with GIS and/or Māori development to supplement the views expressed in the literature. These discussions were held to gauge the extent and intent of current Māori GIS projects, to gain first-hand opinions from GIS practitioners about their experiences and also to gain direct feedback from a wide range of people who would potentially have an interest in GIS as a technology.

6.1 Survey - Māori organisations who use GIS (2003)\textsuperscript{153}

81 Māori organisations were canvassed in 2003 to ascertain their use of GIS as part of a postgraduate research assignment. A mass email was sent out to the organisations from addresses culled from a web search. Predominately iwi organisations, there were also several land trusts who were included in the survey. A brief summary of their responses follows.

Of the 81 organisations surveyed 32 responded (39%). Twenty-five (78%) of the respondents did not use GIS.

Of the 7 respondents who used GIS 3 used MapInfo, 1 used Arcview, 1 respondent used both software and 2 did not specify which software they used. The responses, as well as direct email contact with GIS professionals, combined with literature research and personal experience brought the number of Māori organisations using or developing GIS closer to twenty.

Of the respondents who did not use GIS, 14 respondents (56%) had considered using it and ten respondents indicated they had not looked into GIS or were not interested in GIS. 5 respondents wished to discuss GIS further. Many of the respondents considered they would utilise GIS if the infrastructure was in place and the cost of establishment decreased. The key impediments to GIS establishment at that time were considered to be human resources, cost and prioritisation of more critical factors affecting tangata whenua.

These were predominately iwi organisations and also included several land trusts. Of the 32 who responded, seven stated they were using GIS at that time (Rūnanga, Iwi Authority and a Land Trust). Half of the respondents who did not use GIS had considered using it but had found impediments to its establishment. Many considered they would utilise GIS if they knew

more about it, if infrastructure was in place and if the cost of establishment decreased. The key impediments to GIS establishment at that time were considered to be human resources, cost (of data, equipment etc) and prioritisation of more critical factors affecting tangata whenua. Several respondents indicated they had experience with failed GIS projects caused by failures in the policy/process/funding cycles. One response (Te Runanga o Moeraki, see previous Chapter) clearly identified intellectual property rights and cultural heritage issues as fundamental reasons for not taking up GIS technology.

6.2 Practitioners

All the Māori GIS practitioners contacted or spoken to during the course of this research discussed the wide range of opportunities as well as the infrastructural and technical factors to be considered when adopting GIS. Unsurprisingly, most found from their own experience and their assessment of other projects, that the integration of GIS into existing organisations had been problematic. Most projects had been established on an ad-hoc basis. Some also found the responsibility and expectations placed on them to ‘produce the goods’ to be unintentionally unrealistic. Often a sole position, practitioners found it hard to explain to the non GIS literate that they are faced with expectations to produce the volume and quality of work usually undertaken by a team of GIS analysts and technicians. Most were quite philosophical when evaluating the causes of those infrastructural issues. The ad-hoc adoption of any new tool requires a constant review of organisational procedures to identify and solve problems associated with the new tool. GIS is no different, as the examples described within this thesis show. These problems ranged from access to information and workstations, access to and quality of data and also project management issues. The cause of most discontinued or stalled projects was mainly economic issues, usually because the money had run out or funding priorities had changed. Some projects had ceased when skilled personnel moved on. When discussion moved to the opportunity to resume projects or utilise collected data, concern was also expressed about inadequate metadata collection and data storage.

On the whole, most practitioners (past and present) and those whose work intersected with GIS and Māori development, felt the concept of having a ‘Guide’ to traverse the range of issues attached to GIS would be useful. This comment was also made during a visit to Te Whanau a Apanui in Te Kaha to discuss their investigation into using GIS as a Land Use Optimisation tool for their rohe. In the middle of critical Foreshore and Seabed negotiations with the government and a multitude of other projects, those at the Runanga office for Te Whanau a Apanui were still open to discuss their GIS plans.
6.3 Te Whanau a Apanui

Te Whanau a Apanui’s rohe includes a marine/coastal environment and extends inland to include a mixture of indigenous and exotic forestry and farmland. As a means of providing support for tribal development opportunities Te Whanau a Apanui were successful in a bid to gain TechNZ funding to initiate their Land Use Options investigation. Working with an experienced planner (Kamau), Te Whanau a Apanui saw the project as an opportunity to develop a tool at Te Whanau a Apanui’s Runanga office for the benefit and distribution to their iwi member roopū. The aim of the project was to construct a database and then attach it to a GIS in order to evaluate the range of available land use options. Microsoft Access and MapInfo were the chosen test programmes. This would provide both a tool and a framework with which to analyse and initiate tribal development opportunities.

Te Whanau a Apanui recognised the importance of access to quality data. When engaging with government agencies they requested high quality data to ensure parallel capability during negotiation. The data that had been collected to date was in both ArcInfo and MapInfo datasets thereby providing a wider range of options for software choice and subsequent compatibility with other users. Technically well supported, the GIS was loaded onto a lap-top which made it both convenient and portable. Several Rūnanga portfolio members were conversant with GIS. Appropriate training packages and seminars for them and other roopū members were also to be investigated. From a logistics point of view, the distance from usual training venues inclined them towards on-site training options. Since there were a number of land trusts and other tribal entities involved, and apparent competition between training providers, Te Whanau a Apanui also recognised that favourable terms could probably be negotiated with a software vendor. The need for continued training and succession planning had also been identified and was being incorporated into the infrastructural planning. During our discussions is also became clear that metadata capture and maintenance was another necessary component to build into the project planning.

Overall, the GIS project had been overshadowed and then overtaken by external ‘urgent’ and ‘high priority’ issues (such as the Foreshore and Seabed negotiations). Although this limited the time able to be spent on it, they were determined to not just get it done – but to get it done right.154

Before leaving Te Whanau a Apanui’s experience, it is worth returning to the benefits of in-house modelling. The advantage of contracting work out to mainstream consultants is that they have the infrastructure, expertise and experience all in one handy package. The time taken to model

the analysis is conceivably shorter due to this ‘all in one’ package, once frameworks and outputs have been negotiated. Usually mainstream consultants will also have a skilled network to call on if a modelling request becomes too complicated.

If a GIS is established in-house, control and direction remains within the hands of the organisation. This makes it possible to use GIS to analyse and refine appropriate responses to resource consents or plans. Cultural impact assessments can also be visualised. This enables better articulation of concerns or advantages to both tribes and applicants. The opportunity to use the functionality of GIS to perform analysis of spatial and temporal issues of concern to tangata whenua, from their own agenda with their own perspective is also beneficial. Tangata whenua are able to prioritise their own needs instead of complying with or having to justify that need to outside agencies. The effect of chemical spraying regimes on watercress or puha for example, is of far greater import to tangata whenua than to a regional or district council. The example is indicative of the simple analysis that can be achieved by using in-house modelling without having to justify it or negotiate for it from an indifferent agency. This example could well have been the modelling of low flow water levels on eel migration. The important aspect to emphasise here is that the priorities are directed wholly from the tangata whenua perspective, not from the mainstream perspective where tangata whenua values can become marginalised.

6.4 Summary

This brief chapter has provided direct observations by those who had an interest in GIS or whose work intersected in Māori development/GIS. The main theme that has emerged from this discussion is that while there is currently a high level of interest in establishing GIS there are also acknowledged barriers to doing so. The next, and concluding, chapter summarises points made in this and previous chapters. It uses these as the basis for constructing an establishment Guide, which helps users traverse the range of strategic decisions required to establish a GIS.
Chapter 7: Conclusions

This chapter concludes the thesis. It begins by summarising the key points made in the previous Chapters. It then focuses on whether the research aim and objectives of the research proposal have been met. This chapter then discusses research limitations that have been experienced during the research, before finally enumerating further research options.

In Chapter Two I explained the research design for this project was constructed under a Kaupapa Māori Research framework. A Kaupapa Māori Research framework is conducted in a culturally appropriate manner and is oriented towards simultaneous enablement and empowerment of both the research audience and the researcher. The cultural neutral research method, Participatory Action Research, was also briefly mentioned within this Chapter to identify similar characteristics of vision for successful research. The key differentiating characteristics of KMR to PAR were; that PAR is a culturally neutral method of inquiry, that a KMR researcher understands their post-research obligations of reciprocity and that they will face two juries. The Chapter concluded with a description of the methods used to research and produce thesis and guide information given those KMR determinants.

In Chapter Three I discussed Māori Development. It makes it clear that Māori, as tangata whenua, have a unique position in New Zealand by virtue of their centuries long relationship with their whenua and their special status as kaitiaki. As Māori continue their intergenerational kaitiaki responsibilities they have also continued to refine their methods of undertaking that responsibility. Contemporary Māori development is being augmented by an increasing number of negotiated Waitangi Tribunal claims that typically will result in more land being returned to Māori. Māori development continues to expand opportunities in an increasing array of corporate, scientific, management and cultural arenas. As that expansion has occurred, so too has the level of intensity required to keep abreast of developments. One advent that has assisted contemporary Māori development has been the use of Māori referenced planning aids such as Iwi Management Plans, cultural resource inventories and technologies such as Geographic Information Systems.

The lengthy, descriptive review of the existing literature of Māori GIS in Chapter Four was supplemented by international indigenous GIS examples. Chapter Four identifies many lessons that can be taken from past projects. GIS assists cost effectiveness of spatial research for Waitangi Tribunal claims. The opportunity to support and facilitate complex textual and oral evidence is also reported. GIS is also shown to assist negotiation and empowerment at both central and local government level. Benefits can be gained from integration of GIS technology for preservation and continuity of traditional knowledge and
culture without compromising traditional values. Internationally, indigenous peoples who adopted GIS have also derived significant cultural development benefits.

Chapter Five investigates the efficacy of indigenous mapping/GIS. Examinations of surveys and conference papers illustrate a growing body of international investigation into the efficacy of indigenous GIS. Internationally, while there are many successful uses attributed to GIS projects, there are also precautionary calls made by practitioners regarding the obstacles that they had encountered. Overall, whilst traditional knowledge and contemporary technology can often be beneficially fused together, in many instances there have been hidden or unforeseen consequences that can impede or imperil seamless uptake of this new technology. Precautionary calls were also made by several New Zealand authors, both practically and theoretically based.

Three discussion points deemed to have implications for the successful implementation of GIS are also traversed in Chapter Five. The issues of mapping cultural heritage, indigenous cartography and the lack of current intellectual property rights protection measures are all signalled as potential barriers to successful, long-term integration of GIS into a tribal development matrix.

Chapter Six briefly outlines a survey result and discussions with Māori GIS and tribal development practitioners. The chapter reports that the establishment of GIS has been primarily ad-hoc in nature for the small number of Māori organisations who use or used GIS for tribal development projects. The ad hoc nature of GIS policy development was noted as problematic for governance procedures. Lack of trained GIS technicians also limited the ability of established GIS units to operate past establishment-phase. The theme to emerge from that chapter was that while there is currently a high level of interest in establishing GIS, there are also acknowledged barriers to doing so.

7.1 Benefits and Barriers

What can be concluded from the discussions in previous chapters is that the issues surrounding the establishment of a GIS range from the theoretical (mapping cultural heritage) to the practical (access to data) to the pragmatic (costs and resources). There are benefits and barriers to adopting this technology.

A small sample of the benefits can be described as follows:

- Development opportunities can be analysed from land returned post Waitangi Tribunal claim settlement
GIS can strengthen negotiating positions with central and local government
GIS can provide communication of complex textual and oral evidence and
diversification of Māori development opportunities can be analysed using GIS
multiple responsibilities of roopū can be streamlined or improved by adopting a cohesive GIS
roopū can use personalised cartography to express and communicate their korero
roopū can undertake their own analysis of their own research priorities
probable and possible future options can also be assessed using GIS
communication of spatial and temporal korero can be enhanced

Barriers to efficient uptake of this technology range from
the ad-hoc nature of establishment
a lack of specific policies and framework to support GIS creating infrastructural problems
that GIS is time consuming
there are potential changes to the transmission methods of traditional knowledge
that intellectual property rights are not protected and could be usurped by outsiders
a lack of access to information, data and resources and
lack of training and succession planning

Essentially, what is concluded was that the benefits that can be gained from indigenous GIS provide positive, cultural development opportunities that can reaffirm relationships with ngā tīpuna, whenua, taonga and whānau. Barriers to uptake of this technology are however, more than just practical; there are theoretical implications that should be deliberated by those contemplating it.

The enumeration of the benefits and barriers support the original research objective that a guide traversing all the issues could prove helpful to those considering GIS.

7.2 Meeting the objectives of this research

The objectives of this research were to:

1. Investigate the Māori cultural and epistemological issues concerning mapping mātauranga Māori (Māori knowledge), intellectual property rights, Māori development and the range of applications within a Māori specific context.

2. Evaluate the theoretical range of issues surrounding the development and implementation of a GIS such as -
Should we (establish a GIS unit within the tribal organisation)?
Could we (afford to in terms of economic and human resource cost)?
Would we (be able to efficiently maintain the GIS)?

3 Analyse the pragmatic range of issues surrounding the development and implementation of a GIS such as -
   Where is the information?
   Who needs to hold/secure the information?
   Will it be useful as a decision making tool?

4 Develop a resource Guide using checklists and options for establishing and maintaining a GIS.

The objectives for this research project were fully examined during the research. The theoretical questions within the first three Objectives were answered in Chapters 3 – 6. The theoretical and practical questions of the Objectives are answered within the Guide that is included as the Appendix.

This chapter iterates the conclusions that were reached as to the benefits and barriers to indigenous GIS. Although presented in this thesis afterwards, these conclusions are also supported within the text in the Guide. It is worth noting again, that as an applied piece of research, the construction of the Guide also fulfills the enablement aspect of Kaupapa Māori Research methodology (see discussion page 4). The Guide navigates the theory-praxis relationship in the same way that other applied research does, although the presentation of the Guide as an appendix to this thesis may differ.

The Guide was not tested during the time-frame for this research. So just how practical it is, or how tangible any benefit would be from the Guide is still only theoretical. The reasons for not testing Objective 4 are answered in the next section which deals with the limitations of this research project.

7.3 Limitations of this research

Limitations of this research project fell into three categories – scope, cost and resources.

The first limitation was the scope of the research. This is closely associated with the time needed to research the broad, investigative themes within both benefits and barriers to indigenous GIS. Had issues such as conceptual design and framework of the Guide (inherent in constructing a Guide aimed at a wide and novice audience) been included, the themes and
sub-themes that emerged from the research would probably deserve a thesis in themselves. The scope of the research was broad and as the research requirements snowballed, so too did the time, cost and resources.

Cost proved to be an important limitation. The initial proposal intended to field test the Guide via open hui, and included specific workshops to test the hypothesis that the Guide would assist informed decision making processes. Only one field test (Awarua in Bluff, see later paragraph) and one case study preliminary visit (Te Whanau a Apanui, see page 76) was able to be completed within the research timeline. This was due to several factors that are related to the type of research undertaken. The draft Guide was also given to several practitioners to review. While the feedback was supportive, it was verbal, and no critical analysis was received.

Kaupapa Māori research demands researchers are led by the schedules and decisions of those who are participating in the research. During construction of the Guide several delays were experienced. With a small research project such as this one, the windows of opportunity to meet with practitioners or gain feedback were quite often overshadowed by important issues that participants correctly ranked as being of more consequence. Thus, weeks or months of phone or e-mail tag produced little or no result. On other occasions, only a limited discussion would occur. Student budget resources also meant there was only a single opportunity to visit participants who lived outside Christchurch although it would be more appropriate to visit participants several times before and after conducting a workshop, hui or case-study. Limited resources also meant participation was voluntary. Grateful for any time that participants gave me, I was unsurprised when follow-up didn’t occur during the research timeframe. Ultimately, as the researcher who wanted information it was up to me to make myself available when there was space in their timetable. Many Māori organisations and practitioners are extraordinarily busy and suffer from hui-fatigue – thus, any time they had to give was sufficient. In its own way, the real-life demands on participants ability to meet to discuss GIS actually characterises the barriers to effective uptake of GIS and supported somewhat the need for the Guide to be constructed.

Of note too, is that delays in feedback or meetings were not limited to just Māori participants. At times during the construction of the Guide detail, considerable delay (months) was also experienced when waiting for information back from retailers, technicians and data salespeople.

Another research limitation was access to sufficient financial resources. For the field test in Bluff I was able to spend an entire day with two Runaka members who I took through a Guide presentation (about the Guide as opposed to working through the Guide). The timing of the
visit (ultimately synchronised for very early January), meant other Runaka members who had an interest in GIS were unable to attend. One participant was a novice GIS user (with no exposure or experience with GIS), the other participant had had previous experience with GIS. Both participants provided verbal feedback during the presentation. The key feedback suggestion at that time was to provide even more visual examples of GIS maps and analysis in the guide to aid communication. To a limited extent this was done. However access to resources (data, time and own-skill limitations - all noted as barriers within the Guide) meant the Guide still does not have sufficient visual examples. The second field test was to occur with another roopū identified during the initial research phase that had no prior experience with GIS but who nonetheless had expressed interest in it. However, logistics, timing and eventual closure of the Marae for hui (due to Marae operational problems - ablutions and power) meant the presentation did not, and then, could not, occur. Again, a real-life example of barriers to efficient uptake of technology.

Overall, the research limitations – scope, cost, data, time and skill – are inherent in all research projects. Ironically, as much as they affected my research, the limitations served just as good a purpose for my research. Each barrier that was presented ultimately reinforced an opinion that the Guide could be beneficial and provided real-life experiences of what factors would influence the range of decisions to establish a GIS unit.

7.4 Future Research Options

While the thesis is complete in itself, there are several research questions that can springboard from this research.

1. As the Guide was not field tested within the research project timeframe and budget, a logical future research option would be to field test it. There is also a potential research option to conduct a follow-through case study with any roopū who chose to work through the Guide in its entirety. This would allow a detailed qualitative and quantitative measure to ascertain the uptake of the technology and confirm (or reject) the thesis that the Guide would assist efficient uptake of the technology. Another associated research question could be to ascertain the benefits of constructing a post-establishment Guide; viz, a driving guide for those who already had a GIS up and running.

2. Information has been collated regarding local government interaction (see Appendix Guide, page 15). There is no clear idea about central government initiatives. Therefore, another future research option could be to investigate the nature and extent that government agencies engage in GIS and the extent of their interaction with Māori.
3. Given the continuously evolving nature of intellectual property rights, several questions arise regarding issues surrounding IP rights for indigenous knowledge and those associated with mapping mātauranga. Questions such as:

3.1. what is the extent of protection offered to Māori within scientific or technical development research programmes within New Zealand?

3.2. what co-operative research efforts are being implemented that recognise mātauranga Māori and how has the mainstream and Māori scientific knowledge been integrated?

3.3. what investigation/analysis did Māori undertake regarding the intellectual property and patent issues, when developing project initiatives that have their genesis in Mātauranga Māori (see discussion page 70).

4. Nationally, information technology is being promoted as the new, better and preferred world. Several research questions arise such as

4.1. whether information technology such as GIS/LIS is pushing policy development (driving) or whether it is supporting policy (driven) e.g. how much weight will the ANZLIC (Australia New Zealand Land Information Council) standards hold? And will the Council drive or only support policy development given ANZLIC is developing bi-nationally agreed policies and guidelines in spatial data management?

4.2. whether policy development is occurring regarding provision of free access to Government geospatial data similar to Canada or Hawaii (see Appendix Guide, page 18).

4.3. whether “new” is really “better”, or is it that technology development is driven from what ‘can’ be created as opposed to what ‘needs’ to be created

5. Some final future research options to be tendered are those that are technical in nature.

5.1. to model bat home ranges and kiekie dispersion/abundance to improve understanding of the interconnection / dependence of the kiekie on the bat and vice versa

5.2. to model restoration options for badly contaminated sites (e.g. the Matata Lagoon, impacted on for over 50 years by pulp/paper/timber mill and agricultural / domestic sewage contaminants, has recently been flooded – what affect will that have on cultural and biodiversity restoration options?)

5.3. to model the effect of low flow water levels on eel migration routes (page 82) and modelling the effects in-stream herbicide has had on tuna (eels). (See Appendix Guide page 18)
7.5 Concluding comment on indigenous GIS

In the Introduction I noted that Māori have always used different means to reinforce their culture and celebrate their sense of place within Aotearoa. Never a static culture, always an evolutionary one, Māori have frequently adopted or adapted new technology to complement existing tools. If adopted judiciously, GIS technology has the means to place Māori firmly in the drivers’ seat to manage their development opportunities. Notwithstanding the capacity and resource barriers, GIS as a new technology can visualise a personalised spatial and temporal landscape that can provide linkage to the past and openings to the possible future. While it is only a tool, there is opportunity to adapt and refine it to complement and supplement Māori development.

No reira,
Kua mutu taku koreroro. Kua mutu taku ma hi i tenei kaupapa.

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Lincoln University
2005
A Guide to Geographic Information Systems for tangata whenua

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Te Whare Wanaka o Aoraki
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2005

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A GIS scenario

For GIS novice users, most become interested in GIS when they see an end product, usually a map or an analysis supported by GIS. They may also hear about a GIS project that they themselves see of value to their particular area of interest such as an environmental resource inventory or perhaps a planning tool for forestry harvesting. The following fictitious scenario follows a train of thought and action prompted by (perhaps) a District Council resource inventory map that is presented at an environmental hui which (say) a tribal resource manager attends on behalf of their roopu.

“Hmm, we could do with that. Hmm, how do I get to do that – what’s that programme they use?” so the search for GIS software is initiated; after talking to the presenter and then their ‘GIS guy’ a decision is made to purchase “XYZ” programme; and then the hardware required to run the software package needs to be purchased so off to the agent who shows you the rest of the “bells and whistles” you need to be truly flexible and up to date so “123” hardware is purchased. And then of course you have to have someone to operate the equipment and run the software package and Johnny B who looks like a capable fellow and luckily went to university and did a paper on GIS last year says he’ll do it – “You’re hired Johnny!”; and then the issue of data acquisition appears because without the data you can’t do the project. So off to LINZ and Terralink and Landcare where you buy some data, take it back to the office and Johnny gets cracking! Your ‘Gis guy’ now produces several draft maps that includes not only the District Council inventory but also your own tribal resource markers including your Waahi tapu, mahinga kai and waahi rongoa. Great, just what you wanted. But …

Then the other members of the team want maps or analysis produced for them; and the original project gets superceded by all the other new projects; and the machine freezes up because it can’t handle the additional workload; and worse still, Johnny B, the only skilled person then leaves to go on a GIS programme tracking camels in Australia! Thousands of dollars and hundreds of man-hours are now sitting inside the expensive computer because no-one knows how to access it and no-one knows what to do. The project then gets shelved until ‘we find someone who can run it again’ but the finances are becoming stretched and employing someone specifically for GIS is not a priority; and then ‘someone’ borrows the GPS units and never returns them; and then the computer gets a virus that corrupts all the data; and then a kaumatua complains because someone has taken a draft map and ‘sold’ the location of the arthritis rongoa to a corporation who has gone in and harvested everything in sight; and then the District Council approves a resource consent for a dairy shed on top of a waahi tapu because the applicant supported his application by using one of your draft maps that didn’t show that particular waahi tapu site; and then another kaumatua complains that he never gave approval for the matauranga to be mapped in the first place; then the licensing fee for “XYZ” and the data from Terralink becomes due which really throws out the budget because no-one knew anything about licensing and then….

This fictitious example describes a worst-case scenario that identifies gaps; gaps in knowledge, in resources, in policies and in processes. It identifies gaps in four categories (knowledge, processes, policies and resources) that relate to four of the five integrated elements of managing a computer system (software, hardware, people and data). By ensuring the fifth element – processes – is attended to, these gaps can be bridged. If we take the processes element as the central element around which the other elements revolve, there is opportunity to examine threats and opportunities to GIS integration before significant resources are committed or expended and relationships impacted upon.
This guide has been designed to assist Roopu who wish to investigate the use of Geographical Information Systems. It guides readers through a five-step discussion designed to assist Roopu develop their own GIS policy and process framework. Firstly, an overview of mapping and GIS is presented. Then, practical matters are dealt with where establishment costs are signposted. Thirdly, a discussion on the opportunities for using GIS and the potential threats that may arise from mapping cultural knowledge is presented. Fourthly, planning steps are briefly identified and lastly, Part Five examines project design and management before a final discussion and checklist is presented. As part of the guide a list of GIS internet sites of interest has been included.

At this time, we also introduce a set of characters who will provide commentary throughout these sections. “Nanny E”, “Timu” and “Rangi” are committee members of a tribal roopu who get volunteered to investigate GIS after the committee heard about the Heiltsuk, a First Nations tribe who relocated wolves back to their original homeland in Canada by using something called GIS.

Figure 1: Nanny E, Timu and Rangi, na Chuckie (aka Cherie van Schravendijk)
Part One - GIS

“Hey Timu, you’re the nosey one. What’s GIS?” “I don’t know Nanny E, maybe we should check it out.” “Good idea e hoa. Away you go. Come back and tell us all about it. Write it down so we can read it for a bedtime story.” “Gee thanks Nanny E. Come on Rangi, you can help.” ….

GIS

“Okay you two – let’s see what you got.”

Descriptions of Geographic Information Systems (GIS) vary. It can be described as a computer mapping tool that shows the co-relationship between different attributes. Harmsworth describes GIS as being “highly suited for generating ‘visual’ spatial information which helps people understand relationships between information, concepts, and ideas.”

Relationships or ‘what is’ scenarios like;
- where are the taonga species like Kiwi or Kereru located?
- where are the mahinga kai?
- where were the original land holdings?
- what is the soil like at that place?
- what is the extent of our tribal boundary?
- what change has occurred over time for the size of our fishing grounds?
- how much rainfall does that place get?
- how big is that plantation?

ESRI (Environment Sciences Research Institute), the creators of ArcInfo, have a more ‘technical’ description - “A geographic information system is a system for management, analysis, and display of geographic knowledge, which is represented using a series of information sets such as maps and globes, geographic data sets, processing and workflow models, data models, and metadata.”

Palminteri et al. describe GIS as a system that, “combines computer software with hardware to access, view, manipulate, and display a wide range of geographically-oriented information, such as land uses, soil types, vegetation types, rainfall, elevation contours, human infrastructure or species distributions – anything that can be mapped.”

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156 http://www.esri.com/getting_started/index.html
The capacity to address spatial aspects of information distinguishes GIS technologies from other data analysis software such as spreadsheets and databases. The manipulation of information (predictive modelling) allows the analysis of answers to the ‘what ifs’. The ‘what if’s’ like;

What affect will an earthquake have on our community?
What land use options do we have?
Where could animal resettlement occur?
Which areas are priority for ecological restoration?
What part of our community has the greatest health risk and where are they?
What are the accumulated water abstraction issues from vineyard expansion?
How can we utilise ground and air transport operations better?
What will be the effect of a new motorway?
How effective will our civil defence emergency response measures be?
Where are the potential sources of contamination? or even -
What is the optimum siting for a holiday bach?

“Okay, so it’s basically a database with pictures that we can play with. It sounds pretty intense since we can do a lot more than produce pretty maps. How does it work Rangi?” “Well, I thought you’d ask that so I found some pictures and added it into the report to show you the different things.”

**How does it work?**

GIS uses two **spatial forms**. One is raster where grids (cells) are assigned certain values. The other is vector where points, lines and polygons are used.

![Grid example](image1.png) ![Polygon example](image2.png)

**Figure 2: Grid and Polygon example**

Maps created with GIS are usually called coverages or layers or themes, and are generated using data. All these coverages or themes can be combined in various ways to allow the comparison of different kinds of data.

The data has information (attributes) about a *place* that is collated into a table. The geographic position of that place is also referenced. By having the geographic position (co-ordinates) for that *place*, the attributes can then be projected and spatially displayed. For example, locations you think
are significant can be mapped by creating a table with attribute information - co-ordinate locations, names, type, history, etc. This map or coverage can then be projected using a GIS to visually and spatially display these locations.

<table>
<thead>
<tr>
<th>FID</th>
<th>Shape*</th>
<th>A1000</th>
<th>S_Easting</th>
<th>S_Nthing</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Point</td>
<td>1</td>
<td>2132538</td>
<td>5354806</td>
</tr>
<tr>
<td>1</td>
<td>Point</td>
<td>2</td>
<td>2143172</td>
<td>5353622</td>
</tr>
<tr>
<td>2</td>
<td>Point</td>
<td>3</td>
<td>2139211</td>
<td>5355797</td>
</tr>
<tr>
<td>3</td>
<td>Point</td>
<td>4</td>
<td>2154453</td>
<td>5389344</td>
</tr>
<tr>
<td>4</td>
<td>Point</td>
<td>5</td>
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</tr>
<tr>
<td>5</td>
<td>Point</td>
<td>6</td>
<td>2150820</td>
<td>5393939</td>
</tr>
</tbody>
</table>

Figure 3: Sample point co-ordinates

Figure 4: Sample point layer

One of the functions that differentiates GIS from other information systems is the ability to overlay different coverages where a composite view of different layers can be displayed. For example, if the points layer had lines and polygons overlaid onto it, it would look like this.

Figure 5: Sample points and lines and polygons
Further layers can be added to slowly build up a composite picture of space and place. For instance, by adding another polygon layer into the composite map a more detailed ‘picture’ emerges.

Figure 6: Sample points, lines and polygons

“Did you enjoy that Rangi? What kind of show and tell is this? and what can you show me that makes sense for our mahi? I think it can do more than show us where we live?” “Right oh, I was just getting to that. But before I do, how about if I just finish this off by showing you what the picture looks like once you add just one more layer like roads.”
As many variations or combinations as you wish can be constructed, dependent on the data you have. The points layer could just as easily have been the mahinga kai or harvesting sites or perhaps the kiwi tracking sites.

If you had one layer of information for the location of mahinga kai and another with industrial discharge points, these could be overlaid to assess the proximity of, and potential impact on, a mahinga kai.

Another layer with planned roading construction routes could be overlaid to see the proximity of these works to mahinga kai.

Exotic forestry harvesting blocks polygons could be added so the Roopu's forestry crews work rotation could be planned.

Fish catch records could be added to show volume, location and type of catch history allowing Roopu to ‘zero in’ on overfished, underutilised or even prohibited areas and signpost areas that the forestry crew could monitor as they do their mahi.

“Wow Rangi, that’s starting to sound workable. What else?” “Well Nanny E, GIS has been around for over 60 years. It takes users to another level of commitment above resource mapping. I’ve found a diagram that shows the kind of overlay themes we could use.”
Predictive analysis that manipulates data

Lien has found that GIS becomes an important decision support tool for end-users to assist simple and moderate levels of complex analysis.\textsuperscript{159}

Predictive modelling can manipulate and analyse data for a range of queries Roopu may have. Projects could be as simple as analysing the closest medical or educational facilities to Roopu members as part of a bid to keep the local hospital or school open or, they could involve the analysis of where health programmes need to be targeted, or of analysing the optimum transport


\textsuperscript{159} Lien, C. L. (2001). \textit{An examination of the decision making effectiveness of geographic information systems}. MA thesis. University of Auckland, New Zealand
routes to markets for your horticulture ventures. They could construct the viewshed from the proposed radio tower where you can assess just how ‘visible’ the structure really will be, or maybe even predict what could happen to the kaimoana beds once the aquaculture company gets their mussel farm up and running.

A GIS project could focus on locating optimum sites for growing various species of trees or plants. A query extracting the appropriate soils, temperature, rainfall, sunshine hours, pH, slope, etc can focus development or enhancement investigations on a discrete area, considerably improving on a hit and miss or best guesstimate approach.

Many committees, service providers and support organisations have connections with Roopu. Many have archives or joint ventures with outside agencies that have resulted in their amassing a great deal of site or subject specific data that can be useful for integration into a GIS. For example, a Hauora will have social and public health data that identifies and highlights health aspects of Roopu members, such as a listing of asthma sufferers in the region who have a need for focussed or specialist interest. Not only can their use of health services be tracked but by performing spatial queries, by querying their location with various environmental factors such as frost, sunshine hours, and emission pathways, the correlation between cause and effect may become clearer and mitigation measures negotiated.

Or, to take another example, District and Regional Councils often use Diquat, Roundup or other herbicides to spray their streams and river edges. While this may eradicate or inhibit ‘weeds’, it also regularly destroys watercress plantations. Additionally, tuna feeding patterns rely on burrowing for food. Spraying regimes have an unclear effect on subsurface habitat for tuna. Neither watercress nor recreational or cultural harvesting of tuna feature highly on local governments priority lists, and public health authorities may not necessarily deem it worthy of concern either. These attitudes expose another benefit of in-house GIS – the ability to drive the research and analysis priority from the Roopu’s own perspective.

“That’s the beauty if we run the GIS. We know what the appropriate questions and parameters for the search are because we use our matauranga and our korero to set those questions and we define the search parameters. We could even eliminate the need for outside consultants. And we know what we want to analyse, we don’t have to justify our reasons for doing any analysis to the regulators, we can use the analysis to support our concerns when we negotiate mitigation packages!” “Steady on Rangi, just keep on with the explanation”
“Sorry Timu, nearly there. Okay, now we have an idea what GIS is, how it works and how it might work for us. What next?” “Well, I think we should split up and find out what we need to set this up. Computer systems are usually grouped into five integrated elements; software, hardware, people, data and processes. The same applies to GIS. There’s three of us, so we’ll split up the jobs. Nanny E, you take software; Timu, you take hardware and I’ll take data.” Get some details and we’ll compare notes”

**Part Two – practical matters**

Introducing the practical matters associated with establishing a GIS. Nanny E, Timu and Rangi have spent several weeks gathering their information and meet to pool their ideas and work out the next best approach.

“Okay Nanny E. You’re up first, what’s the story about software?”

**Software Costs**

Based on a survey of Roopu, Councils and Universities, the three most popular software packages appear to be Arcview, MapInfo and Geomedia. Most of the Regional Councils I canvassed used ArcGIS, some used both and Environment Waikato uses all three. According to Mark Williams from Environment Waikato, they “use whichever package we need to get the job done.” It’s an even split between software programmes for District Councils and most Roopu use MapInfo.

All three New Zealand desktop GIS have New Zealand agents (Eagle Technology for ESRI’s ArcView, Critchlow & Associates for MapInfo and Intergraph Corporation New Zealand for Geomedia). Many software developers and onsellers separate the actual software package from the ‘care’ package (technical support, upgrades, patches, etc). Licence or maintenance fees also contribute to the overall costs of establishing and running a GIS.

<table>
<thead>
<tr>
<th></th>
<th>Basic package</th>
<th>Extras</th>
<th>Technical support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arcview</td>
<td>Single Use licence, $3750 + GST,</td>
<td>Software upgrades offered via annual</td>
<td>Unlimited technical</td>
</tr>
<tr>
<td></td>
<td>Annual Maintenance Support Fee: $1,200 + GST</td>
<td>maintenance fee</td>
<td>support via email or 0800 number</td>
</tr>
<tr>
<td></td>
<td>Concurrent Use Licence, $8,750 + GST</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Annual Maintenance Support Fee: $1,800 + GST</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

160 M. Williams, email communication, 10 November 2004  
161 Costs and details as at November 2004
MapInfo

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per named user</td>
<td>$3,200 + GST</td>
</tr>
<tr>
<td>Volume discounts available</td>
<td></td>
</tr>
<tr>
<td>Optional annual maintenance fee</td>
<td>20% of list price</td>
</tr>
<tr>
<td>Software upgrades and bug fixes offered via annual maintenance fee</td>
<td></td>
</tr>
<tr>
<td>Additional Annual Help desk service fee</td>
<td>$300</td>
</tr>
<tr>
<td>Annual Help desk service offers technical support via email or 0800 number, limited free help desk service offered for those who attend MapInfo Intro courses</td>
<td></td>
</tr>
</tbody>
</table>

GeoMedia

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single licence</td>
<td>$3,000 + GST</td>
</tr>
<tr>
<td>Optional monthly maintenance fee</td>
<td>$50</td>
</tr>
<tr>
<td>Software upgrades offered via monthly maintenance fee</td>
<td></td>
</tr>
<tr>
<td>Technical support via phone and web</td>
<td></td>
</tr>
</tbody>
</table>

As can be seen from the table, the purchasing cost for a basic GIS package begins at $3,000 plus various annual costs ranging from $300 to $1500, depending on what you require. For the majority of new users, technical support is critical while establishing the GIS. Another decision would need to be made when considering the internal availability of the software once purchased. Single use licences allow installation of the software on one desktop PC only. Costs for expansion of GIS use could therefore become quite considerable.

Several options for evaluating a potential software product are readily apparent. They could include a visit to the local council (or other GIS user) to see their GIS ‘in action’, asking the vendors to either send an evaluation copy of their software to ‘try before you buy’, or sending the vendors a list and description of your needs and letting them develop a bid for your work. Terralink also offers a GIS consultancy service. In North America, both ESRI and MapInfo have several support initiatives such as grants and joint venture projects for indigenous mapping so it may be worth exploring these options here in New Zealand.

Inasmuch as the initial cost of software is expensive, it is also ongoing given the upgrades are being regularly developed. The cost of technical support also needs to be factored in to the project’s long-term costs.

Freeware

Freeware is also another option for GIS users whereby computer programmers have developed free GIS programmes that are available over the internet.

GRASS (Geographic Resource Analysis Support System) is a freeware or shareware package available over the internet. It can apparently be used on either Windows or Mac platforms. The site also gives access to tutorials, data and tips on how to access and utilise the package. Familiarity with GIS and computer software programming will help.

MapScan for Windows was developed in about 1995 by the United Nations. Designed to assist automatic map data entry, converting raster maps, images and drawings into vector formats or to transfer printed and hand-drawn maps into a mapping system, MapScan software is apparently

http://grass.baylor.edu
available to United Nations Population Fund (UNFPA) supported programmes and developing country government agencies and academic institutions free of charge.\textsuperscript{163}

CAMRIS is another freeware.\textsuperscript{164} The Computer Aided Mapping and Resource Inventory System appears to have been designed by the U.S. Fish and Wildlife Service in 1999 as a conservationist / biologist mapping and manipulation tool.

SPRING is yet another GIS freeware available over the internet. It was developed by the Brazilian National Institute for Space Research with several other agencies and organisations. Written primarily in Spanish, SPRING says it is a fully developed GIS that can be used for all the spatial analysis you may need.\textsuperscript{165}

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“You know, with the freeware around we may want to have a closer look at it. Maybe even brush up on our Spanish! We will need to look at whether we want to do ‘plain’ mapping or predictive modelling at some stage. But for right now, that’s what I found out about GIS software.”

“Okay. So now we know the cost of the commercial products, and the possible ongoing costs with it. We’ll probably have to look at our Roopu’s management structure so we can assess who will be responsible for evaluating and deciding what is the best software to use. We also need to decide who will be responsible for making the financial decision. Thanks Nanny E, software choice is a bit more complicated than I thought. Timu, must be your turn.”

“Sure thing Rangi. I found out you can have stand-alone data or you can get the package deal. It all depends on what you want to do. It also depends whether you’re using New Zealand datasets or international ones because there are different datums and projection systems.”
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Data

New Zealand has many data sets that are available from several vendors. Some of them may be useful for developmental opportunities such as;

\textsuperscript{163} http://netgis.geo.uw.edu.pl/free/mapscan/mswug.pdf
\textsuperscript{164} http://www.camris.com
\textsuperscript{165} http://www.dpi.inpe.br/spring
Lenz, (Land Environment New Zealand) is an environment based classification product produced by Manaaki Whenua/ Landcare. Distributed under licence, the classification uses fifteen data layers describing various aspects of New Zealand climate, landforms and soils such as lowest temperature, highest winter solar radiation, drainage etc.

The Crown Forestry Rental Trust undertakes mapping for Treaty of Waitangi claimants who have claims registered against the Crown State Forest assets. Te Matua Whenua or the Land History Alienation Database traces alienation from the original Maori Land Court title to current times. (see Appendix 6, Figure 1: Crown Forestry Rental Trust Maori Land Alienation Database, page 69)

Critchlow Associates Limited customised a Maori land database extension for the program MapInfo that may be worth investigating.

The National Maori Land Information Database for GIS was developed by Te Puni Kokiri and is accessible online. This GIS database allows users to locate Maori Land Blocks in New Zealand and their underlying management and ownership information (see Appendix 6, Figure 2: Te Puni Kokiri Maori Land Information Land Base map, page 69)

The National Institute for Water and Air holds the national climate database featuring temperature, rainfall, solar radiation and frost isoline data.

LINZ topographical shapefiles, derived from NZ Topo series maps are available locating monuments to rivers to forests and from airports locations to wrecks to waterfalls etc. Their bulk cadastral (land property boundaries) datasets are also available for a fee. Terralink and other vendors have manipulated the data into datasets that are easily transportable to most GIS applications.

The Department of Conservation has biophysical and spatial datasets for their administered lands, areas of national importance and native species including their distribution. DoC also manages the New Zealand Archaeological Site Recording Scheme. DoC also utilises GIS predictive modelling for their work, one example being an investigation into the correlation between environmental factors and Maori pa and pa site locations in New Zealand.

It is possible that future costs of datasets may decrease if international examples are followed. The Canadian government has launched an internet portal called Geobase that provides Canadian

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166 Provided appropriate acknowledgement are made of source and limitations of the data plus confirmation that the data wouldn’t be transmitted electronically to third persons, it is possible for iwi, etc to get a copy of the 56,000 plus records, free of charge, if it is for resource management purposes or research only. T. Walton, Department of Conservation, email communication, December 2004.

citizens with free, unrestricted access to its geospatial data. The Hawaiian State wide GIS program offers similar, free geospatial data. The Otago Regional Council is a New Zealand local government example providing a similar direction. The ORC funded a project where the soil and climate data for the whole region was collected over three years. NIWA, AgResearch and Landcare, alongside Otago and Auckland Universities developed 96 information maps for this initiative. Access to the maps will be through the Council’s web site or via a CD available for the cost of production only. Most Regional Councils and some District Councils also provide internet viewing access to their biophysical and resource consent layers.

While the ORC is providing a worthy exemplar, and the New Zealand government is attempting to make government-held information more readily available by decreasing the costs of central government datasets and not imposing copyright fees, there is still no apparent overarching policy to match the Canadian government’s example.

There are also free GIS data web sites you can download information from such as Nativemaps.org, the Aboriginal Mapping Network and the Free GIS Data Depot. One opportunity that could be investigated is that offered by the datasets available from Government Agencies like the Statistics Department, Ministry for Agriculture and Forestry, Fisheries, Justice, Health, etc. NZ Universities have also amassed information and data from the research work they have undertaken.

The following datasets would nominally appear as the ‘starter’ kits for GIS;

Table 2: Dataset Costs

<table>
<thead>
<tr>
<th>Dataset Description</th>
<th>Cost</th>
<th>License fee</th>
<th>Annual Maintenance fee</th>
<th>Update</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tumonz</strong>, a basic mapping programme that does not go further than querying and mapping</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tumonz data</td>
<td>$90</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Legal property boundaries, address and owner details</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Property boundaries with 1/4ly updates</td>
<td></td>
<td>$240</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linz colour aerial photos (2003)</td>
<td>$45</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seabed contours</td>
<td>$95</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spreadsheet Datalink</td>
<td>$280</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LINZ</strong>, (Land Information New Zealand), one of the ex Department of Survey and Land Information arms, holds the cadastral database for NZ with topographical vector datasets. Many onsellers provide convenient reformatted data for end-users (e.g. Tumonz, Eagle, Critchlow and Terralink)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LINZ – property data Cadastral data via Bulk Data supplied from Landonline (requires manipulation)</td>
<td>$270 (GST incl) irrespective of size of data supplied</td>
<td>Nil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>168, 169</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e-search (title &amp; survey searching)</td>
<td>$500</td>
<td>$80</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

168 Meshblock data (demographics/population) available from Linz however licence needs to be purchased from Statistics Department first and not included in price

169 In 2002 the cadastral database cost from Linz included a set up fee and a first year licence fee amounting to $3145 and an annual maintenance fee of $280


171 using this licence a title search would cost $2.00 rather than $4.00
Another opportunity to acquire data is represented by the consultancy work being carried out by consultants developing projects like land development, research surveys or scientific studies. If they carry out any spatial data analysis in your role you could require the digital data to be part of the report that you receive once they’ve completed their project. This low cost or no cost way would keep new data flowing in a format that fits into your GIS. Even if you had no GIS up and running at the time, you could always be amassing data for future use.

The importance of ensuring you have good quality data should also not be undervalued or underestimated. The Jemez Pueblo in New Mexico found many GIS projects had failed or were stalled because data was either insufficient or incompatible.\(^\text{172}\) When roopu are acquiring datasets - from whatever source - negotiating high quality, usable data at the outset can avoid potential setbacks.

When assessing new data, check when the datasets were first geographically referenced. In the old days, data was recorded and projected using imperial measurements. Then it was changed to metric. Such changes are evident in the records for the registered archaeological sites of New Zealand. Most information is now in the newer MapGrid co-ordinates. NZ has recently had another geographical datum established to bring it more into line with other international datum and

\[^{172}\text{http://www.conservationgis.org/links/native4.html#PuebloofJemez, accessed on 14 November 2004}^\]
in the future there may be as many as three co-ordinate references listed once new data is generated and maps are updated.

Another interesting aspect to data is its accuracy and what it actually represents. To continue the discussion on NZ Archaeological sites – while not all archaeological sites are recorded in the New Zealand Archaeological Sites Registry the information that is recorded is also not necessarily 100% accurate. Some errors occurred during the original recording of sites, and other errors crept in during the changeover to metric coordinates that occurred in the 1980’s. Moreover, point coordinates do not always reflect the actual size of the site, because many sites, perhaps 100-200 metres in diameter, could be recorded as a one-point coordinate. The limitations in the data are well signposted by the declarations that most data agencies supply and local knowledge usually picks up any anomalies once groundtruthing occurs. (for example see Appendix 6, Figure 4: East Coast Archaeological Sites, page 69)

“Good stuff Timu. So it’s pretty clear that, similar to the decision on software, we need to define exactly what range of projects we want to undertake before we decide what data we need. Righto, must be my turn.”

Hardware

It is important to ensure the right hardware is on hand to run a GIS given it is a ‘hungry’ software that can take up a significant amount of PC capacity. The space required for data is also fairly substantial. A faster computer that has sufficient space to install the software and good capacity to run mapping enquiries – as well as analysis – ensures the most efficient use of users time and helps to maintain data integrity.

<table>
<thead>
<tr>
<th>Table 3: Hardware system requirements for ESRI’s ArcView</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating System</td>
</tr>
<tr>
<td>Speed</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>RAM</td>
</tr>
<tr>
<td>Disk Space</td>
</tr>
<tr>
<td>Other recommendations from the vendor</td>
</tr>
</tbody>
</table>

Basic desktop computer costs for GIS can range from $3000 upwards. It would help to consider additional factors like the extra storage (memory) capacity needed for holding the information data (gigabytes rather than megabytes) as well as virtual memory capacity when determining if current computer capacity is suitable.
The costs of other hardware requirements should also be considered, such as
another $3–400 for a scanner (for scanning maps or sketches) and printer.
a GPS (Geographic Positioning System) for entering data coordinates during fieldwork or
groundtruthing can cost anything from $300 - $1,000, and if you want the luxury item,
a digitising tablet to build vector layers from hardcopy maps - be ready to invest another $4,000.

The type and cost of the hardware will be determined by the range of projects the Roopu wish to
undertake and to some extent by the skills of the people who will operate the system.

Decisions will also need to be made about who has access to workstations should new hardware be
purchased. Whether the workstation becomes a shared resource or a dedicated person’s
workstation will determine access security to the programme and the data. These considerations
ought to be explored as part of an overall GIS project design.

“You know, I also looked around to see what we might need in terms of people
skills to run this GIS. We need to look at succession training, making sure we’ve
got several people who can run the GIS.”

People skills

The number of people and the range of skills required to run a GIS project depends on the project
Roopu wish to undertake. Digitising, taking GPS co-ordinates and importing them into a GIS plus
basic mapping are skills that can be taught in a few sessions. Data manipulation and analysis
however, requires a more precise level of training. At the time of writing, most New Zealand
universities offer GIS papers. Most offer the ESRI product ArcView as their taught software. Victoria
and Otago universities also mention having MapInfo software available and Massey also offers a GIS
paper extramurally. Prices for GIS papers varied. Canterbury University advertised their entry level
paper at $714 and Lincoln University, $477.\footnote{173}

The entry level GIS paper at Lincoln University is a good example of the topics covered. Lectures
cover both raster and vector analysis, using aerial photos as basemaps, viewsheds, remote sensing
and georeferencing. All relate to the main assignments - identifying the potential habitat and
breeding areas for Kiwi, fire outlook analysis for a fire protection scheme for a portion of a harbour
basin, location of a house site based on specific viewshed, slope and vicinity criteria and a walkway
management system where prioritisation of track maintenance is modelled.

\footnote{173 web search, November 2004.}
Product specific training courses are also available from product vendors.

<table>
<thead>
<tr>
<th>Training</th>
<th>Arcview</th>
<th>Held in Wellington and Auckland centres</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$1100 + GST for introductory 2 day training course</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$1650 + GST for next level</td>
</tr>
<tr>
<td></td>
<td>MapInfo</td>
<td>Held in Wellington</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$1200 for introductory 2 day training course</td>
</tr>
<tr>
<td></td>
<td>GeoMedia</td>
<td>Held in Auckland and Christchurch</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$1050 + GST for 2 day training course</td>
</tr>
</tbody>
</table>

Joint training programmes with other Roopu could also be investigated in which trainers are brought to a convenient venue for specific training programmes, rather than sending several individuals to distant locations.

“Okay so now we’ve got most of the exploratory information together – what it is, how it works, what the software, hardware and data needs are and what potential training options could be – it’s time to look deeper into it.”

\(^{174}\) Costs and details as at 2 November 2004
Part Three – opportunities and risks

Part three discusses some of the opportunities that GIS has offered indigenous peoples. It also highlights some of the risks that may arise from using a new tool such as GIS, with particular reference to mapping matauranga. Nanny E, Timu and Rangi, having spent some time gathering their practical data, now meet to discuss the next step in their investigation.

“All of us have come across references to others who use GIS in some manner. Now we have a better understanding of what they’re talking about we should see what kind of projects are actually out there. Since it’s relatively new here perhaps we should look at what other indigenous peoples are doing. It may give us a better idea of what we can do and what to look out for.”

“Sure thing Rangi, it’s important to look at how others have used this tool. I came across a reference about a couple of recent indigenous GIS conferences. The first one was in British Colombia in November 2003 where the conference theme was, ‘Mapping for Communities: First Nations, GIS and the Big Picture’ 175, and then another in Canada in 2004 where over 200 participants from 24 countries came together to discuss indigenous GIS and its applications. The Crown Forestry Rental Trust Land Alienation Project was presented at that conference too. I’ll do a quick search and see what else I can find.”

International Opportunities

Indigenous peoples in the 21st century face the results of nineteenth and twentieth century pollution. The biophysical threats from synthetic and man made sources are amplified by globalisation and the complexities of multi-national, trans-national agendas and protectionism. As the global community stretches and expands its boundaries, it has in effect shrunk the boundaries traditionally controlled by indigenous communities and peoples. The need to protect their biophysical and cultural resources is also exacerbated by a global trend to commodify and commercialise indigenous knowledge. This trend requires indigenous peoples to engage in scientific, technical and legal intricacies at an unprecedented level. As part of that engagement, many indigenous peoples have participated in mapping opportunities.

Participatory mapping (or community mapping or ethnocartography) does not require a large investment in technology. Many initiatives use hand-crafted mapping and drafting techniques to

175 http://www.bcfn.org/isp/PDFs/GIS_Survey.pdf, downloaded 12/12/04, 6.00pm
compile their maps. An increasing number of projects illustrate a change in the ‘ownership’ of the projects with indigenous communities functioning as active participants rather than being the subject. Projects ranged from mapping cultural inventories and tribal lands to watershed modeling and health impact surveys. All reflect outcomes based on the indigenous peoples own preferences or priorities.  

**Examples of indigenous peoples GIS projects**

The Nunavut Planning Commission has introduced a Nunavut-wide GIS database and planning application system called PLANNER. The Public Land-use Application, Network Notification and Environmental Reporter allows a project location to be entered using an interactive map. Customised maps are able to be generated showing the proposed project in relation to tribal resources ranging from wildlife to landuse to cleanup sites and other themes. Automatically emailed to the requester, the automatic spatial query also triggers internal automatic responses, such as appropriate permit applications for the proponent and automatic notification to appropriate authorities. In planning terms, the benefit of communicating tribal standards to applicants thereby clearly indicating to them the minimum benchmark for application is apparent.

As a result of their successful suit against the U.S. government for upstream mismanagement that damaged the Zuni River watershed, the Zuni Nation is using GIS as part of a Conservation watershed rehabilitation project that will include a “computerized system for resource management and the training of Zuni professionals and technicians in the survey, inventory and collection of geomorphic and hydraulic data, their analysis for watershed modeling, and mobile river-bed analysis.” They also identified an additional 255,266 acres over and above that which was originally identified by the Zuni korero. The need for spatial data to support the Zuni in litigation also acted as a springboard for developing an automated spatial database.

In Neguev, Costa Rica, a GIS project combined western and indigenous knowledge systems to produce a GIS automated response model allowing local farmers to query optimal cropping options for land based on different slope and soil characteristics using their preferences.

The Oglala Sioux Badlands Bombing Range Project in Pine Ridge, South Dakota, enables Oglala Sioux tribal members to use GIS to map evicted families original land holdings in the Badlands Bombing Range, while at the same time the project is using GIS to map the locations of the detonated and unexploded ordnance (ranging from bombs to hand grenades to bullets) resulting from the US government’s abrupt appropriation of their land for a World War II bombing range that imposed the relocation in the first place.

In Cambodia, the villagers of the Treng commune participated in a project focussed on the Chisang, Chea, Montrey and Kilo villages to prioritise their clearance objectives for the removal of ordnance (in this case land mines) in order to facilitate safe agricultural farming for the communities.

The Indonesian Merauke community utilised GPS to develop plans outlining traditional resource use in the Wasur National Park that mapped sago gardens, sacred sites, travel routes across the Papua New Guinea border to visit relatives, as well as hunting and fishing sites.

The Jemez Pueblo in New Mexico uses GIS extensively to undertake their tribal development initiatives like housing development, water modelling and waste management design. Using

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176 Several organisations and web-sites are listed in the appendix for Roopu to refer to if they wish to explore this further.
177 http://planner.nunavut.ca
182 ibid
information gathered during a student survey, they have also investigated the environmental impact on the increase of asthma patients in the Pueblo due to upwind pumice mining. They hope to find whether there is a potential correlation between the dust particulate and the rise in asthma patients.  

The Ramingining community in Northern Australia used GIS to map their cultural resources and current baseline environmental inventories to assist the local community “in making informed land management decisions with regard to environmental problems that are new to both traditional owners and the region itself”. Appropriate allocation of colour mapping was constructed to make it suitable for local interpretation; for instance “the Melaleuca species were allocated tones of grey to match the approximate colour of the bark. The floodplain grasses were colour-coded in tones of brown, to resemble their appearance during the dry season.”

The Manitoba Keewatinowi Okinakanak tribe used GIS to defend their traditional rights from the impact of hydroelectric developments and large scale forestry activities on the physical resources.

East Kalimantan Indonesians used GIS to evaluate different means of coordinating indigenous resource management systems with government instituted systems of management and as a basis for formal legal recognition and protection of customary forest tenure arrangements.

**Tangata whenua opportunities**

“So, it looks as if there’s quite a bit of interest internationally amongst the indigenous peoples. In New Zealand it seems we’ve used GIS mainly as a mapping and assessment opportunity. However, we’ve only had our teeth into GIS for around ten years, so it’s not surprising. Still, with the land-base increasing and more active participation in planning and development, there’s not much written information about our own GIS projects.”

The number of maps outlining traditional and historical land and marine resource use that have been created for Waitangi Tribunal claims is extensive. Some iwi have undertaken mapping projects through government funded initiatives. Ngai Tahu, for instance, are plotting land use capacity via the ARGOS scheme initiated by MAF. Te Whanau a Apanui are developing a custom-made GIS for a Land Use Optimisation project through a TechNZ funding project. Local government, like the Opotiki District Council and the Tasman Unitary Council, are also supporting or funding cultural mapping initiatives with local iwi.

Roopu have explored a number of different development opportunities involving:

<table>
<thead>
<tr>
<th>tribal resource inventories</th>
<th>fish harvesting</th>
</tr>
</thead>
<tbody>
<tr>
<td>eco-tourism</td>
<td>habitat ecosystems</td>
</tr>
</tbody>
</table>

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186 Hakopa, ibid, p 66
archaeology
streams
land suitable for different crops and cropping methods
traffic flow
identifying historic and current property titles and ownership

More specific examples include;

Ngati Hauiti use the Terralink digital maps
Ngati Kahungunu are considering GIS to assist in eel management planning
Mangatu Incorporated use GIS to assist them in their farming enterprises
Taumutu Runanga used GIS for mapping and resource management
Ngati Whatua are investigating the use of GIS as part of their iwi management planning and
Both Kati Huirapa Runaka in Otago and the Ngai Tai iwi Authority in the Bay of Plenty use GIS
Te Whenua used GIS to map its landholding and to assist in its forestry development

Te Runanga o Ngati Porou mapped their landholdings from five different periods over a 120 year period to
assist its treaty claims and planned to use the system to map its social services and housing work. It also
used their GIS to assist their collaborative research project with Manaaki Whenua Landcare Research; to
specifically “record and utilise Maori knowledge alongside scientific information to improve understanding
of cultural values, catchment processes, and environmental change, for integrated catchment planning”.

The archaeological research on Poutu Peninsula conducted for the Te Uri o Hau o Te Wahapu o
Kaipara Waitangi Tribunal claim was supported by a GIS whereby the series of maps produced
complemented the research reports and was also used to assist interpretation of temporal and spatial
records, including being able to visually represent the changes in the coastline and even the correlation
between pa sites and soil types

Ngati Tama, Te Atiawa and Ngati Mutunga of Taranaki, used GIS to map cultural and historical information
as part of their Waitangi Tribunal claim negotiations. The possible use of GIS as a tool for economic
development and resource management post settlement was also a factor when purchasing their GIS

Ngati Raukawa are completing a conventional GIS exercise to map demographic data collected in their iwi
census. The resultant data set and GIS will enhance their ability to better target social, health and
education services to their tribal members

Te Runanga o Ngai Tahu Customary Fisheries Unit designed and implemented a GIS system to record
precise and accurate data where customary fishing occurred enabling both spatial and temporal
analysis to be undertaken to enhance management options

Te Runanga o Turanganui a Kiwa (TROTAK) had the existing capacity (human resource, equipment and
administrative support) to develop a Maori Land Database as a means to develop under-utilised Maori
land in Turanga. Contracted by the Community Employment Group to provide the database, the decision
was made to utilise a GIS at an early stage, instead of the original spreadsheet concept. MapInfo training
was provided by an experienced Maori GIS practitioner enabling the upskilling of researchers and project
team members alike. The resultant database provided a tool for economic development that was culturally
approved and appropriate.

“Okay. Now we know what is happening out there. Mainly mapping and analysis of
cultural resources here in Aotearoa – and it all sounds pretty cool stuff! But. We
should have a look at the downside too, see if there’s any problems with mapping

190 Engle, S.T., Negotiating Technology – (Re)considering the Use of GIS by Indigenous Peoples, New Zealand Geographer (57 (1) 2001
“Okay Nanny E, Timu. When I thought about it, it was clear that the first outcome for any mapping or GIS project was typically a cultural resource inventory – what we identified as being important to us – our rohe, our landmarks, our traditional land use, our cultural markers like battle sites, rongoa sites, mahinga kai, taonga, waahi tapu etc. Then I thought about what happens once we’ve mapped all this indigenous knowledge – this matauranga of ours – and even more issues came to mind. There was an aspect I hadn’t even considered until I saw a newspaper article about how a group of African people got ripped off by biopirates for an enzyme found only in their lake, that can be used to give jeans that faded look. Add that to the waste of money if we don’t plan how to maintain our GIS and how our maps might even be used against us it’s pretty clear we should plan properly and put the right policies and processes in place right from the start if we want to avoid unexpected consequences. Good thing we looked at it.”

The increase in participatory mapping, also known as community mapping or ethnocartography has resulted in several controversial instances of misuse and appropriation of indigenous collective knowledge. Maps, generated or commissioned by indigenous peoples, have at times been used against them and contrary to their original purpose.

**Two examples of consequences of mapping cultural resources**

In Australia, an incomplete map, locating only some sites of significance, commissioned by the Western Australia Aboriginal Legal Service as part of a case in the Mining Warden’s Court, was used by the mining company Amax, as an authoritative indication of significant sites, supporting their intent to drill a wildcat well near Umpampurru. Umpampurru was well known as a significant site in the region “linked to major Ngaranggani (Dreaming) figures associated with goannas, lizards, frogs, kangaroos, turkeys, snakes and other reptiles.”

Concerned with industrial logging practices, the Mamo Atoskewin Association (MAA) used GIS to establish a database and map of Atikamekw lands based on traditional knowledge of Moose, Beaver

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191 see Appendices for further examples
and waterfowl information alongside information for gathering sites. Supported by aerial photos their mapping showed evidence that logging was non-compliant with regulations and threatened wildlife and flora. After sending supposedly confidential maps to government agencies, the MAA not only received no response from those agencies but found Quebec’s resource management agencies had used their maps without consent.\textsuperscript{193}

\textit{Bio-piracy}

Indigenous knowledge (also known as Traditional Ecological Knowledge or Local Knowledge) is the living, dynamic knowledge that indigenous peoples continue to amass from their long-standing, multigenerational, intimate connection with the environment and its resources. The debate surrounding the dissemination and illicit use of indigenous knowledge is hotly pursued in both national and international arenas. The commodification and corporatisation of anything organic or inorganic; tangible or intangible; known, contemplated or speculated, is a global phenomena that has consequences for all indigenous peoples. The actions of unethical biotech companies, scientists, academics and corrupt governments have all contributed to a common indigenous complaint of biopiracy.

\textit{Two examples of bio-piracy}\textsuperscript{194}

in Gabon, the University of Wisconsin was granted exclusive U.S. market rights to brazzein, a protein extracted from the berries of a West African plant found on native lands.\textsuperscript{195}

In Zimbabwe, Phytera (a U.S. company) and the University of Lausanne (Swiss) attempted to patent the snake-bean tree used by traditional healers for generations.

As much as three-quarters of the plants that provide active ingredients for prescription drugs originally came to the attention of researchers because of their uses in traditional medicine.\textsuperscript{196} Pharmaceutical industries are estimated to have earned almost five billion dollars from plant germplasm taken from South Africa. Agricultural acquisition of the sorghum germplasm originally collected in Ethiopia has apparently netted a cool 12 million dollars a year for commercial farmers in the United States.\textsuperscript{197}

Biopiracy can occur anywhere and anytime – even at conferences where biopiracy features highly on the agenda at that very time –


\textsuperscript{194} See Appendices for further examples

\textsuperscript{195} Ibid. Also to be noted is the multiplicity of evidence available through U.N. and NGO documents available either in the published hardcopy arena or available through internet searches. See for example Johansen's recent book, \textit{“Indigenous Peoples and environmental issues, An Encyclopaedia”}; and also the Cultural Survival Quarterly web newsheets

\textsuperscript{196} Kloppenberg, “No Hunting! Biodiversity, Indigenous Rights and Scientific Poaching.” Cultural Survival Quarterly, 15.3.

“When the Convention on Biological Diversity convened for its second COP in Jakarta late in 1995, delegates were confronted with an infuriating local example of biopiracy. The family of a Novo Nordisk employee holidaying in Indonesia had used a company-provided sample kit to scoop up soil from a local monkey temple. Subsequent research showed that an enzyme extracted from that sample could be widely used in soft-drink manufacture to convert starch to sugar. The advice for temple guardians in Indonesia? Have tourists wipe their feet _after_ they leave.”

*Indigenous symbology and korero*

Indigenous people’s imagery and words have also been used in marketing ploys that have outraged and offended indigenous peoples. Global and nation-state copyright laws do not protect indigenous symbology from inappropriate use, let alone the kind of unauthorised use experienced by the Inuit. The Inukshuk, an Inuit symbol of a pile of rocks used as a navigation marker, “now adorns the box of a product used to combat erectile dysfunction”. Maori have also been faced with their own instances of inappropriate use of symbology in the recent past when a Sony game featured a taiaha wielding male warrior with a Kaua e and Lego stopped marketing a Bionicle toy after complaints about its use of words such as “tohunga” and “whenua.”

*A New Benchmark?*

Risks to indigenous people’s knowledge stem from the advent of bio-piracy where biological theft occurs via patenting and copyright legislation and agreements that fail to recognise indigenous people’s rights. However, a recent positive initiative may provide the new benchmark by which negotiated outcomes can be compared.

SciDevNet recently reported the Samoan government and the University of California, Berkeley have signed an agreement to share equally in the profits from a potential anti-HIV drug derived from the bark of the Mamala tree, which is indigenous to Samoa. Interest in the tree bark was stimulated from an ethnobotanist who first learnt of its properties from local healers. Apparently the AIDS Research Alliance has also pledged to give 20 per cent of any profits they make from their clinical trials back to the country.

*New Zealand*

To date, New Zealand does not have any specific legislation outlawing or regulating bio-piracy or bio-prospecting. It is a member of and signatory to the World Trade Organisation’s TRIPS (Trade Related Aspects of Intellectual Property Rights) agreement. This agreement obliges

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201 reported on http://www.SciDevNet., 07 October 2004
202 Report from the Royal Commission on Genetic Modification, p 293
countries to provide intellectual property protection for plant varieties nationally, either through patents or a sui generis (special) system. The goal of the agreement is to facilitate free trade by ensuring that intellectual property rights are protected throughout the world. However it does not refer to indigenous peoples. Moreover, New Zealand is also signatory to the Biological Diversity Convention. The 1992 Convention was ratified by New Zealand in September 1993 when the NZ government promised to “respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities” with respect to biological diversity (article 8. (j)). These ‘promises’ have not stopped New Zealand companies being cited for at least ten incidences of grass seed bio-piracy.\(^{203}\)

The United Nations 1994 Draft Declaration on the Rights of Indigenous Peoples, the 1993 Mataatua Declaration and the Indigenous Flora and Fauna Waitangi Tribunal Claim (WAI 262) all contribute to the New Zealand debate over intellectual property rights and indigenous rights.\(^{204}\) The matauranga that is already in the public domain is extensive. The current laws and conventions consider that if it is documented, it is in the public domain. Consequently there is ample opportunity for open perusal by any bio-tech company who is interested in spring-boarding their research on the back of indigenous knowledge.

An example of the inadequacy of current patent laws for matauranga is the Te Roopu Raranga-Whatu o Aotearoa’s patent application. Their application was for a coprosma extract used “to dye flax baskets yellow in order to head off a French company which was investigating its use as a hair dye. On the question of time limits she [Cath Brown] stated: It has worked so far but then you lose your patents they wear out after so many years and then what do we do?”\(^{205}\)

This example illustrates the dichotomy that is created when to protect indigenous knowledge indigenous people are forced to patent it. However, to add even further complexity to the issue, two aspects of indigenous knowledge fall outside basic criteria for current patent laws, that of being ancestral and collective in nature. The dilemma facing Maori thus becomes – if I or we apply for a patent – do we have a right to do so considering our matauranga is a distillation of many generations of our tipuna’s collective wisdom that is held in trust for future generations. Is it exclusive to our whanau, our roopu, our iwi, our waka or our hapu or is it a district wide matauranga, or perhaps so widely known that just the question of who holds the mana behind the matauranga provokes dispute amongst the whanui. And if we do protectively patent our matauranga, what happens when a patent runs out, since it will then become available for public exploitation? Will patents contribute to our responsibilities as kaitiaki? Some Roopu have already

\(^{203}\) Plant Breeders Wrongs, An inquiry into patents for plant piracy through international intellectual property conventions, A report by RAFI [Rural Advancement Foundation International], in partnership with Heritage Seed Curators, Australia, 1998, downloaded from http://www.etcgroup.org/article.asp?newsid=234, 2 December 2004

\(^{204}\) see appendices for more information

\(^{205}\) Royal Commission on Genetic Modification,
investigated the intellectual property and patent issues as part of their development initiatives that have their genesis in Matauranga Maori.\footnote{Ministry of Research, Science and Technology 2004 report “A ‘Snapshot’ of Vote Research, Science & Technology Investment in ‘Maori Research’ in the period July 2002 to June 2003”}

- Titi Oil is investigating the unique qualities of the wax esters collected from the Titi islands, “the project will result in the development of a new cosmeceutical.”
- The Maorifood.com & Kinaki Wild Herbs project “involves the protected cultivation of a rare ‘essential oil’ flavoured edible fern variety with outstanding culinary potential.”
- The Taewa project involves “the development of a virus-free, commercial scale seed bank of the main varieties of Maori potatoes, and tradition conscious protocols for their production and storage”
- The Tokaanu Hot Pools project will “establish processes for the production of balneotherapy salts from the pools’ runoff and investigate the pharmaceutical potential of the extremophilic microbes in the pools”
- The Tairawhitii Pharmaceuticals project “will establish new value-added options for the elevated anti-microbial oil extracted from the elite, naturally selected manuka strains of the Eastern Cape area.”

\textit{Mapping matauranga}

The final ‘risk’ to be considered, is the impact of picking up a tool such as GIS. This tool is reliant on expensive technology and involves a process that can consume vast amounts of time and energy. It uses a paper visual stimuli to communicate its information and it is limited in its cartographic re-presentation of our epistemology. It may be recreated within a sterile environmental vacuum. We need to consider the impact this tool can have on our traditional methods of transmitting and retaining indigenous knowledge.

The original method of transmitting indigenous knowledge by talking, demonstrating, experiencing and remembering, may be at risk of being overtaken by a reliance on an ‘easier’ method of recalling knowledge. Without getting your hands dirty or trudging for two days into the bush to get to the harvesting site you can ‘learn’ all about it. And if you forget, just have another look at the map.

Maps can only be two dimensional at best. Experiences are three dimensional. The contextualisation of the map is led by the experience, and ultimately leads to the enrichment of the person and the tribe i.e. having landmarks pointed out, absorbing matauranga within the waiata and korero, watching the birds or noting that particular shade and texture of a rongoa flower ripe for harvesting. Even the best graphics package cannot recreate this. It is all this associated learning that makes the experience a real one rather than a remote one. The map remains the accessory to the experience.
Maps have been used to disempower indigenous peoples for centuries. Indigenous peoples are regaining control from those who have used hegemonic practices to displace knowledge. Some place locations have become lost because we lost access to them; at first physically, then through the loss of those who actually experienced or visited the sites and the accompanying korero that went with the sites, and at times because the maps have removed reference to the sites or located them inaccurately. We do not need to recreate those inequities by relying on our own maps to replace or displace knowledge. It follows that great care should be taken to make sure that maps do not disempower korero\(^\text{207}\) nor should GIS and its maps take the place of tohunga.\(^\text{208}\) The oral and experiential traditions that inform our matauranga and create that cognitive spatial cartographic skill that ensured we could (to paraphrase Tobias) carry maps of our whenua in our heads, with our mental images embroidered with intricate detail and knowledge, based on our oral history and our direct relationship to our korero, our tupuna, our rohe and its resources. This is as much a part of our cultural heritage as are the resources we fight to protect. The products of GIS, as much as the process of GIS, are therefore only a tool that complements our uniqueness as indigenous peoples. Historically, Maori have been capable of quickly utilising new technology for the betterment of the tribes position, e.g. muskets and flour mills. By taking on new technology such as GIS and adding it to the tribal toolkit, we are just as capable of exploiting the technology for our own purposes.

“Whew, that was difficult. You know, each experience we have with a site, an event or a story, enriches our tribal korero - even falling over and getting your clothes messy when you skid on the wet mud next to the watercress patch. Like you did yesterday Timu.”

“Yeah Rangi, but it could have been worse, I could have fallen into the river like Nanny E did when she was little!”

“That’s enough out of you two. I was with all the koroua and kuia at the time, learning how to prepare the Raupo paru – how was I to know my cousin had tied the hinaki line to that tree!”

“Yes Nanny E, but that story has to go down in the history books, I’ll make sure I mark the spot where you fell in on the map, right next to the pa-tuna. Then I can tell my mokopuna all about it and we can preserve your spot.”

“Very funny. Let’s get on with it. The consequences of mapping matauranga are important to get our heads around neh? All the things we’ve looked at over the last

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\(^{207}\) a view held by Te Runanga o Moeraki Inc. who are not considering GIS due to this (and other) issues, email communication, 2003

\(^{208}\) Hauiti Hakopa, pers comm. Dunedin, 9 November 2004
few months, there’s heaps for us to consider and we all have to agree if it’s going to work. Tobias prioritised consensus as the most important task for a successful project and I agree. We should all be in the same waka and facing the same way when we make this decision. I guess the real work starts now that we’ve canvassed GIS, cultural mapping, practical matters, opportunities and threats - the big decision needs to be made – do we still want to go ahead and install a GIS?”
Part Four: planning

The previous sections within this guide inform the processes that are described in this section. The main function of Part Four is to discuss the process of establishing and maintaining a GIS that gives Roopu what they themselves have defined as necessary, if at all.

The actual decision making process changes the order of the issues canvassed in the previous sections. Possible projects, risks and then practical issues are considered in this order to limit the potential for uninformed mistakes or disputed actions. Doing this focuses the decision making processes on the positive benefits that roopu have collectively identified, rather than recycling aspects that distract from the project.

The necessary elements to be considered are bundled under five inter-related themes - Why are we doing this? What do we want to do?, How are we going to do it? When are we going to do it? and Do we really need to do this?

The first theme: Why are we doing this?

Most projects begin with mapping a cultural resource inventory and thus cultural heritage, so it is important that there is a consensus of opinion to do so and most importantly - that a collective decision is reached. Thus it is important to explore the support for cultural heritage mapping through a participatory process.

Other planning exercises that Roopu have already undertaken, such as strategic or environmental planning workshops or plans, may be useful as a foundation for discussion. It is important to record the discussion and decisions made at this hui. This allows recall of important issues, ideas and sources of information that can be forgotten in the heavy workloads most Roopu carry.

Some Roopu may already have objectives that have been articulated such as

- the protection of freshwater resources by actively undertaking the role of kaitiaki for those resources within the rohe
- actively participate in the regional development opportunities within their rohe
- promote and enhance the retention of tribal matauranga

If not already articulated, it is necessary to discuss the options to reach those objectives. It could be

- a need for support maps for negotiation with the Crown over resource use or contested alienation of land by a utility company
- a desire to develop your own environmental management plan
• a desire to document your cultural and traditional knowledge for the benefit of future generations

It may prove beneficial to conduct a risk (threat) analysis for your resource inventory categories (see page 79 for sample). This process may take some time to complete however, it enables a clear picture to emerge whether there are any chronically or critically important resources under threat. This in turn, benefits the decision making process by identifying priorities that may have been previously obscured by busy workloads.

Once consensus is reached a clear decision about the project objective should also be recorded. This can be done by way of a formal motion. However, participants may wish to record their decision by stating they have achieved consensus.

The second theme: What do we want to do?

It is imperative to establish and define what you actually want to do. Most planning strategies identify the need to make decisions that define the scope of the project. While outlining the ‘what’ can be done by administrative members or portfolio holders, defining the ‘what’ is a fundamental responsibility of the Roopu as a whole. For the project’s long-term viability this should be undertaken during the planning hui.

The type of decisions for the scope of this kind of project generally consist of two different aspects. Those associated with mapping and those that require manipulation of data to allow analysis or modelling.

• do you want to map your cultural resources – your cultural indicators such as marae, whenua, waahi tapu, mahinga kai, rarapahore, urupa, rongoa sites, etc
• do you want to map your historical association with your whenua – the original extent and subsequent alienation of your traditional rohe
• do you want to map your contemporary relationship with the whenua – your current farming, forestry or fishing ventures, your market gardens, your corporate or educational facilities

• do you want to analyse your operational options – your farming pasture renovation, your wetland rehabilitation options, your kiwi recovery programme, the impact of your land development, your horse trekking and backpack adventure programme, your forestry planting, harvesting and transport options
• do you want to analyse your land and aquaculture options – your tuna nursery plans, your inanga riparian management plans, the spread or decline of watercress or puha within your area, high or low quality water sources within your rohe
- do you want to assess your resource management responses – your position on that proposed housing or roading development, your concerns about that new discharge application from the local egg farm, your response to that new hill-side mansion that will demolish half your waahi tapu

Another consideration that could be discussed at this time is the potential to produce maps defined by your own language and epistemology. Do you want the colours and symbols to reflect your own unique identity?

For example, do you want to label place names in English or Maori or both? Do you want your wharenui to be identified as a ‘house’ icon or have its own specific icon? Do you want to develop your own customised icons for rakau, ngahere, manu or ika? While there are many standard icons available within commercial applications, the opportunity for participants to define symbology based on their collective preferences may also contribute to the sense of ownership the project engenders for participants.

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Figure 9: Wharenui icons

**Scope**

The scope of the project should then be identified. If the decision is to map your resource inventory first or as part of an environmental management plan there should be clear project parameters, guidelines and expected outcomes identified by the roopu. These may already be in place from a previous plan or document and if so should be reiterated. The hui may wish administrators to further develop the scope for consideration at a later hui. However, the aspirations and expectations of the hui should be recorded and used as the basis from which the project outline is developed. An example of the decisions that may be reached at the hui is as follows:

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209 Icon file sizes should remain small when developing custom icons (10 – 20 Kb normally), thus .bmp files are recommended for high use icons
**Decision 1** of the hui may be:  
That consensus has been reached on whether to ‘map or not to map’

**Decision 2** of the hui may be:  
That having reached that consensus we wish to map our  
Cultural heritage  
Historical association with our whenua and our moana  
Contemporary relationship with our whenua and our moana

**Decision 3** of the hui may be:  
That having achieved that consensus we wish to model our  
Operational options  
Land and aquaculture options  
Resource management responses

**The third theme: How are we going to do this?**

At this stage it may be helpful to appoint a project design co-ordinator who will be responsible for preparing a project brief that will achieve the expectations the hui has just declared. Some Roopu will already have a manager or portfolio holder who has the ability to design the project and construct its brief. However, they may not have the time. This should be taken into consideration when appointing a project designer who may need to be employed specifically for this task. The task for the project designer should be articulated as clearly as possible. So should the expectation of the minimum requirements in the project brief. It is not helpful if everyone ‘thought’ they knew what they were supposed to come up with, but in reality it was only a vague “hey, how about putting together the project?” Your most demanding Roopu member will want to know that ‘so and so’ is doing ‘such and such’. Defining the boundaries at the start can help eliminate potential hiccups if ‘so and so’ is challenged about how they completed their task. It will also eliminate double ups if the left hand knows what the right hand is doing. Moreover, the quality of the project needs to be high for it to be of lasting value. Sound project planning and design is an important foundation.

The project brief will usually include a reiteration of the Roopu expectations –

- the specific focus of the project as defined by the Roopu  
- where the project sits in relation to existing or recommended plans and policies  
- where the actual project will sit within the organisational structure  
- the hierarchy of the project  
- employment needs and job descriptions  
- resource needs and perhaps  
- cartographic symbology needs
The brief will usually include tasks to be completed such as

- hardware, software and data evaluation and purchase costs
- project management
- information management
- milestones to be reached
- timetable for completion of tasks and
- all the associated recommendations

Part two of the guide indicated start up costs of at least $10,000 for the first year to provide a basic GIS setup. The cost for personnel is determined by the scope of the project that has been identified during the hui. From this it may already be apparent that the current financial resources will not permit the investment into the project at this time, and it slips down the Roopu priority list. If a more limited project is able to go ahead, there are less expensive mapping options available such as Tumonz or Terrascan. There may also be current joint ventures in place that have built relationships with local government, government agencies, corporate businesses or even a Roopu within the whanui who may be amenable to sharing or supporting the project. If the project brief is going to include identifying potential funding sources for the project, this should be clearly stated at the outset. Sourcing potential funding for a project of this magnitude can take a significant amount of time and the project designer may not want that responsibility.

**Decision 4** of the hui may be:

That _____ be appointed project designer to prepare a project brief that includes …… **Or**
That _____ be delegated the responsibility to find and employ a project designer to prepare a project brief that includes …………………

That ______ prepare a funding source options paper to be considered alongside the project brief
That ______ prepare the project brief and its associated recommendations and present it to __________ for consideration and approval

**The Fourth theme: When are we going to do this?**

Despite the brevity of this theme discussion, it is a critical planning step. Discussion on the actual timetable for GIS establishment may take place once the project brief is delivered. Or, dependent on the Roopu’s management and operational structure, the decision may have been left in the hands of the manager or committee to confirm. The next time the Roopu hears about the project could be when the announcement is made that the project is/is not on the road! For clarity, and to save the administrator receiving frequent phone calls asking/nagging for information – set the report-back time before the hui participants disperse. Once milestones have been identified within the project design
these too should be reported back to participants to ensure clarity, transparency and authority in the
decision making process.

The Fifth theme: Do we still want to do this?

Again, this is another decision that will be dependent on what the project brief prescribes. The final
assessment whether to establish a fully capable GIS project does not only on the cost. It also relies
on whether the benefits it can bring to Roopu are sufficient for their purposes. To remind participants
of the benefits they have anticipated and to engender a deeper sense of ownership for the project –
to ensure the decision is driven from the flax roots – a synopsis of the discussions and decisions
should be prepared and distributed as soon as possible. Finally, the pros and cons of using the GIS
tool must be laid out side by side to ensure the sourcing and expenditure of perhaps $40,000 in one
year can be evaluated. To ensure long-term functionality of the project, make this critical decision at
a second hui, thereby ensuring the entire Roopu is supportive of the long term vision for the GIS.
Roopu members will therefore remain the ultimate authority of the applications requirements and

**Part Five: project management**

This section is divided into two parts. There is a passing reference to overall project management, and the rest of the section is devoted to specific project management issues that should be included in the project design.

**Overall project management**

It is important to consider overall project management, in order to alleviate a potential overlap of responsibilities and tasks. The project design will define employment opportunities, field work, office space and resource allocation, purchase of new resources and contracts negotiated and signed, etc. There may already be clear definitions of roles and clear policies for employment responsibilities, recruitment preferences, financial limitations, levels of authority etc. Existing policies and processes must be available for the project designer to integrate into their design. A common cause of failed projects is that boundaries and processes were not discussed and agreed upon at the outset, leaving everyone in effect working in avoidable isolation or crossing boundaries between governance, management and bureaucracy. By planning and specifying where the GIS will fit into the overall Roopu management structure a positive focus is established and maintained.

**Specific tasks within the project design**

“Hey Timu, those fullas at Hauora have heaps of information. Reckon we should ask them for a copy of their stuff? And what about the big land trust down the road, you know, “Rangimarie”, the one that’s got all the farming and forestry on it. I know they’ve got a lot of data for the land, even got really good district environmental data they’ve gathered over the years. Probably got more than we have right now anyway. I reckon they should be okay about giving us the stuff.”

“Hmm, you’re right Nanny E, but didn’t you have an argument with one of the Trustees a couple of years ago? Aren’t they still crabby at you? And I don’t think they’ve forgotten when young Nicholas got his hands on some of their data and spouted off as if he was the ‘big cheese’. And you know we’ve got to watch out for ‘boundary’ issues. We’ve got to be careful with some of this sensitive stuff you know.”

“Yes, I know. But it’s not for our benefit, it’s for all of us. I reckon it’ll be sweet as!. They’ll know it’s for the Roopu, for the whanui - just something that will help us make decisions and get our development up and running
The following discussion identifies particular elements that need to be clearly spelt out within the project brief. The project design will have had its scope defined by the wishes of the hui – they have set the desired outcome – and it is now necessary to consider how to best achieve those aspirations.

As alluded to in the previous paragraphs, the desired output has driven the resource and investment requirements. Once these outputs have been defined the number of people and range of skills that are needed can be fitted to project design, as can the other key integrated elements of a computer system: software, hardware, data and process.

There are three components that should be carefully considered within the project design: access to information, protocols for transfer of data, and information management.

**Access to information - internal, external, communication**

There are a raft of issues surrounding access to information. These basically stem from three facets; internal, external and joint. It is important to deal with those issues affecting Roopu members first as it centres decisions on the most important elements of why the project is being run – for the benefit of the Roopu.

Distinction between data and information (or knowledge) also needs to be made at this time as this also stresses and confirms the personalisation of the process. Data is something that can be procured from outside sources. It can be transferred in digital or hardcopy formats for a price. Knowledge or information however, is usually transferred by personal commitment.

Knowledge or information that is offered contextualises the importance of the knowledge to the Roopu, so the acquisition of information or knowledge must be treated with the respect it demands throughout the entire transfer process. Some experts may be reluctant or resistant to their matauranga being documented and some may defer to others. Some may have less to offer than they think and some more than they thought. Still others may only have the hugely important element of enthusiasm to offer.

The recording of matauranga should be undertaken pursuant to the tikanga of the Roopu. For example, if a kaumatua was approached without warning by someone without the appropriate tribal credentials and asked to verify the location of a battle or a particular rongoa place, the offence may inhibit the process. [On the other hand, if they have been involved in the planning of the project from...
its inception and well aware of the intent and purpose of the project, kaumatua and kuia will know their knowledge is valued and valuable to the tribe and will trust the process]. Ultimately, the persons who record the information have to be capable and acceptable.

All the roles within the project should be clearly delineated within each job description – overloaded workers do not produce quality work and quality is fundamental to the success of the project.

Part of the project design should be dedicated to access policies once the information is collected. It is of no use to collect the information and then find it was compromised when Nanny E wanted to look into the information database, decided to change it, and ended up wiping half the records. The levels of security access should be defined including who will or won’t have access, what gradient levels of security passwords will be required, storage mechanisms and place, backup considerations etc. Many of these policies will already be in place although they may need to be updated. The recommendation about whether a dedicated computer is required will also be dependant on information access and security issues.

Information access and security policies and processes should also be defined for external parties. The project and what it produces belong to the Roopu, and there should be clear definition who is to have access to the information and the outputs (files or maps). The issues discussed at length in Part three, send constructive messages as to the potential consequences of unauthorised access and use of information.

The same applies to joint ventures wherein many councils are assisting in cultural mapping opportunities. The buffering of sites of significance is an accepted mechanism to maintain sensitive information about a site. However, designing a method that triggers appropriate Roopu responses without compromising sensitive information need not be problematic. For instance a waahi tapu that has koiwi buried under a wetlands will have different action responses to one that is the last known rongoa site for arthritis. You may not necessarily want outsiders to know exactly why a site is important – just that it is. Creating random fuzzy boundary shapes for areas of special interest is also another option. Rather than circular buffers, where the centre is the point of interest, offsetting or randomising shapes can disguise locations to an extent. Both Laituri and Kamau discuss this notion of “fuzzy maps”. Roopu can also design their own colour or numeric code or assign a number sequence to sites of significance that will then be triggered when the resource consent ‘hits’ the office. If it is an internal, secure document, no one on the outside knows the key to the codes and Roopu responses can be defined based on their own internal priorities and action responses.

Fuzzy Maps

Figure 10: Example of fuzzy maps

Example 1: location of buried kaunui

Example 2: buffered polygon, central point is the kaunui site with an equi-distant circular polygon draped over the site.
Note: normally the site would not be visible.

Example 3: offset polygon, offset circular polygon is draped over kaunui location.

Example 4: random polygon, randomised polygon is draped over kaunui location.

Example 5: external information for public viewing random polygon is draped over kaunui location, randomised code is attached to polygon, key is held only by Roopu.

Roopu Randomised Code
Publicly viewable information

Figure 11: Example of fuzzy map with randomised code for public
Protocols for transfer of data
Another important component that needs to be clearly stated within project briefs are data transfer protocols that will define how relationships are managed. By relationships, it is meant the internal relationships and associations between Roopu members, committees and functionaries. These relationships can sometimes become stressed when misconceptions of power and information sharing occurs. The principles of manaakitanga, whanaungatanga and kaitiakitanga will underpin data sharing agreements or transfer protocols that should be constructed at the outset to avoid stress being placed on relationships.

Protocols for data transfer should also be constructed with organisations that lie outside the tribal or roopu network. The ease of construction is dependant on the relationships that have been formed in the past or are formed during discussions. Transfer methods (format and time frames for information or data transfer), receipt acknowledgement mechanisms and timeframes, statements of agreed restrictions on use, information sharing agreements and procedures for the upgrade or maintenance of information should all be defined and agreed upon. Ngati Hamua have recently entered into a joint venture arrangement with the Greater Wellington District Council that has seen capacity building outcomes that have benefited both Ngati Hamua and the GWDC. Their sites of significance protocols are appended to this guide (see Appendix 9: Ngati Hamua Sites of Significance Protocol, page 84)

“Hey Rangi, how are we going to manage our data? What happens if you decide to take a holiday and disappear away from here for a couple of years? How would we know how good the data is or where it came from?”

Metadata and data dictionaries
Metadata is the data that is held about the data that has been acquired or derived. It is the technical information that explains explicitly how the data was derived e.g. what map projection was used (most countries have their own map projections), how big the cells are for the raster layer (there is a big difference between 25 metre resolution or 100 metres), scanning resolutions and digitising methods, and much, much more. Metadata gives managers and technicians the ability to ensure their analysis is not compromised by using data that is incompatible or questionable.

Metadata can describe when, where, how and what the data is e.g. when it was purchased or derived or donated (date), where it was obtained from (e.g. Linz, District Council, DoC, in-house GIS analyst, consultancy firm, scientist, Roopu member etc), how it was acquired (e.g. purchased, licensed, gifted), what was acquired (e.g. data package, cd rom, hardcopy map that was digitised, electronic transfer of co-ordinates etc) and what data exactly was acquired (e.g. vector, raster, excel table subsequently imported into software, jpeg image etc). Other events such as modifications to the original data should also be included.
An analysis using out of date or inaccurate data distorts the analysis and therefore the conclusion. Ensuring metadata is kept up to date ensures accurate records are kept of when and from whom data was acquired. This in turn ensures that the accuracy of the data itself can be determined and monitored. Complaints are made if we view maps that have inaccurate positions or portrayals of our cultural indicators or the data that was used in an analysis was years out of date. Imagine the horror if we ourselves reproduced those errors. Data can also be subject to a licence fee (e.g. LINZ cadastral information). A good metadata construction can also keep track of the licence currency or particular version of data output.
**Part Six – final checklist**

The final section of this guide uses the discussion and information in previous sections to compile a sample checklist for Roopu.

**Task Checklist**

√ 1  Define objectives for a Gis
    √ Identify objectives in existing plans and strategies
    √ Identify where Gis can support projects and decision making

√ 2  Call the hui
    √ Identify the objectives
    √ Identify the options
    √ In-house, contracted, built into current or planned funding opportunities, negotiated component of other agencies work (councils, consultants, government agencies)

√ 1st take – Mapping cultural heritage, matauranga

√ 2nd take – Extent of projects

√ 3rd take – project design -
    √ appointment of project designer
    √ nomination of __________ to appoint project designer
    √ authority for appointment of project designer designated
    √ financial authority for appointment of project designer designated

√ 3  Feedback and call back set

√ 4  Project design

√ 5  Final hui for approval of project
**Sample Design Checklist**

Project was approved for investigation at hui held at ______________ on ______________

Minuted resolution at that hui reads: ________________________________

The project designer was appointed by ________________________________

The project designer was asked to: ________________________________

The project sits within the following strategies and plans: ________________________________

The project specification is to:
1 * map the cultural resources of __________________
2 * map the alienation of land including historical and contemporary ownership
3a * identify asthma population
3b * assess the co-relationship between asthma sufferers and environmental factors

This will involve purchase and acquisition of the following information:
* Topographical dataset
* LINZ Cadastral (land property boundaries) historical dataset
* Terraview Cadastral boundaries
* LENZ (Land Environment of New Zealand) dataset
** Archaeological sites
** District and Regional Council heritage and landscape data
** Department of Conservation data
** Public Health housing and environmental factors data and statistics
** Hauora data and statistics
** New Zealand housing data
** District and Regional Council
** Te Puni Kokiri Maori Land Dataset
** Maori Land Court dataset
*** Cultural heritage sites

*Financial and contractual approval authorised by ________________________________
** data transfer protocols negotiated by ________________________________
*** cultural heritage research project managed by ________________________________

The **software** of choice is ______________________________________________

The cost of software is ________________________________________________

Maintenance and licence costs are ________________________________________________

Password security access extension provided by Consultant ________________________________

**Hardware requirements are**
- Desktop computer
  - Software space
  - Data storage space
  - Memory
  - Graphics card
  - Processing power
- Laptop
- Printer

The cost of hardware is
Nil – in-house existing computer XXXX will be used or
$ - purchased from XXX, 12 month guarantee, limited on site technical support included in purchase price

**Equipment requirements** are
GPS units
Audio/visual recording units

The cost of equipment is
Nil – existing XXXX will be used
Nil – audio/visual recording units on loan from xxxx
$ - purchased from XXX, 6 month guarantee, in-store technical support cost $

**Human resources required** are
GIS technician (1)
Researchers (2)

The cost of human resources are:
GIS technician XXX, 1 year contract
$X hourly rate
$X stationery
$X training

Researchers XXX, 6 month contract,
$X hourly rate
$X transport
$X stationery
$X training

District Council agreement to provide consultancy services from their GIS department for six months during establishment, as needed, up to 100 man-hours

The **relationship hierarchy** is

```
<table>
<thead>
<tr>
<th></th>
<th>Project Manager</th>
<th>Administrator</th>
</tr>
</thead>
<tbody>
<tr>
<td>District Council</td>
<td>GIS technicians</td>
<td>Researchers</td>
</tr>
<tr>
<td>GIS technicians</td>
<td>GIS technician</td>
<td>Researchers</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

**Storage and security**
Equipment will be stored in __________________________
Archival material will be stored in ______________________
Backup data will be stored at _________________________
Copies of data will be stored in _______________________
Outputs (hardcopy maps) will be stored in ______________

Responsibility
_________ is responsible for security to locked storage facilities
_________ is responsible for maintaining weekly backup of computer data
_________ will maintain storage logs
Data access
Full data input and manipulation access including confidential layers – Manager, GIS technician
Data Input access only – researchers
Metadata input – Manager, GIS technician, researchers

Viewing access
Public layer - publicly available information, location only (excluding confidential layers)
Project layer - some location and limited attribute data – agencies, joint venture partners, etc as agreed in negotiated protocols
Confidential layer 1 - most location and most attribute data – wider Roopu members
Confidential layer 2 - all location and most attribute data – Roopu committee members except where specific restrictions in place
Confidential layer 3 – all location and attribute data – Trustees, Directors, Manager, GIS technician

Information Management
GIS technician will be responsible for establishing metadata records
Researchers, GIS technician, Manager will be responsible for maintaining metadata whenever they derive or modify data
Documented, archived records will be stored at _____ and will be available upon authorisation from _____________

Protocols for data transfer
Protocols to be entered into with District Council, Regional Council, Department of Conservation, Historic Places Trust, Landcare Research, Hauora, Land Committee
Detailing:
Data transfer in xx format in tabular, textual and spatial layers in xxx interchange format
Limitations in data statement supplied
Statement of agreed restrictions on use
Information sharing agreement
Open – layers, outputs to be available to all are __________
Joint (Roopu and xxx) – analysis, layers, outputs and data to be shared are ______________________
Restricted (Roopu only) – analysis, layers, outputs, data restricted to Roopu only are ______________________

Process for sharing information
Upgrades received every xx
Agreed storage place and security measures
Statement of acknowledgement of data use in outputs and reports is agreed as being “……………..”
Acknowledgement and authority of data transfer protocol confirmed by ______
Milestones to be completed

<table>
<thead>
<tr>
<th>Month 1</th>
<th>Month 2</th>
<th>Month 3</th>
<th>Month 4</th>
<th>Month 5</th>
<th>Month 6</th>
<th>Month 7 etc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acquire project resources</td>
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<tr>
<td>Employ technician and researchers</td>
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<tr>
<td>Data transfer protocols established</td>
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<tr>
<td>Access security extension commissioned</td>
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<tr>
<td>1 Researchers training</td>
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<tr>
<td>Interviews set up</td>
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<tr>
<td>Field work</td>
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<td>Data input</td>
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<tr>
<td>Cultural heritage layers confirmed</td>
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<tr>
<td>2 Acquire land datasets</td>
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<tr>
<td>Construct Database</td>
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<tr>
<td>Digitise land parcels</td>
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<tr>
<td>Historic Land layers confirmed</td>
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<tr>
<td>3a Identify and acquire health and housing datasets</td>
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<td></td>
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<tr>
<td>Map current and historic asthma population</td>
<td></td>
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<tr>
<td>3b Construct GIS health analysis</td>
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<tr>
<td>Co-relationship analysis complete</td>
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</tbody>
</table>

Projected costs

| Hardware | $ | | | | | |
| Software | $ | | | | | |
| Data | $ | $ | | | | |
| Equipment | $ | | | | | |
| Gis technician | $ | $ | $ | $ | $ | $ | $ | |
| Researchers | $ | $ | $ | $ | $ | $ | $ | |
| Stationery | $ | $ | $ | $ | $ | $ | $ | |
| Fieldwork | $ | $ | $ | $ | $ | $ | $ | |
| Consultant | $ | | | | | | |
| Totals | $ | | | | | | |

[ indicates ongoing or commencement timeframe outside sample timeline]

Financial authority
Financial approval for the projected cost is authorised by ________________________________

Operational authority
Final approval for the project is authorised by ________________________________ at hui held on ________________________________ at ________________________________
Desired GIS Layers

<table>
<thead>
<tr>
<th>Own</th>
<th>Councils</th>
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<tbody>
<tr>
<td>Own Roopu sites</td>
<td>Council Boundaries</td>
</tr>
<tr>
<td>(nohoanga, topuni, mataitai, etc)</td>
<td>Resource consents</td>
</tr>
<tr>
<td>Maori freehold land</td>
<td>Administration boundaries including fire zones</td>
</tr>
<tr>
<td>Wahi taonga, noho taonga under other ownership</td>
<td>Councils</td>
</tr>
<tr>
<td>Mahinga kai</td>
<td></td>
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<tr>
<td>Urupa</td>
<td></td>
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<tr>
<td>Waka Turanga</td>
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<tr>
<td>Pa (current and historic)</td>
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<tr>
<td>Kainga tawhito</td>
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<tr>
<td>Marae (current)</td>
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<tr>
<td>Maunga</td>
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<tr>
<td>Confidential sites</td>
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<td>Registered Historic archaeological sites</td>
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<td>Tangata Tiaki areas</td>
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<td>Cultural Impact Study Areas</td>
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<td>Joint venture sites</td>
<td></td>
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<td>Land use</td>
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<td>Roopu commercial sites</td>
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<tr>
<td>Forestry blocks</td>
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<td>Survey sites</td>
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<td>Department of Conservation</td>
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<tr>
<td>Doc administered lands and plans</td>
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<td>Scientific study sites (both flora and fauna)</td>
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<td>Species distribution</td>
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<td>Whale stranding sites</td>
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<td>Crown lands</td>
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<td>Concessions and permits</td>
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<tr>
<td>Pastoral leases</td>
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</tr>
<tr>
<td>QEII covenant areas</td>
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</table>

A comment on GIS and its use for indigenous resource managers...

The ultimate authority of applications requirements and usefulness are the users themselves.\(^\text{212}\)

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November 2004


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Teariki, C., Spoonley, P., & Tomoana, N. (1992). Te Whakapakari Te Mana Tangata. The politics and process of research for Maori. Massey University, New Zealand: Department of Sociology

The Case for Sui Generis Protection for Maori Cultural & Intellectual Property, powerpoint presentation, Aroha Te Pareake Mead, Victoria School of Management, Call of the Earth Llamado de la Tierra, August 2003. Downloaded from http://r0.unctad.org/trade_env/test1/meetings/tk2/Sui%20Generis%20Protection%20Awatope2.ppt

Tobias, T.N., (2000) Chief Kerry’s Moose, a guidebook to land use and occupancy mapping, research design and data collection, Vancouver, Canada: Union of BC Indian Chiefs and Ecotrust Canada joint publication

Trade Marks Act 2002, Pt 1, s 4f and Pt 2, Subpart 2, s178 - 179


WorldWide, April 2003

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Appendix 1: Sites for GIS information

http://www.esri.com  for ArcEditor, ArcReader, ArcView, ArcInfo software information and purchase
http://www.mapinfo.com  for MapInfo software information and purchase
http://www.intergraph.com  a company that offers integrated software package systems including GeoMedia
http://www.tumonz.co.nz  for Tumonz information and purchase
http://www.eagle.co.nz  Eagle Technology, the NZ agents for ESRI’s Arcview
http://www.critchlow.co.nz  Critchlow company, the NZ agents for MapInfo
http://www.gis.com  a GIS internet site created by ESRI, with some free data, lots of introductory and mid range information with some limited free GIS software
http://www.freegis.com  offers software overviews, with some software links (for those who are familiar with GIS)
http://www.geocomm.com  a multi use gis/mapping site offering newsletters, industry news, some free software downloads, loads of commentary
http://www.gisuser.co.nz  an image processing package
http://www.gisuser.co.nz  a GIS internet site sponsored by Eagle Technology
http://www.techle.com  GIS Software & Solutions listed here from various companies.
http://www.maptoaster.com  MapToaster Topo/NZ maps & software
http://www.nativemaps.com  an indigenous mapping website
http://www.BambooWeb.com  Articles & Information about GIS, including aerial photos, information guides to software, environmental courses e.g. groundwater modelling risk assessment
http://www.gita.org.au  Geospatial Information & Technology Association, offers members regional seminars and workshops in Australia and New Zealand
http://www.integrated-mapping.com  Developers of MapToaster, topographic mapping with aerial photos, prices range from $169 for one island standard edition to $499 for the works (High resolution toponaps for both islands plus High resolution NZ AirPhoto Bundle)
http://www.pacificworlds.com/jpsg  The web site for the Indigenous Peoples Specialty Group, Association of American Geographers
http://www.iapad.org  Community mapping publications directory
http://www.dgroups.org/groups/ppgis  The web site for Development through Dialogues Open Forum on Participatory Geographic Systems and Technologies, open forum where questions or requests for help can be discussed via open web forum
Appendix 2: Further examples

Consequences of mapping cultural resources

The Colville Confederated Tribes encountered problems when they established a GIS, as part of a Bureau of Indian Affairs initiative to introduce GIS to tribal authorities in the U.S. The CCT found access to basic BIA data (such as land property files) problematic as were the issues of system monopoly by one part of tribal development (forestry) over other applications such as planning, housing and infrastructure. While they found biographical maps played a positive role in environmental impact assessment, the access to the BIA housed GIS and control over its data became an issue for the tribes. There was also concern “that sensitive traditional knowledge, once stored in GIS, would neutralize traditional informal controls.” Similar sentiments were reported from the indigenous peoples of Kayan Mentarang in Indonesia, who held concerns over a WWF supported project for the production of maps using exotic technology that could see outsiders controlling information over local resource use which had previously been reserved to the community.

The Darién region of Panama was the focus of a series of participatory mapping projects to map biophysical and cultural resources in Latin America undertaken by the Centre for Native Lands. The project’s intention was to build capacity and was intended to be a mapping project for indigenous peoples by indigenous peoples – the final map being the property of the Emberá, Wounaan and Kuna Peoples. Its ideals were however subject to a lack of experience working with indigenous peoples and the projects own internal wrangling. As it hiccupped to its conclusion, the importance of early articulation and setting of project boundaries manifested itself. The lead cartographer (a non-indigenous, contracted, project member) took the position that the final draft composite maps were ‘his’, both in physical reality and intellectual property sense in that he ‘produced’ them. Informed that “he was in no sense the “owner” of the maps” he later, “slipped the originals out of the project office and left the following morning on the plane, maps in hand, for the United States.” It took the project co-ordinators and indigenous peoples groups over a year to get them returned. The final master map of the Darien was finally the property of the Emberá, Wounaan and Kuna Peoples

Exploitation

Ironically, one benefit that has arisen from globalisation, is that abuse and exploitation of indigenous peoples around the world is now reported much more widely and quickly. Institutions, once able to report their activities in relative isolation, are now under intense scrutiny by a global community - even institutions such as the World Bank.

---

214 ibid
Examples of institutional exploitation

The tribal people of Madagascar have vigorously opposed a proposed World Bank mine that would deforest the area;

The Chatisgarh of India have complained of being pushed off their land for a giant steel plant and the World Bank’s insistence on eliminating traditional rice growing for conversion to industrial agriculture of exotic fruits and vegetables for export.

The Maya Achi paid the ultimate penalty for defying global acquisition when villagers refused to leave their ancestral lands in order for a dam to be constructed. The opposition to the World Bank, Inter-American Development Bank and Guatemala National Institute of Electrification scheme led to Guatemala army forces massacring approximately 400 Mayans.216

In Ethiopia, exploration by a Canadian petroleum company led to a Government transmigration programme where 60,000 settlers were moved into traditional Anuak land217

More examples of bio-piracy

In Gabon, the University of Wisconsin was granted exclusive U.S. market rights to brazzein, a protein extracted from the berries of a West African plant found on native lands.218

India has had its fair share of threats as well, such as when the government and the people had to fight to cancel European and American patents on age–old cultivars; Neem, Turmeric and Basmati Rice.

In Zimbabwe, Phytera (a U.S. company) and the University of Lausanne (Swiss) attempted to patent the snake-bean tree used by traditional healers for generations

As a result of the traditional ecological knowledge gained from the San Peoples, the South African Council for Scientific and Industrial Research sold the development rights for an anti-obesity drug to a U.K. company. Phytopharm, together with Pfizer (U.S.) patented the Hoodia plant as a miracle diet pill without consultation, acknowledgement or agreement from the b !Kung.219

Indigenous farmers in Mexico were also affected when the President of Pod-Ners, an American seed company, bought a bag of beans in Mexico, went home, grew it for two years, patented the Enola bean and then required Mexican bean growers to pay a royalty when importing it into the U.S.220

A rare pest-resistant variety of cowpea germplasm, that was bred for centuries by West African farmers, recently had its active gene isolated and patented by a British biotechnology firm - “Once licensed this

217 ibid
218 Ibid. Also to be noted is the multiplicity of evidence available through U.N. and NGO documents available either in the published hardcopy arena or available through internet searches. See for example Johansen's recent book, “Indigenous Peoples and environmental issues, An Encyclopaedia”, the Cultural Survival Quarterly web newsheets
219 After an intensive lobbying programme, the San peoples were eventually able to negotiate an agreement where they would receive eight percent of all milestone profits from Phytopharm as well as six percent of all royalties that the CSIR receives once the drug is commercially available.
220 Reported extensively through the media and networks such as the PR Newswire, Pesticide Action Network North America, Rural Advancement Foundation International and Agjournal. Patents were subsequently overturned after extensive and expensive lobbying
genetic material will earn millions of pounds for the biotech company but there is no mechanism for reimbursing the farmers who bred the useful variety."221

The issues bio-piracy brings to the indigenous landscape has been summarised in this article by GRAIN, one of the many international, non-governmental organisations who report bio-piracy issues they find.

Biopiracy takes everything and returns nothing or very little. The only “value” added to native knowledge is a mere confirmation by Western scientists of the properties of the resource, often known to the community for years. Unlike the social system in which this knowledge evolves, in the commercial system from the origin to the end product, each “value-adder” seeks a profit-oriented monopoly. And more often than not it is the pharmaceutical or agri-chemical companies marketing the finished product that secure patents, irrespective of the fact that the product may have had its origin in traditional knowledge. So the “first-to-file” gets legally protected rights rather than the “first-to-invent”; rights which ironically the former can use to prevent the original “inventor” from exercising any control over the resource in question. So the issue of protection of traditional knowledge is also that of preventing unauthorised persons from obtaining protection to the detriment of the real innovators.222

**Trademarks and patents**

A Taiwanese honey producer reportedly registered the name “Manuka” as a trade mark in Taiwan. “The effect of this registration means that, prima facie, the registered proprietor could sue any New Zealand exporter of honey to Taiwan where the description “manuka honey” is used.” Even the name, “New Zealand”, is not sacrosanct – the New Zealand Government had to have a U.S. registered trademark for ‘New Zealand’ hair products removed.223

“GlaxoSmithKline, the UK’s largest pharmaceuticals company, has written to Tony Blair to demand new tax credits and patent concessions to encourage the development of medicines for the world’s poorest countries. The company is also urging the Prime Minister to use Britain’s presidency of the G8 group of industrialised nations to strengthen global agreements on intellectual property rights….Separately, a BBC programme this week will accuse GSK of backing drugs trials in the US in which underprivileged children were forced to test Aids treatments against their will.”224

---


Appendix 3: Further information on Intellectual Property Rights

UN Draft Declaration on the Rights of Indigenous Peoples

New Zealand is a member nation-state of the United Nations. The UN Draft Declaration on the Rights of Indigenous Peoples was formally adopted by the UN Working Group on Indigenous Populations in July 1994. Article 29 which deals with cultural and intellectual property states: 

"Indigenous peoples are entitled to the recognition of the full ownership, control and protection of their cultural and intellectual property. They have the right to special measures to control, develop and protect their sciences, technologies and cultural manifestations, including human and other genetic resources, seeds, medicines, knowledge of the properties of fauna and flora, oral traditions, literatures, designs and visual and performing arts."

Due to the intense lobbying and protest by indigenous peoples against the efforts of signatory Governments, including New Zealand, to water down the language and provisions within the draft declaration, it is still to be ratified.

Mataatua Declaration

The 1993 Mataatua Declaration, signed by tangata whenua and indigenous peoples from 14 countries, declares that “Indigenous flora and fauna is inextricably bound to the territories of indigenous communities and any property right claims must recognise their traditional guardianship. (cl. 2.6) and “Commercialisation of any traditional plants and medicines of Indigenous Peoples, must be managed by the Indigenous Peoples who have inherited such knowledge.” (cl. 2.7)

WAI 262

The Waitangi Tribunal claim, (Wai 262, the Indigenous Flora and Fauna and Maori Intellectual Property claim) illustrates the depth of unease which Maori feel towards illegitimate and inequitable uptake and abuse of indigenous knowledge. The claim contends that the Crown has failed to honour the Treaty of Waitangi guarantee that Maori would retain rangatiratanga over their taonga in that Maori have not been able to retain the right to manage and control their highly prized possessions and the Crown has failed to afford adequate protection for Maori intellectual property. The claim’s first hearing was held in September 1997 and several preliminary reports have been published traversing historical and legal aspects of the claim (The Crown and Flora and Fauna, Crown Laws and Policies, Effective Exclusion? [loosely – the exclusion of Maori within the settler-state narrative], Maori Knowledge Systems, Matauranga Maori and Taonga and lastly the report on Treaty Rights and Pigeon Poaching). The Tribunal is currently writing a Statement of Issues report that is expected to be released in 2005.
Appendix 4: Indigenous Plant information and Patents

Indigenous plant information

Matauranga Maori has been documented since first contact by tauwi (non-Maori). The use of indigenous plants has been investigated by anthropologists, archaeologists, colonists, historians, ethnographers, scientists and the like since europeans first entered New Zealand. An amazing variety of information is readily available in the public domain that under current and expanding national and international law, is able to be used and perhaps even acquired, by others. Food, like Pikopiko and Horopito is being revitalised in nouveau cuisine and 'real value' products being marketed using the 'Maori' or 'indigenous' cachet. Manuka has had its medicinal qualities explored substantially and those properties are marketed internationally in the ‘natural remedies’ market segment.

Spot samples of information held by Manaaki Whenua

A spot sample of the information held on a Landcare database, Ngā Tipu Whakaoranga - People Plants Infobase - a web resource of information on the traditional uses of New Zealand native plants by Māori - illustrates this availability. Puha and Harakeke are still primary resources used today by Maori. The abbreviated table of the “Puha” record is included

Table 5: Record of Puha from Landcare Research Nga Tipu Whakaoranga Database (adapted)

<table>
<thead>
<tr>
<th>FAMILY</th>
<th>Asteraceae (Daisy family)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOTANICAL</td>
<td>Sonchus oleraceus (introduced). Sonchus spp. Sonchus kirkii is endemic. because it is an indicator of the medicinal information that appears for a seemingly unimportant vegetable. The very abbreviated sample for &quot;Harakeke&quot; is included as it has been examined extensively for its pharmaceutical, medicinal, and fibre properties as has “Manuka” which already has a number of NZ patents registered against it.</td>
</tr>
<tr>
<td>COMMON</td>
<td>sow thistle, rauriki</td>
</tr>
<tr>
<td>MĀORI</td>
<td>RAURIKI, PŪHĀ, Pūwha, pororua, manga (greens).</td>
</tr>
<tr>
<td>MEDICINAL</td>
<td>Juice drunk with wild turnip juice for haemorrhage in childbirth (Bell 1890). Decoction (with kopakopa, clover, salt) to expel placenta. Decoction, with Disphyma australe, used locally for boils (Goldie 1905; Best 1906). Antiscorbutic (Cook). Used for scrofulous sores and as a drink for stomach complaints (Taylor 1870; Kerry-Nicholls 1886). Leaves crushed until wet with milky fluid. Applied, bound on cuts to prevent poisoning. (Adams 1945). Related pharmacology and chemistry in Brooker, Cambie and Cooper 1987.</td>
</tr>
<tr>
<td>FISH/HUNT</td>
<td>The juice of sow thistles and pōporo (Solanum) used to size canoes before painting (Barstow, quoted in Best 1925).</td>
</tr>
<tr>
<td>RECORD ID</td>
<td>1111</td>
</tr>
</tbody>
</table>
Table 6: Record of Harakeke from Landcare Research Nga Tipu Whakaoranga Database (adapted)

**FAMILY**
Hemerocallidaceae

**BOTANICAL**
*Phormium tenax*

**MĀORI**
harakeke, kōrari, harapere, harareke; the flower stalk is kōrari; the seed capsule is kuruwaka; fibre is muka (especially in North Island) or whïtau (South Island); honey found in flowers is wai kōrari, wai harakeke, or ngongo kōrari (Best 1942).

**COMMON**
New Zealand flax, flax

**MEDICINAL**
Gum: alkaline, excellent demulcent, applied to wounds, burns and scalds. Used for dysentery (Goldie 1905; Best 1906). For diarrhea - "I can also speak very highly of the flax gum ... a mouthful repeated every hour until cured" (O’Carroll 1884). Gum from flax used to stuff into a hole in the tooth for toothache (Beattie 1920). Root, leaf base: poultice for boils. Decoction used for intestinal worms, constipation. Mixed with juice of kōhia berry, taken internally for flatulence (J. White). Mixed with bush lawyer. Taken for difficult menstruation - 4 pieces of flax root boiled with 4 pieces of aka taramoa (bush lawyer, *Rubus* sp). Pieces must be taken from east side of plants for this particular complaint. For other complaints, materials may be taken from any part. Lotion used for ringworm (Goldie 1905; Best 1906, 1909). Rhizome scraped, boiled, brown fluid stored. Medicine for constipation, stomach trouble. Dose is half a teacup (Adams 1945). For ague - centre part of one root of harakeke, 12 leaves of kohukohou, leaves of 3 ordinary sized branches of the matoutou (a small tree that grows at Patea and the inland district of the Waitara). Boil in just sufficient water to cover the leaves until the parts appear cooked. Strain when cool. Dose: one paua shell full (about two tablespoonfuls), night and morning. (O’Carroll 1884). Strong decoction of roots and butts of leaves boiled for 12 hours excellent for healing wounds, lacerations and amputations. Monckton used it in hundreds of cases. (Monckton 1885; also quoted in Aston 1923b). Extract of root used as an aperient (recipes given) and for chilblains (Neil 1889). Mucilage at the base of flax leaves used for burns. The mountain species were more valuable. Rhizome used for worms, for stomach disorders and ringworm (Given 1940). The white part of flax butts sliced finely and mixed with inner "bark" of houhi, *Hoheria populnea*, in water. Burns bathed with resultant fluid, which gives immediate results (K. Kahaki 1941). Infusion of flax-root, tataramoa and raupō root boiled together, used as cleansing remedy to assist in removal of placenta (M. Withers, Opotiki, 1941). Infusion of kohekohe bark, manakura bark (*Melicytus micranthus*), puawānanga vine (*Clematis paniculata*), korare (*Phormium*) stalk and kahikātoa leaves (*Leptospermum scoparium*) taken 3x a day before meals for female haemorrhage, bleeding piles, general blood disorders, kidney troubles and skin eruptions; decoction containing korare root taken 2x daily before meals for "stoppage" and stomach troubles (Anon; Department of Scientific and Industrial Research, Botany Division files 22/15 of 8/1/59). Leaves: Dressed fibre (muka) used as dressing wound. (Bell 1890).

**FOOD**
Seeds form excellent substitute for coffee (Kirk, in Taylor 1870).

**FIBRE**
A yellow colour is given to flax by holding the fresh leaves over fire (Thompson 1859). "Admirably adapted" for paper manufacture. "The flax, when immersed in a solution of alum, is readily converted into a pulp..." There are many varieties of this valuable plant. (Taylor 1855). Superior flaxes cultivated - uses noted (Colenso 1881). Produces extremely durable paper (Reed and Bretts 1874).

**DYES**
Juice of the root used as ink (Colenso 1869a).

**DOMESTIC**
Used by natives as substitute for sealing wax (Taylor 1855).

**FISH/HUNT**
Flax-tow smeared with gum from *Pseudopanax arboreus* (fivefinger) used for caulkling canoes (Best 1925). Bottom and sides of canoes on Chatham Islands made of kōrari. Called waka puhara or waka kōrari (Best 1942; Shand 1911).

**RECORD ID**
1088
Manuka Sample

Patents that may have originated from matauranga Maori can be difficult to trace. Rongoa has common, Maori and scientific names applied to it (see previous table). When searching or monitoring patent databases, different results can be produced dependent on which name is search for. Consider for example, the Manuka. The antiseptic and diuretic properties of Manuka have been well known to Maori for many generations and many Maori still use it today.

The following table displays the Intellectual Property Office of New Zealand (IPONZ) ‘quick search’ results for “Manuka”. The results were generated 11 January 2005 at 1.00pm

Table 7: IPONZ ‘quick search’ for patents on “Manuka”
An internet web search for “Manuka” and “oil” produces results from Coast Biologicals. Note the Patent Application Number.

Table 8: Lema Oil (Coast Biologicals) website (adapted)²²⁵

<table>
<thead>
<tr>
<th>LEMA Oil</th>
<th>Patent Application Number 332694</th>
</tr>
</thead>
<tbody>
<tr>
<td>A blend of high potency fractions from Leptospermum scoparium [Manuka Oil] and Melaleuca alternifolia (Tea Tree Oil)</td>
<td></td>
</tr>
</tbody>
</table>

Introduction

It is well known that the Essential Oil distilled from Leptospermum scoparium (Manuka Oil) has low toxicity and an excellent potency particularly against gram positive micro-organisms.

It is also known that the Essential Oil distilled from Melaleuca alternifolia (Tea Tree Oil) has relatively low toxicity and a good potency, particularly against gram negative micro-organisms. Both oils also have quite strong distinctive perfumes.

Why LEMA Oil?

There is a clear need for a natural, low toxicity, broad spectrum, high potency oil, with a low perfume level, particularly for use in cosmetics and medical applications, and for skin antiseptics.

What is LEMA Oil?

LEMA Oil is a mixture of the most microbiologically active fractions of Leptospermum scoparium oil (Manuka Oil), and the most microbiologically active fractions of Melaleuca alternifolia oil (Tea Tree Oil). The resulting oil is broad spectrum and potent, and also has reduced perfume.

In Cosmetics:

Such an oil could be used for its antimicrobial properties, and because of low use rates, any natural perfume associated with it would be diluted out.

In Medical Applications:

Essential Oils often help the healing process so LEMA Oil being a broad spectrum, highly potent, low toxicity, antimicrobial could find many uses where topical applications to combat infections are called for: Such applications could include impregnation of gauze applied to trauma sites and skin infections.

In Skin Antiseptic:

In critical areas such as hospitals, it is increasingly vital to have access to highly effective, low toxicity broad spectrum preparations. LEMA Oil can be incorporated in scrubs and hand sprays. Increasingly food handlers are transmitting infection. Because of its high potency and low toxicity LEMA Oil offers an ideal active ingredient where repeated use calls for an effective antimicrobial which will not cause skin problems.

Specifications for Coast LEMA Oil

<table>
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<tr>
<th>TEST</th>
<th>SPECIFICATIONS</th>
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<tbody>
<tr>
<td>Appearance (Visual)</td>
<td>Clear Mobile Liquid</td>
</tr>
<tr>
<td>Colour (Visual)</td>
<td>Pale Yellow</td>
</tr>
<tr>
<td>Relative Density @ 20°C</td>
<td>0.93 ±0.005</td>
</tr>
<tr>
<td>Moisture Content (Visual)</td>
<td>No Visible water @ 20°C</td>
</tr>
<tr>
<td>Miscibility with 100% Ethanol @ 20°C</td>
<td>Clear solution with 1 vol. oil to 1 vol. 100% Ethanol</td>
</tr>
<tr>
<td>Assay Terpinene - 4 - ol</td>
<td>395 to 410 g/l</td>
</tr>
<tr>
<td>Assay g - Terpinene</td>
<td>4.5 to 5.5 g/l</td>
</tr>
<tr>
<td>Assay Flavesone</td>
<td>6.5 to 7.5 g/l</td>
</tr>
<tr>
<td>Assay Lepispermone</td>
<td>15 to 20 g/l</td>
</tr>
</tbody>
</table>

Coast LEMA Oil compared to Manuka and Tea Tree Oil

GREATEST DILUTION SHOWING MICROCIDAL EFFECT

<table>
<thead>
<tr>
<th>ESCHERICHIA coli</th>
<th>MANUKA</th>
<th>TEA TREE</th>
<th>LEMA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:900</td>
<td>1:10</td>
<td>1:500</td>
<td>1:900</td>
</tr>
<tr>
<td>STAPHYLOCOCCUS aureus</td>
<td>1:1500</td>
<td>1:400</td>
<td>1:900</td>
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<tr>
<td>PSEUDOMONAS aeruginosa</td>
<td>&lt;1:10</td>
<td>&lt;1:10</td>
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<td>PROTEUS vulgaris</td>
<td>&lt;1:10</td>
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<td>CANDIDA albicans</td>
<td>&lt;1:30</td>
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<td>STREPTOCOCCUS pyogenes</td>
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²²⁵ adapted for space reasons from http://www.Coast.co.nz/Manuka.htm web page, downloaded 11 January 2005, 1.30pm
Returning to the IPONZ site, a search for the Patent Number that Coast Biologicals advertises on its web site (Patent 332694) reveals the following.

<table>
<thead>
<tr>
<th>Patent Details</th>
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<tbody>
<tr>
<td>Patent Number (11)</td>
<td>332694</td>
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<tr>
<td>Current Status</td>
<td>Granted and Sealed</td>
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<tr>
<td>International Application Number</td>
<td></td>
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<tr>
<td>WO Publication Number</td>
<td></td>
</tr>
<tr>
<td>Patent Type</td>
<td>Patent Non-Convention Complete</td>
</tr>
<tr>
<td>Patent Title (54)</td>
<td>Improvements in and relating to antimicrobial compositions</td>
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<tr>
<td>Provisional</td>
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<td>Filed (22)</td>
<td>05-NOV-1999</td>
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<td>05-NOV-2006</td>
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<td>Classification</td>
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<td>IPC7</td>
<td>A61K35/78; A01N65/00</td>
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<tr>
<td>Documents</td>
<td></td>
</tr>
<tr>
<td>Abstract/Abridgement</td>
<td>Document 4.6 Kb</td>
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<tr>
<td>Provisional Specification</td>
<td>Document 391.4 Kb View as PDF</td>
</tr>
<tr>
<td>Complete Specification</td>
<td>Document 813 Kb View as PDF</td>
</tr>
<tr>
<td>Applicant / Patentee: (71)</td>
<td>COAST BIOLOGICALS LIMITED . 260 Roscommon Road, Wiri, Manukau, New Zealand</td>
</tr>
<tr>
<td>Contact : (74)</td>
<td>JAMES &amp; WELLS . 9th Floor, Ellerslie Tower, 56 Cawley Street, Ellerslie, Auckland, New Zealand</td>
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<td>Service Address :</td>
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<td>Published Date</td>
<td>30-MAR-2001</td>
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<td>Application Accepted</td>
<td>12-MAR-2001</td>
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<tr>
<td>Filed</td>
<td>06-NOV-1998</td>
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</table>

Related Patents
No Related Patents found

Objections / Hearings
There are no current objections or hearings present

Renewal Interest
JAMES & WELLS
Level 12, KPMG Centre, 85 Alexandra Street, Hamilton, New Zealand

Applicant / Patentee & Licensee History
No applicants nor licensees on record or public access is restricted

Inventors (72)
Courtney, William John

Concluding comment on patents

As can be seen from the above examples, there is a significant amount of matauranga already openly and freely available in published media. There are already a number of patents existing for products that have used Matauranga Maori as a springboard for their ‘inventions’, and, these patents may be missed during cursory patent searches. Taken together, all these factors

adapted for space reasons from table downloaded from http://www.IPONZ.govt.nz, 11 January 2005 at 1.39pm
mean that Roopu have to be comfortable with their security of their matauranga and should establish robust internal and external security protocols, perhaps even having to adopt a precautionary patent monitoring approach to ensure their mapped matauranga remains secure. While this may appear ‘overkill’, to monitor patent applications to check (in this country at least) whether patent applications could compromise matauranga or have sprung from matauranga, the previous examples (Appendix 2 in particular) have shown just how easy it is for biopirates to raid indigenous knowledge.
Appendix 5: World Wildlife Organisation desktop study of indigenous mapping

SOUTH AMERICA
Argentina: Wichi Land Occupancy / Basic Mapping
Bolivia: Yuqui Self-Demarcation / Aerial Imagery, GIS
Brazil: Acre Community Agroforestry / GIS
Brazil: Jau National Park / Basic Mapping
Brazil: Menkragnoti Kayapo Demarcation / GPS
Brazil: Xikrin Kayapo / Forest Management and Land-Use Planning / GPS
Paraguay: Ache Mbaracuyo Reserve / GPS
Peru: Communal Land Titling and Reserves / Basic Mapping
Peru: Land Titling / Basic Mapping
Venezuela: Ye’kuana Demarcation Project / Basic Mapping
COICA: Regional Land Management / PRA, GIS

CENTRAL AMERICA
Belize: Maya Land Use / Basic Mapping
Honduras: La Mosquitia Land Use and Occupancy / Basic Mapping
Nicaragua: Miskito Coast Protected Area / Cartography, Sketch Maps
Panama: Indigenous Mapping of the Darien / Cartography, Sketch Maps

CARIBBEAN
Dominican Republic: Social Forestry Initiatives / PRA

NORTH AMERICA
Canada: Ditidaht Traditional Knowledge Mapping / GIS
Canada: The Eagle Project / GIS
Canada: Inuit Land Use and Occupancy Study / Basic Mapping
Canada: Inuit of Quebec Land Use and Ecological Mapping / GIS
Canada: Mamo Atoskewin Association Impact Assessment / GIS
Canada: Manitoba Keewatinowi Okimakanak / GIS
Canada: Sanikiluaq / Aerial Photographic Animal Census
Canada: Shuswap Nation Tribal Council / GIS
United States: Colville Confederated Tribes / GIS
United States: Tulalip Fisheries/Aerial Videography
United States: Zuni Sustainable Resource Development Plan / GIS

AFRICA
Ethiopia: Local Land Use Planning / Aerial Photography
Guinea-Bissau: Wetlands / Aerial Photographs
Kenya: Ukambani Mapping Land-Use Changes / PRA
Kenya: Machakos Land Use Changes / PRA, GIS
Kenya: Aerial Photography and Household Studies
Namibia: Ju’hoansi Bushmanland Land Use Planning / PRA, GPS, GIS

ASIA & SOUTH PACIFIC
Indonesia: Asmat Traditional Forest Use
Indonesia: Bentian Dayak / Basic Mapping
Indonesia: Bukit Baka-Bukit Raya National Park / Basic Mapping
Indonesia: Kayan Mentarang Reserve / PRA, GPS, GIS, Aerial Imagery
Indonesia: Kenyah Uma Lung, Long Ul Village / GPS, GIS
Indonesia: Wasur National Park / Sketch Mapping, GPS
Nepal: Land Use Planning / Aerial Photography
Papua New Guinea: Resource Appraisal / Aerial Photography
Philippines: Ancestral Domain Mapping / Basic Mapping, GPS, GIS
Philippines: Cagayan de Oro / Sketch Mapping
Philippines: Iraya Mangyar, Mindoro / Basic Mapping, PRA
Philippines: Kalahan Reserve, Nueva Vizcaya / Sketch Mapping
Philippines: Palawan / GIS
Thailand: Participatory Land Use Planning / 3-D Maps
Thailand: Sam Mun Watershed Planning / 3-D Maps
Thailand: Karen Natural Resources Management Planning / 3-D Maps

BRIEF MENTIONS
Bangladesh: Social Forestry Opportunity Maps
Brazil: Xavante Border Monitoring
Canada: Ayuukht Nisga’a Mapping Land Ownership / Protected Knowledge
Canada: Chipewyan Land Use, Northwest Territories / Map Biographies
Canada: Cree, Fort George Resource Use and Subsistence Economy
Canada: Cree & Beaver, Infrastructural Impact Assessment / Map Biographies
Canada: Inuit Halibut Fishery
Canada: Manitouwuk Sound Waterfowl Ecology Mapping
Canada: Nimpkish Kwakiutl Resource Management Study / Basic Mapping
Canada: Nisga’a / Aerial Video-Mapping
Canada: Whapmagoostui Land-Use Study / GIS
Ecuador: Shuar Land Claims
Senegal: Ndam Mor Fademba Boundaries / RRA
Appendix 6: Additional sample maps

A range of basic, sample maps have been created for three different locations; the Te Kaha, Bluff and Kaikoura regions. These maps have been constructed using the same spatial datasets but using different subsets of the data. They are part of the visual aids supporting the presentation of the Guide and are intended to assist reader focus.

Layers were constructed using the following datasets held by Lincoln University: - Coastline, South Island Digital Elevation Model, Land Environment of NZ, Land Resource Inventory, Landcover Database, Places, Regions, River Environment Classification, Territorial Local Authorities, Topoimages and Toposhapefiles.

The sample maps in this Appendix illustrate the range and types of datasets available only. Initial preparation involved creating clips from the large datasets. This decreased the time taken to draw the data and the size of data that needed to be manipulated. Since the sample maps are intended as visual aids only, errors such as small coastal islands that were in some vector datasets and not others have not been rectified. These maps, some of which are referenced within the guide, plus those included within the Guide itself, are visual aids only and do not have any analytical value.

List of Appendix 6 Figures
1. Crown Forestry Rental Trust Maori Land Alienation Database (page 70)
2. Te Puni Kokiri Maori Land Information Base location map (page 70)
3. Te Puni Kokiri Maori Land Information Base thematic map detailing Maori owners per Maori freehold land block (page 70)
4. East Coast archaeological sites (page 71)
5. East Coast Digital Elevation model samples - slope, aspect, hillshade, contour lines and 25 metre viewshed (page 72)
6. Awarua (Bluff) Land Resource Inventory, soils (page 73)
7. Awarua (Bluff) Land Resource Inventory, land use class (page 74)
8. Kaikoura Land Resource Inventory, land use class (page 75)
9. Kaikoura Land Resource Inventory, soils type, pH (page 76)
10. Kaikoura Land Environment New Zealand clips (winter solar radiation, acid soils, drainage, water deficit, minimum temperature) (page 77)
11. Kaikoura, LENZ and LRI, preliminary potential truffles sites (page 78)
Appendix 6, Figure 1: **Crown Forestry Rental Trust Maori Land Alienation Database**

Example of Crown Forestry Rental Trust, Maori Land Alienation Database (Te Matua Whenua)

Putauaki, Pokohua and Ruawahia Blocks by decade

Appendix 6, Figure 2: **Te Puni Kokiri Maori Land Information Land Base map**

Example of Te Puni Kokiri Maori Land Information Base map for Kawerau A1

Appendix 6, Figure 3: **Te Puni Kokiri thematic map for Maori freehold land**

Example of Te Puni Kokiri Thematic Map detailing number of Maori owners per Maori freehold land block near Mahia, 1995

Key

<table>
<thead>
<tr>
<th>Color</th>
<th>Number of Owners</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>1 – 10 owners</td>
</tr>
<tr>
<td>Yellow</td>
<td>11 – 50 owners</td>
</tr>
<tr>
<td>Dark Green</td>
<td>50 – 100 owners</td>
</tr>
<tr>
<td>Purple</td>
<td>101+ owners</td>
</tr>
</tbody>
</table>
Appendix 6, Figure 4: East Coast Archaeological Sites

Legend
- Registered Archaeological Sites
- Registered archaeological "Pas sites"

New Zealand Archaeological Sites overlayed onto NZ Topographic map. (1:30 000 scale)

Archaeological sites registered as "Pa" highlighted in blue.

Note the sites that are in the ocean. This is potentially caused by:
- inaccurate record taking
- problems with metric conversion of co-ordinates
- conversion to new projections
- etc.

This illustrates multiple tasks required to confirm accuracy of data.

Data sourced from
- NZC INZAS archaeological records
- NZ Topographic 260 series
Appendix 6, Figure 5: East Coast Digital Elevation Model
Appendix 6, Figure 6: Bluff Land Resource Information (LRI), Soils

Legend

- Tisbury Soils
- Omaui Soils
- Omaui Hill Soils
- Otatara Soils
- Riverton Soils
- Invercargill Soils
- Otanomomo Soils
- Motukarara Soils
- Bluff

Soil Classification for Bluff: Descriptions taken from Soil Bureau bulletin 27, 1968

581 - Tisbury Soils [et thirn tā ārawa]: Tufanana greywacke silt over greywacke gravels. Native vegetation is Rātā/kiwi forest with patches of podocarp forest, some red tussock, and manuka scrub.

583 - Omaui Soils [sandy loams, peaty loams, and silt loams]: Tufanana greywacke silt overlying early and ultrabasic rocks. Native vegetation is Coastal broadleaved forest with patches of flax/kiwi forest, manuka and healthy scrub.

582 - Omaui Hill Soils [sandy loams to sandy sands]: Moraine and ultrabasic rocks with discontinuous cover of tufanana greywacke silt. Native vegetation is Manuka/cassiope scrub with patches of flax/kiwi forest.

70 - Otatara Soils [sandy loams to sandy sands]: Sand from tufanana greywacke, clastic, and granite. Native vegetation is Manuka, broadleaved akeke, few podocarps, some red tussock.

718 - Riverton Soils [sandy sands, thin sandy loams, and sandy loams]: Sandstone tufanana greywacke clastic, and granite. Also boulder banks of greywacke and clastic. Native vegetation is Red/white tussock, scrub, manuka, and coastal scrub.

860 - Invercargill Soils [loamy peats, peaty loams, loamy sands]: Organic matter from sedges, rushes, peat, sedge, and clay. Native vegetation is Tussock crowns, sedge, flax, and swamp forest.

87 - Otanomomo Soils [peat]: Organic matter from moss and rushes. Native vegetation is Wire rush and sphagnum mosses; some red tussock and flax.

52 - Motukarara Soils [sandy loams to clay loams]: Alluvial material from greywacke. Native vegetation is Setaria, herb and grass, plant communities indicate wider range of soil concentrations.
Appendix 6, Figure 7: Bluff, Land Resource Information (LRI), Land Use Capability

LUC Class Code:

4 - Land with moderate limitations for arable use, but suitable for occasional cropping, pasture or forestry

6 - Non-arable land with moderate limitations for use under perennial vegetation such as pasture or forest

7 - Non-arable land with severe limitations for use under perennial vegetation such as pasture or forest

LUC Subclass Modifier:

e - erosion susceptibility, deposition or the effects of past erosion damage first limits production

w - soil wetness resulting from poor drainage or a high water table, or from frequent overflow from streams or coastal waters first limits production

s - soil physical or chemical properties in the rooting zone such as shallowness, stoniness, low moisture holding capacity, low fertility (which is difficult to correct), salinity, or toxicity first limits production

c - climatic limitations such as coldness, frost frequency, and salt-laden onshore winds first limits production

Therefore:

7s = Non-arable land with severe limitations for use under perennial vegetation such as pasture or forest, with soil physical or chemical properties in the rooting zone such as shallowness, stoniness, low moisture holding capacity, low fertility (which is difficult to correct), salinity, or toxicity first limits production

[Note: Other subclass identifiers indicate other unique values]
Appendix 6, Figure 8: Kaikoura, Land Resource Inventory, land use classes
Appendix 6, Figure 9: Kaikoura Land Resource Inventory (LRI), soils type & pH
Appendix 6, Figure 10: Kaikoura Land Environment New Zealand (LENZ)

These maps have been extracted from Land Environment New Zealand (LENZ) data to visualise the extent of some of the available dataset.

Scale of all maps 1:595,000
Appendix 6, Figure 11: Kaikoura LRI and LENV datasets, potential Truffle growing locations

Preliminary only
Potential Truffle growing locations in Kaikoura

Indicators based on information found in Crop & Food Research publication "Tuber melanosporum - Perigord black truffle"

Optimum requirements:
- Warm summers and cool winters
- Free draining
- High pH (7.5 and above)

Other factors include tree density and rainfall

LRI and LENV datasets used in this preliminary analysis
Appendix 7: Risk (threat) analysis

An abbreviated sample of a typical inventory document is provided here (adapted from Winiata, 1986 and Loomis, 2000). This is to provide context for the risk analysis matrix. This example follows the process from identification of resource through the assessment of a (theoretical) risk priority analysis.

<table>
<thead>
<tr>
<th>Resources Cultural (Physical)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Pou</td>
</tr>
<tr>
<td>(1) Maunga</td>
</tr>
<tr>
<td>(2) Awa</td>
</tr>
<tr>
<td>(3) Moana</td>
</tr>
<tr>
<td>(4) Urupa</td>
</tr>
<tr>
<td>(5) Toka</td>
</tr>
<tr>
<td>(6) Roto</td>
</tr>
<tr>
<td>…</td>
</tr>
<tr>
<td>(b) Marae</td>
</tr>
<tr>
<td>(1) Number of marae</td>
</tr>
<tr>
<td>(2) Physical state of repair</td>
</tr>
<tr>
<td>(i) Building new marae</td>
</tr>
<tr>
<td>(ii) Repairs required …</td>
</tr>
<tr>
<td>(c) Taonga</td>
</tr>
<tr>
<td>(1) Pouamumu</td>
</tr>
<tr>
<td>(2) Iconic wildlife</td>
</tr>
<tr>
<td>(3) Manuscripts …</td>
</tr>
<tr>
<td>(d) Land</td>
</tr>
<tr>
<td>(1) Tribal</td>
</tr>
<tr>
<td>(2) Membership</td>
</tr>
<tr>
<td>(3) Joint venture</td>
</tr>
<tr>
<td>(4) Joint management…</td>
</tr>
<tr>
<td>(i) Quantity</td>
</tr>
<tr>
<td>(ii) Quality</td>
</tr>
<tr>
<td>(iii) Location…</td>
</tr>
<tr>
<td>(e) Biophysical</td>
</tr>
<tr>
<td>(1) Fish</td>
</tr>
<tr>
<td>(2) Watercress</td>
</tr>
<tr>
<td>(3) Koura</td>
</tr>
<tr>
<td>(4) Manu</td>
</tr>
<tr>
<td>(5) Maara…</td>
</tr>
<tr>
<td>(f) Fishing rights</td>
</tr>
<tr>
<td>(1) Number and size of areas to guaranteed fishing rights</td>
</tr>
<tr>
<td>(2) Stocks of supplies…</td>
</tr>
<tr>
<td>(i) within tribal rohe</td>
</tr>
<tr>
<td>(ii) outside tribal rohe…</td>
</tr>
<tr>
<td>(g) Investments</td>
</tr>
<tr>
<td>(i) within tribal rohe</td>
</tr>
<tr>
<td>(ii) outside tribal rohe…</td>
</tr>
<tr>
<td>etc</td>
</tr>
</tbody>
</table>

The scenario of this example is that water quality at a traditional tuna harvesting site has become degraded due to the discharge of sewage/industrial effluent 500 metres upriver of the site. The harvesting site is:

- at the very edge of the current effluent/river mixing zone
- in a Regional/Local Council riparian management zone that has yet to have a management plan constructed for it
- has a Class CR Water quality designation (being water managed for contact recreation purposes)

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difficult to access due to surrounding neighbourhood farming operations
used intermittently due to the above conditions
not the sole source of tuna for the local hapu (i.e. can be retired from use for a period of time) The risk (threat) analysis is used to quickly ascertain the threat/protection status of any resource.

<table>
<thead>
<tr>
<th>Threat (1-6)</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>little threat</td>
</tr>
<tr>
<td>2</td>
<td>slight threat</td>
</tr>
<tr>
<td>3</td>
<td>threatened</td>
</tr>
<tr>
<td>4</td>
<td>chronically threatened</td>
</tr>
<tr>
<td>5</td>
<td>acutely threatened</td>
</tr>
<tr>
<td>6</td>
<td>critically threatened</td>
</tr>
</tbody>
</table>

Protection (0-100%)

| safe with best protection | 100 |
| well protected with ongoing protection | 80 |
| secure with increasing protection planned | 60 |
| limited protection | 40 |
| slight protection | 20 |
| nil protection measures in place | 0 |

In this example the risk analysis quickly identifies the threat as “2” or “3”, (slight risk dependent on mitigation or management measures, or, threatened and needing investigation). It has limited protection (40%) as the water does have a CR water class designation and a management plan for the riparian zone will be constructed. By using the risk analysis Roopu can personalise their priorities (their opinion rather than ‘other’), and can discern whether protection measures should be increased or whether intervention and remedial measures should be instigated.
Appendix 8: Compilation of detail for Part Two of the Guide

Most of the detail for costs relating to Part Two of the Guide (software, freeware, hardware, data and training) were compiled through internet searches with some follow-up done over the telephone.

Expectation that ArcGis and MapInfo were the most popular GIS software in use by Councils proved correct. However there was also another GIS software in use – Geomedia. Since 7 of the fifteen Regional Councils failed to respond, it is likely that Geomedia could possibly be used by one or more of those Councils.²²⁹ Based on a previous District Council survey undertaken in 2003 where Geomedia was also listed as a software in use, the costing for Geomedia was included in the software pricing survey.²³⁰ Direct email contact was made with the vendors of ArcGis (Eagle Technology), MapInfo (Critchlow & Associates) and Geomedia (Intergraph Corporation NZ) to ascertain specific details (such as cost) not available through their websites. Technical or sales persons were happy to oblige with details, some querying whether or not comparisons would be made for functionality of the software. While this may be a worthwhile exercise, the technical skills required to proceed with a functionality review well exceed my own GIS skills. Tumonz, an inexpensive mapping software was also investigated. This software is a limited version of a GIS that can answer basic search and query facilities. Detail and discussion on Tumonz was therefore not included within the guide as the focus was primarily on opportunities provided by a fully functional GIS.

Internet and literature searches were made for information on freeware and hardware requirements. Minimum hardware specifications for each software were generalised and random retail computer vendors telephoned for prices of computers that would meet those specifications. An average cost was used in the Guide. Data costs proved more time consuming to collate. Again, technical and salespersons eventually responded. However as it was a theoretical exercise, several months passed before the data table was close to completion. Training costs were established via internet searches. A search of University and Polytechnic web sites found that only Universities were offering GIS papers, and all offered tuition in ArcGis only (although Victoria University mentioned they had MapInfo available). Each of the software vendors responded with information regarding cost and venues for their specific training courses. Costs for GIS tuition at two Universities (Canterbury and Lincoln) were then sampled to provide comparative information.

²²⁹ Interestingly, a Regional Council respondent had only indicated they used Geomedia and it wasn’t until further contact was made that the fact emerged that the Council actually used all three GIS software.
²³⁰ A survey summary of GIS use by 27 Regional and District Councils, published on http://www.gisuser.co.nz website, identified 21 ESRI, 1 Genamap, 9 MapInfo and 5 Intergraph users
Appendix 9: Ngati Hamua Sites of Significance Protocol

Ngäti Hämua Sites of Significance Protocol

1.0 Parties to the Protocol – Hämua Sites of Significance Database

- Rangitäne o Wairarapa Incorporated; and
- Wellington Regional Council (Planning and Resources Department and Technical Services section).

Greater Wellington – The Regional Council (Greater Wellington) is the promotional name of Wellington Regional Council, which will be the title referred to in the remainder of this protocol.

2.0 Objective

That Rangitäne o Wairarapa provides Greater Wellington with an updated database of sites significant to Hämua; and

That Greater Wellington informs Rangitäne o Wairarapa of consent applications near to those sites.

3.0 Desired Outcomes

1. That Rangitäne o Wairarapa provide Greater Wellington with an updated and accurate record of sites;

2. That Greater Wellington loads these sites onto their Geographic Information System as an alert layer;

3. Greater Wellington ensures that this data is restricted to authorised personnel only;

4. That Rangitäne o Wairarapa are aware of any consent application (not including controlled activities) that are on or near a recorded Hämua site of significance and have the opportunity to communicate their concerns with the applicant and/or relevant council;

5. Improved communication between applicants, district councils, Rangitäne o Wairarapa and Greater Wellington with regard to the consents process;

6. Increased recognition and protection of Hämua sites of significance;

7. Increased awareness of wähi tapu sites amongst landowners and councils;

8. Increased awareness of what activities can lead to adverse impacts on wähi tapu;

9. That sensitive information is retained by the Iwi Authority; and

10. That any amendment to this protocol is agreed to by both parties.

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\[231\] included by permission of Jayson Kerehi, Greater Wellington District Regional Council
4.0 Key Activities and Methods

Greater Wellington will undertake the following:

1. Ensure that a designated staff member from Technical Services is responsible for downloading, transferring and upgrading of data from Rangitāne o Wairarapa;

2. Ensure that designated staff, who have access to the Hāmua sites of significance database, receive adequate training, knowledge and understanding of the potentially sensitive nature of this data;

3. Instigate a 12-month trial of the use of this database with regard to the consents process. After which time, they will undertake a joint review with Rangitāne o Wairarapa;

4. The Section Leader – Consents and Compliance will notify Rangitāne of any consent\(^1\) that is on or near a recorded Hāmua site of significance and, where appropriate, advise the applicant or relevant council to contact Rangitāne for further information;

5. The Section Leader – Policy and Planning will notify Rangitāne of any proposal that is on or near a recorded Hāmua site of significance and, where appropriate, advise the applicant or relevant council to contact Rangitāne for further information;

6. Notify Rangitāne of any changes in personnel authorised to access the Hāmua Sites of Significance Database;

7. Restrict access of the Hāmua Sites of Significance Database to the following positions within the councils Wairarapa Division:
   - Manager – Planning and Resources;
   - Section Leader – Policy and Planning;
   - Māori Policy Advisor – Policy and Planning;
   - Section Leader – Consents;
   - Administration Assistant – Consents; and
   - GIS Technical Officer – Technical Services

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1. This does not include bore consent applications, as was agreed to when re-signing the consents contracts for 2002/03 financial year
Rangitāne o Wairarapa will undertake the following:

1. Develop a process for the identification and verification of Hāmua sites of significance. Add verified sites to the database;
2. Be responsible for the selection and approval of sites that are deemed appropriate for transfer to Greater Wellington;
3. Provide Greater Wellington with an electronic update of sites every 12 months;
4. Provide Greater Wellington with a list of persons who can authenticate sites on behalf of Rangitāne o Wairarapa (designated authorities);
5. Notify Greater Wellington if those designated authorities change; and
6. Keeps authenticated and dated hard copies of all sites transferred to Greater Wellington and provide council with access to those records on request.

5.0 Participation

This protocol should be read in conjunction with the Charter of Understanding (July 2000). The charter covers issues such as:

- Acting in good faith
- Principles for the relationship between the Iwi and council
- Recommendations on conflict resolution

This protocol should also take into consideration the terms of the Data Sharing Agreement that allows the use of council data by the iwi.

6.0 Review

There will be a joint initial review 12 months from the signing of the protocol. Subsequent reviews will be determined by the parties to the protocol.