
Reflections from an Indigenous Community on Volcanic Event Management, Communications and Resilience

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Abstract

Ngāti Rangī, an indigenous tribe of Aotearoa New Zealand, live on the southern flanks of their ancestral mountain, Ruapehu, an active volcano. Ruapehu has erupted and caused lahars within living memory, and nearby Tongariro erupted as recently as 2012. Ngāti Rangī and other tribes affiliated to these mountains are intimately connected to and familiar with the moods, signs, and language of the mountains and have valuable knowledge to contribute to decision-making and warning systems during volcanic events. To date this knowledge or *mātauranga* Māori has been somewhat under-utilised, and Ngāti Rangī have not always been included in decision-making processes during volcanic events. But communication is improving, and Ngāti Rangī have begun a journey of building their own monitoring, information collection, and communication systems. Past and present monitoring, warning systems, communications and tribal civil defence resources are examined to determine how Ngāti Rangī and their tribal knowledge can be better recognised, communications with governmental volcanic hazard management agencies improved to ultimately work together to improve outcomes for the tribe and local community.

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1 Introduction

Koro Ruapehu is constantly changing. Sometimes he's sleeping, sometimes he's active – sometimes he erupts

(pers. comm. Ngāti Rangī Trust 2014)

Despite a plethora of initiatives internationally, regionally and locally to reduce risk or increase resilience to natural hazards (e.g. the United Nations International Strategy for

Disaster Reduction), indigenous communities and peoples are not well provided for.

Like many indigenous cultures around the world the indigenous people of Aotearoa New Zealand, have observed and monitored and then responded to and recovered from numerous hazardous volcanic events. The indigenous knowledge gained from these experiences is rarely considered when scientifically identifying volcanic hazards or developing emergency management plans, yet mātauranga Māori (Māori knowledge) does contain a unique, valid epistemology and data source. The mātauranga has driven Māori decision making to endure and adapt to the natural hazards they face (Durie 2005). This has not been fully recognised by current hazard and emergency management regimes in New Zealand and has resulted in a disconnect in communication between the indigenous populations and Government agencies (Jolly et al. 2014). This disconnect has become more evident over time and particularly in relation to the 1995–6 sequence of eruptions of Ruapehu, the 2007 lahar and eruptions of Ruapehu and the 2012 eruption of Te Maari, Mt. Tongariro. Is it then feasible to communicate hazard and risk in today's world to Māori living in these areas within a knowledge framework that is spatially and temporally consistent with their past understandings? Simply, is there a means to desegregate methods to create an understanding of risk unique to our volcanic areas that is universally acceptable by all?

The case study chosen for this research is Ngāti Rangi, a central North Island iwi (tribe) who have held unbroken occupation over the area for over 1000 years. They have an intense and living relationship with their ancestral maunga (mountain), which they refer to as Matua te Mana (“*prestige of the father*”) and is located within the Tongariro National Park, one of New Zealand's United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage sites. The Tongariro National Park is recognised not only for the natural values of the landscape, but also for the cultural values associated with these maunga (mountain) (UNESCO 2014). This recognition demonstrates the cultural

importance placed on this area by local iwi and the acknowledgement of this by UNESCO, who govern the World Heritage List and locations worldwide, in the awarding of dual status in 1993 (recognition of cultural and environmental values) (Keys and Green 2008). The Tongariro National Park is managed by the Department of Conservation, a Crown entity (an organisation that forms part of New Zealand's state sector). Despite the formal recognition of the cultural significance to local iwi of the Tongariro National Park, iwi have little involvement in its management (Gabrielsen 2014).

To understand and develop resilience within Māori communities requires an examination of the role of traditional knowledge within volcanological hazards, risk communication, and emergency management. This research combines several disciplines and therefore requires a distinct method to acquire and analyse data. A mixture of qualitative and semi quantitative research data collection techniques were applied that is based upon recognised kaupapa Māori techniques (Smith 1997). The research undertaken for this study is based on an analysis of the current emergency management framework, analysis of marae survey data, marae assessments, conversations with Ngāti Rangi leaders and elders and an assessment of volcanic based data.

An important aspect of this research is that all researchers are Māori with knowledge of Māori language culture and customs. Secondly, the case study proposed was based on iwi and their interactions with their environment. This meant that iwi determined the progression of the research throughout which was paramount. This process also allows the iwi to be the decision makers, to provide what information they want and to decide how it is used. Consequently, special processes that protect the iwi and their knowledge base were crucial to this research. This research involved the interviewing of iwi leaders, iwi environmental management staff and elders within the Ngāti Rangi Tribe. Over the course of a year (2014) approximately 10 individuals were interviewed and 3 wananga (traditional workshops of 3–5 people) were held on

Ngāti Rangi Marae (traditional meeting house) in rural areas located within the Ruapehu Volcano ring plain in recently active volcanic areas. In conjunction with interviews, oral traditions, waiata (traditional songs), purakau (ancestral accounts) were also examined. Another unique source of information was written records or minutes of traditional church meetings from the 1800s. Due to traditional practice iwi members are reluctant to have their information publically quoted.

The qualitative aspect of this research was used largely to seek a human perspective. The aim was to identify perspectives from the ground, from people that lived in the area, and from people with a relationship to the land, and to the volcano. Iwi in general have large repositories of knowledge coded in local waiata (songs) and karakia (prayer) and held by those in particular deemed worthy of holding on to such knowledge. Historical knowledge of volcanic episodes should be confined within iwi history and korero (speech). This assumption was made purely based on the fact that Ngāti Rangi have long lived within the lands of their ancestors, for over a thousand years, and therefore will have experienced and recorded in some way, volcanic events.

Gaining a better understanding of historical occurrences and responses is beneficial for current research on volcanic hazards and for emergency management. A qualitative approach was able to unearth to some degree the current gap in the knowledge base regarding iwi and volcanic hazards, and understanding what aspects contribute to iwi resilience to natural hazards. This approach was also required as a means for some freedom of movement in the type of method utilised to better support the dynamic nature of iwi and the preference with which iwi choose to be consulted. The ultimate outcome is elucidating some potential indicators of what resilience means to Māori and can it be strengthened within current emergency management frameworks.

1.1 Resilience and Indigenous Communities

Various aspects of communication with, and the resilience of, indigenous communities are contained within natural hazards research, but are described in the following ways: disaster prevention (Alcántara-Ayala 2002), disaster risk reduction (Mercer et al. 2010), and assessing the vulnerability of communities to natural hazards (Cutter et al. 2010). Work with indigenous communities within the Pacific region has provided examples of capacity building within indigenous communities and incorporating their own cultural knowledge into scientific methodology to adequately prepare for, and deal with, natural hazards (Pettersen et al. 2003). The community of Savo Island in the Solomon Islands is exposed to a high level of volcanic activity with a history of large fatalities (Pettersen et al. 2003). Outside expertise and assistance was sought to initiate the development of strategies to address the risks from volcanic activity on the island (Pettersen et al. 2003).

The development of these strategies to address the risks from volcanic activity on Savo encompassed in-depth work with the local community. This work included workshops and identifying and using local knowledge of hazards in conjunction with science to develop a disaster management plan. This process identified in some respects how crucial the political, economic and infrastructural climate is in supporting the resilience of these island nations; political drivers secured the expertise thus enabling the development and implementation of the disaster management plan. Despite the best intentions in aiding indigenous communities in developing strategies to deal with natural hazards, there can be a multitude of barriers in undertaking this work. One of the challenges identified in work undertaken on Ambae Island, Vanuatu, was initially the lack of acceptance by the local population of scientific knowledge (Cronin et al. 2004b).

Breaking through the barrier of the dominance of science is essential for indigenous cultures, as there are a significant number of deep-seated issues surrounding research, intellectual property and exploitation. These issues have led to indigenous communities distrusting researchers, their methods and their desired outcomes. As a means to alleviate such issues researchers have used the principles of the Participatory Rural Appraisal to alter the attitudes and approach of the specialists and to promote community input and knowledge (Bird and Gísladóttir 2012; Cronin et al. 2004a, b). These principles perhaps parallel Māori research initiatives (e.g. kaupapa Māori; Smith 1997), which emphasises elements central to the Treaty of Waitangi, such as participation, partnership, and protection (Robertson 1999). In Vanuatu, Cronin et al. (2004b) observed that strong cultural customs prevented the indigenous peoples from accommodating standard scientific methods, but also that these methods were inconsistent with those customs and the knowledge and beliefs of the people. The researchers envisaged that PRA would act as the instrument to incorporate traditional knowledge into the development of a hazard management plan without the risk of jeopardising the indigenous communities' local belief structures (Cronin et al. 2004b).

Despite work by scientists and disaster management researchers in their aim to understand and improve the resilience of many indigenous cultures, Campbell (2009) indicates that many Pacific Island nations were once inherently resilient to natural hazards. Traditional disaster reduction measures describe the ways through which indigenous communities succeeded in living with natural hazards. Colonisation introduced changes to these societies (Zimmet et al. 1990) that removed the importance of their traditional and highly social practices and left communities unprepared and ill-equipped to deal with natural hazards. Globalisation and other external pressures may be processes that are out of these communities' control, but still have far reaching impacts on their internal processes and

traditions (Mercer et al. 2010; Pelling and Uitto 2001). Among these pressures, Paulinson (1993) found the market forces to be at fault. These aspects may inhibit indigenous communities from being resilient. Despite this, the traditional disaster reduction measures that are representative of inherent qualities central to communities living with natural hazards promote resilience.

2 Ruapehu Volcano

The convergence of the Australian and Pacific tectonic plates is the driver of volcanism within New Zealand. Situated within the Tongariro Volcanic Centre (TVC) (Acoella et al. 2003) (Fig. 1), Ruapehu is the largest and most active volcano in the North Island standing at 2797 m high (Lecointre et al. 2004; Neall et al. 1999). Upon Ruapehu are three summit craters that have all been active over the last 10,000 years (Donoghue and Neall 2001). This includes the current Crater Lake, Te Wai-a-moe, which is situated over the active southern Crater. Ruapehu's periodic activity causes a number of hazardous events with evidence of these volcanic hazards recorded in the landscape and represented by the surrounding volcanoclastic ring plain, (Fig. 1) which is made up of fragmented rocks deposited by historical lahars, debris avalanches and some fluvial and glacial deposits (Donoghue and Neall 2001).

The Department of Conservation management of this area is guided by the Tongariro National Park Management Plan 2006–2016 (Department of Conservation 2006a, b). This document outlines the roles and responsibilities of the Department and the policies that guide the use of this area. The responsibility of managing natural hazards lies with the District and Regional Councils, while monitoring volcanic activity is undertaken in conjunction with research providers such as GNS Science and Massey University. The Department of Conservation describes the risks from natural hazards as taking '*two main forms*' (Department of Conservation

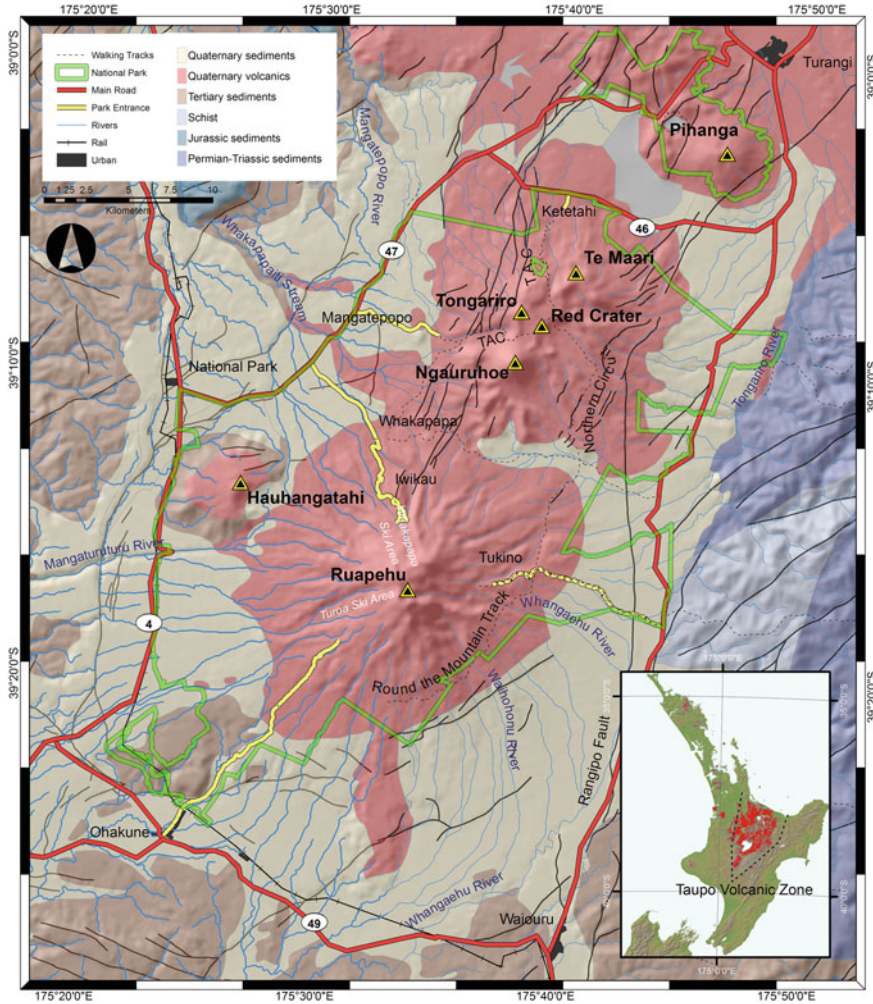


Fig. 1 Location map of Tongariro Volcanic Centre, New Zealand and the Taupo Volcanic Zone (*inset*)

2006b): (1) flows such as lahars, pyroclastic flows, lateral blasts, landslides/floods and lava flows and (2) air borne materials such as rocks, tephra and toxic gases. Ruapehu is unique in the sense that the Crater Lake, Te Wai-a-moe, is located over the current active vent of the volcano. Keys and Green (2008) mention that only one other crater lake (i.e. Kelut in Java, Indonesia) similar to that of Ruapehu exists within the world where there has been an intense focus on physical lahar mitigation. Both of these crater lakes and the research undertaken in reference to lahar hazards have provided important scientific data for hazards research.

3 Māori/Iwi in New Zealand and Ngāti Rangī

Indigenous cultures around the world have unique world views that inform their cultural values, belief systems and link them to the natural world. Royal (2005) argues this worldview sets Māori and other indigenous cultures apart from the mainstream populations. The common denominator among indigenous cultures is that the natural world is perceived as a living being (Royal 2005; Hart 2010) and this connection with the environment ties indigenous peoples

around the world with one another, epistemologically.

Although world views varies from iwi to iwi, a strong thread uniting iwi Māori viewpoints is the genealogical connection to the physical and spiritual world. In the Māori world view, human beings are the last creation of the god of the forest, Tāne Māhuta. Rather than this furnishing humans with primacy over creation, as is the common interpretation within the European tradition, for Māori this position renders them as subordinates of all other creatures in the natural world. This world view has two implications. Firstly, Māori are connected to all things within nature. This includes physical features, such as mountains, rivers, rocks, and land, as well as what is traditionally thought of as living things. For Māori everything has a life force, an essence or a mauri. Māori are bound to be continually respectful to those who have precedence, i.e. the rocks, the mountains, etc. that precede them in their genealogy.

Mātauranga Māori is defined as ‘Māori knowledge’, and is a term that places importance on Māori histories, knowledge, and language, and refers to Māori ways of thinking, doing, and acting (e.g. Smith 1990). It is a multi-faceted and complex concept that is connected to a multitude of sources of language, culture, land, customary and intellectual knowledge sources. Furthermore, mātauranga Māori bridges both traditional and contemporary Māori knowledge and philosophies through which Māori history and knowledge are uncompromisingly told. The platform of mātauranga Māori advocates for a system of Māori knowledge that recognises cultural identity and cultural affirmation as important foundations that are connected to Māori world views. Mātauranga Māori is a crucial element in chronicling perspectives, experiences and knowledge of specific landscape and volcanic events within iwi history in Aotearoa New Zealand. Information surrounding volcanic hazards exists within the mātauranga-ā-iwi (specific tribal knowledge), for Ngāti Rangi principally through waiata (song) and karakia (prayer). As a repository of cultural knowledge and information

over the generations of Ngāti Rangi existence, these examples provide the opportunity to review past events and provide a basis of knowledge to recover from future events.

At the time of the arrival of European explorers and traders, Māori may have numbered about 100,000 (citation Pool 1991). Māori numbers plummeted to around 42,000 in 1896, due to war and disease, before recovering in the early 20th century (Pool 1991). A large proportion of Māori land was alienated, often through land confiscations by the Crown, suspect land purchases, or as a result of debt accrued, in association with the Crown programme of converting customary titles to fit with the British land title system; this loss removed the economic base of the people and severed connections to traditional lands. Māori culture was severely affected through the imposition of European belief systems, practices, and laws. Despite that, iwi across New Zealand maintained cultural knowledge and connections to place. For Ngāti Rangi, this means chiefly or in part a connection to Ruapehu, their ancestral mountain and active volcano.

3.1 Māori and Hazards

There is limited literature on Māori and natural hazards within New Zealand. Few unpublished documents have provided further insight into the relationship that exists between iwi and the natural hazards present within their rohe (tribal area). Proctor (2010) explores how the principles of tikanga (traditional practices) can be applied to the management of natural hazards, particularly flooding in Pawarenga in Northland, New Zealand. Proctor (2010) found that tikanga was a valued resource used by locals and concluded that ‘tikanga Māori is an inherent part of ... resiliency’ (Proctor 2010).

King et al. (2007) and Lowe et al. (2002) are the few who have explored the relationships between iwi and natural hazards. They found that iwi and hapū (sub-tribe) hold a store of information throughout oral narratives such as

‘mōteatea (laments), pēpeha (quotations), whakatauki (proverbs) and waiata (songs)’ (King et al. 2007). These repositories of information not only tell stories but can contribute information on historical events and natural hazard occurrences to natural hazard management. King et al. (2007) outlines three specific ways that Māori environmental knowledge can be applied to natural hazard management: (1) as described previously, stories, songs and place names hold a wealth of knowledge based on experiences and recollections of events; (2) the information extracted from these avenues can thus be mapped in relation to natural hazards; and (3) it can also provide for Māori involvement in planning for hazards.

Most of the current volcanic based knowledge that exists in New Zealand is largely derived from the European context. Lowe et al. (2002) suggest that the lack of information is partly due to the late settlement of New Zealand by humans. Consequently, the recorded history of interactions between people and volcanism is short. There is a paucity of information that has been published on the actual experiences of early Māori prior to colonization; however, Lowe et al. (2002) assume that Māori must have experienced numerous volcanic events from many of New Zealand’s volcanic centers (Table 1).

3.2 Ngāti Rangī and “Their” Volcano

In terms of volcanoes, the Māori world view results in an approach where humans are connected through genealogy to mountains, and in particular for Ngāti Rangī they are descendants of Mount Ruapehu. To Ngāti Rangī Mt. Ruapehu is referred to as the grandfather. For Ngāti Rangī, specific connections to the maunga come through Te Rau-hā-moa and Paerangi. When Te Rau-hā-moa brought Paerangi to Aotearoa (New Zealand), the alighting of the bird ignited the fires waiting in Ruapehu, waking up the volcanic life of the mountain. Paerangi himself made the mountain his home, giving rise to one of the names of the mountain—Paerangi i te Whare Toka, or Paerangi of the House of Stone. Today, Ngāti Rangī numbers are at an estimated 8000 people (citation). Fifteen percent of those live in the tribal area (rohe) (Fig. 2), while the others live elsewhere in New Zealand and overseas. The iwi is supported by an iwi authority, Ngāti Rangī Trust, and guided by a tribal council representing all subtribes, Te Kāhui o Paerangi. The Trust is responsible for supporting the day to day work of the tribe, from social support programmes, to tribal events, to upholding the environmental responsibilities and cultural knowledge of the tribe.

Table 1 Volcanic hazards probably experienced or witnessed by prehistoric Māori

Hazard type	Volcano or centre associated with event
Pyroclastic fall	Taranaki, Tongariro, Whakaari, Auckland, Okataina
Pyroclastic flows	Tarakaki, Tongariro, Okataina
Pyroclastic surges	Okataina
Lava flows	Tongariro, Auckland, Okataina
Lava dome building	Taranaki, Tongariro, Okataina, Tuhua
Lahars	Taranaki, Tongariro
Post-eruptive flooding	Taranaki, Tongariro, Okataina
Debris avalanches	Taranaki, Tongariro, Whakaari
Volcanogenic earthquakes	Taranaki, Tongariro, Auckland, Okataina
Lightning, forest fires	Taranaki, Tongariro, Okataina
Hydrothermal eruptions	High-temp. geothermal systems in the Taupo volcanic zone (e.g. Ketetahi Springs)
Acidic rain/volcanic gases	Ruapehu, Tongariro

Adapted from Lowe et al. (2002)

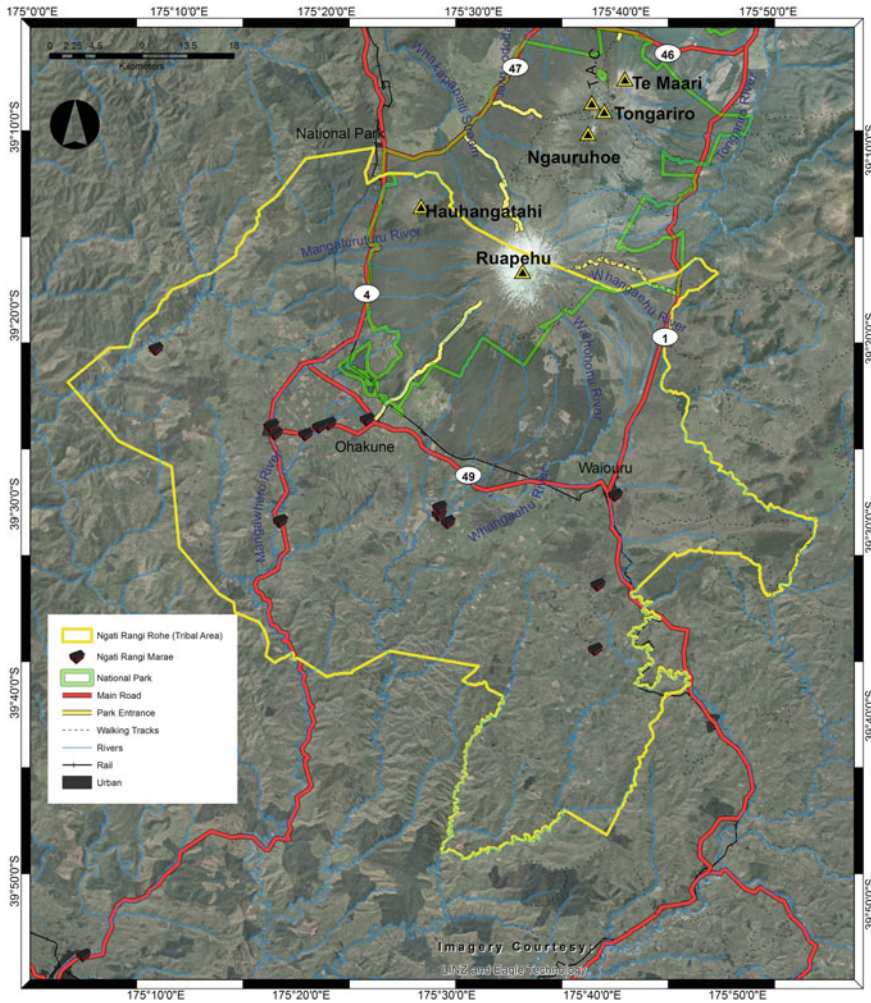


Fig. 2 Ngāti Rangi tribal area or rohe and the Tongariro Volcanic Centre including the location of Ngāti Rangi marae or traditional meeting house

For countless generations Ngāti Rangi have inhabited the southern flanks of Ruapehu (Fig. 2). They have born witness to his volcanic activity since human settlement in New Zealand. There are early written accounts of lahars within the Whangaehu River, one such by Reverend Richard Taylor (*as cited in Hodgson 1993*) who in 1861 reported uncharacteristic flooding within the Whangaehu River. Ngāti Rangi has within their oral narratives records of events, records by way of mōteatea (poetry, accounts of ancestors, ngeri (chants), karakia (prayer), and other forms of waiata (songs). For example, the waiata below

is from Ngāti Rangi and was written with reference to the eruption of 1945:

Moimoi Tahuārangī te pikinga i Tuhirangi
 Ka whakamau te hiwi ki Murimotu ee
 Kei tuahiwi taku rori haerenga ki roto Ōhāpopo
 Takoto whāroa ngā mānia ki Karioi ee
 Kia tū wātea taku titiro te puke ki Ruapehu
 Te whakaingo mai he tau pakipaki
 Papaki rawa i taku uma
He puke nohoanga nō te keukeu roa
 He roa te tāringa kia whakaaria mai ngā tohu
 tukutuku
Tukutahi te puehu turaki whakatua
Ka whakahoki mai hei tāpora mō te nohoanga ia
 koutou mā eei

The guardians cry as they ascend Tuhirangi
 And then continue on to Murimotu
 Over yonder is the path to Ōhāpopo
 Where the plains of Karioi open up
 So that I can clearly view Ruapehu
 Oh the majesty as I wait for a clear period of
 weather
 And his majesty also reminds
 That he originated from the great surges of the
 ocean
 I stand waiting for activity
 Behold! An eruption of ash.
 Do not fear, this ash will cloak and replenish the
 land and help us live as one.

The waiata is another example of traditional knowledge; waiata is a medium where large tracks of information are stored and repeated throughout the generations. Through this translation provided by Ngāti Rangi, the waiata (songs) relays a number of factors describing the iwi and their relationship with Ruapehu, and their reaction to volcanic activity. This has the potential to reveal the nature of the relationship between Ngāti Rangi and their ancestral maunga and the associated volcanic processes or hazards.

4 Ngāti Rangi Experiences

The communication of Ngāti Rangi perceptions of volcanic ‘hazards’ or mātauranga Māori (Maori knowledge) or mātauranga-ā-iwi (iwi knowledge) is articulated in their internal iwi korero (oral tradition; language), but also officially stated within their Ngāti Rangi Taiao Management Plan 2014, a management plan developed to address environmental issues within the Ngāti Rangi rohe or region (Gabrielsen 2014). Ngāti Rangi rejects the use of the term hazard when describing the consequence of volcanic activity (Rainforth et al. 2012; Gabrielsen 2014). The perspective is that it is a natural event that should not be restrained, diverted or withheld. This position is communicated throughout the generations and therefore is widely accepted throughout the iwi. This viewpoint is based on the acceptance of Matua te Mana (in general terms, the power and prestige associated with the volcano as an ancestor) and in a wider context, Rūaumoko, as natural entities

and processes involved in volcanic activity. A Ngāti Rangi pao, a very concise song usually sung for entertainment, describes Ruapehu in his eruptive state.

O rongo Ruapehu
 Turaki auahi
 Puahiri Whakarunga
 Ki whai tua ee

If you ever hear Ruapehu
 Erupting with ash
 You can be comforted knowing
 The prevailing wind takes it elsewhere.

Key words and phrases within this pao such as ‘puahiri whakarunga’ is a descriptive word for an eruption, ‘turaki auahi’ could also signify the visual experience of witnessing a plume of ash—‘auahi’ meaning smoke and ‘turaki’ to throw down. ‘Rongo’ could also represent reputation; the reputation or fame of Ruapehu, perhaps an indication of the perceptions and understanding of Ruapehu as a volcanic entity.

The Maori perceptions of the volcano as being an active, living entity provides a focus and a need for engagement with that entity on a practical level through the designation of tapu (sacred) areas in relation to the mountain. Practical measures such as exclusion areas or explicit prescriptions of behavior (i.e. not to stop in lahar channels when walking through) were put in place to signify the dangers and risks of places around the maunga, such as Te One Tapu and the kaitiaki (guardian) of the mountain that exist in this area known as Te Ririo and Takakā. Tapu is a belief, a notion that educates one to respect the natural world as ‘Māori things involve the whole of nature’ (Pewhairangi 1992).

In the past, Ngāti Rangi has taken advantage of the active nature of Ruapehu as a means to deliver specific kōrero (speech) and historical knowledge concerning volcanic activity. Despite the lull between periods of volcanic activity, there is a continuation of internal iwi knowledge sharing which extends throughout these periods of quiescence. There are a variety of techniques Ngāti Rangi use to share knowledge and historical experiences regarding the maunga, which is not always specific to volcanic activity. These are through wānanga (workshops) and rā wairua

(religious services or more specifically the Rā maramatanga—an annual event dedicated to the spiritual experiences of Ngāti Rangi). Knowledge and experiences are also transmitted via tikanga, iwi stories, karakia and waiata. The exchange of knowledge is also crucial to the understanding and sharing of cultural and scientific language on a bi-cultural level.

4.1 1945 Eruption

The eruption of 1945 had substantial impacts on the daily lives of those living at the foot of the mountain, largely revolving around ash and its resulting impacts: skin, eye and throat issues, crop failure, issues with stock feed, shearing blades dulling during shearing season, impacts on driving visibility and corrosive impacts on vehicles and machinery (Johnston 1997). A prominent Ngāti Rangi kuia recollected the eruption clearly '*we were covered in ash*' (pers comm. 2014). Johnston (1997) sourced 13 separate references of ash fall within Ohākune in 1945 from July through to September with the final date of ash fall occurring over a three-day period. The tribal account of this event is also captured within a waiata 'Moimoi Tahuarangi' which pays homage to the prestige of the mountain and the celebration of eruptive events. During this time, the relationship between the tribe and their mountain was not really recognized by authorities, and cultural use of the mountain was nil due to his state of tapu (sacredness) or exclusion areas were defined.

4.2 Tangiwai Disaster 1953

The Tangiwai railway disaster of 1953 (where a lahar removed a rail bridge across the channel moments before a train crossed killing 151 people) is long held within the memory of Ngāti Rangi and is potentially the most memorable lahar, due to the present elder generation being alive during this time. Many whānau (families) hold stories about this night, as many were scheduled to

travel on the train, and others had a local dance interrupted by news of the event. Many families also contributed to the cleanup of the awa post-disaster and for some time Ngāti Rangi did not visit the Whangāehu River for their cultural and spiritual purposes. A cultural a rāhui (period of prohibition) over the area was implemented by the iwi until a time when it was deemed culturally appropriate. The communication of this event was predominantly by word of mouth. As a result of this event, the New Zealand Railways Department installed a lahar warning device upstream of the Tangiwai Bridge in order to detect any future rise in river level and acidity in existing stream flow due to the introduction of Crater Lake water which could signal an alarm to halt railway traffic until inspection (Neall 1976).

4.3 1995/1996 Series of Eruptions

The 1995/1996 volcanic activity initiated internal discussions within Ngāti Rangi around historical iwi kōrero relating to volcanic activity. This period was integral for iwi revisiting local knowledge and perhaps gaining a more scientific understanding of volcanic activity. This again would have fortified the iwi and their relationship with their ancestral mountain. Notwithstanding this, activity still stimulated practical questions regarding the safety of the iwi marae, homes and infrastructure from volcanic flows (leading up to the 2007 lahar). Many prominent key Ngāti Rangi leaders had belief in their ancestral maunga that he would look after the iwi, which is resounded throughout the iwi. This also contributes to the trust in the experience of Ngāti Rangi tupuna (tribal ancestors) in the placement of marae in the rohe.

4.4 Consultation and Involvement Pre-2007 Lahar

The flow of communication between the Crown and Ngāti Rangi became an integral part of consultation following the 1995/1996 eruptions

due to the risk of an eminent Crater Lake dam break, which occurred on 18 March 2007. The consultation between Ngāti Rangi and the government (by way of the Department of Conservation, Minister of Conservation Sandra Lee and the Ministry of Civil Defence and Emergency Management) was viewed as successful. The success was due to the sharing of knowledge, communication and decision-making by Ngāti Rangi. Ngāti Rangi took a stance on the engineering solutions that were proposed and deemed them unacceptable on a cultural and spiritual level, as well as practically.

The position Ngāti Rangi held and still hold was that no intervention would be undertaken on the maunga when discussions turned to a proposed engineering solution at the Crater Lake. An alternative was chosen with the creation of a bund on an apex of the laharic fan or Te One Tapu in consultation with neighboring iwi and the Crown. Emergency management preparation was central to the lead up to the 2007 lahar. The local Karioi Forestry and the timber mill of Winstone Pulp International (WPI) participated in planning for the event as the Whangaehu River meanders through the forest and both of their industrial sites (Karioi and the Timbermill) are located within a 1–2 km vicinity to the Whangaehu River and the Tangiwai Bridge.

The community at Karioi was involved as part of preparatory measures to ensure the safety of the community as the lahar made its way past the Tirorangi Marae bridge. Two community meetings were held for the Karioi residents largely to discuss traffic safety measures and the movement of stock. Pagers were the main means of communicating instructions, timeframes and—monitoring the lahar flow. The main concern for the residents was the safety of the bridge, as the potential impact from its ruin would have resounding economic and social impacts. The local community was empowered through the process of consultation and heavy involvement in the response to the lahar.

4.5 Current Communication

The Ngāti Rangi Trust website provides users with direct links via the internet to a variety of current volcanic surveillance and monitoring tools of Ruapehu, which are:

- Links to GeoNet for current volcanic alert levels;
- Link to Horizon Regional Council's maunga camera;
- and The Ngāti Rangi installed Te Wai-ā-moe (Crater Lake, Ruapehu) camera, which feeds directly to the Trust.

High-level communication occurs at the top level, among research and monitoring institutes such as GNS Science and Massey University, local authorities such as Horizons Regional Council and Waikato Regional Council and Crown entities such as the Department of Conservation and the Ministry of Civil Defence and Emergency Management and the iwi authority, Ngāti Rangi Trust. Through these interactions active involvement in current monitoring of culturally significant sites has been initiated by the iwi and supported by these organisations. The iwi initiated monitoring of Te Wai-ā-moe, Whangaehu River and potentially Lake Rotokura in the near future. The ongoing dissemination of information through these high-level personnel is crucial.

5 Discussion

Tobin and Montz (1997) describe natural hazards as the possibility of interaction between natural events and humans. Therefore, based on this description, a natural hazard is described based on its potential to impact people and property. It is clear that the use of the term 'hazards' to describe a volcanic eruption and its resulting impact on surrounding populations by scientists

and emergency managers in New Zealand and internationally is a subject of contention for Ngāti Rangi. Their relationship with Ruapehu expresses their acceptance and understanding of him as a powerful being of nature and awareness of their place within nature and te ao Māori (the Maori world). This recognition and understanding of Ruapehu ultimately means that Ngāti Rangi people accept him as an active volcanic entity and celebrate and welcome his volcanic processes. Ruapehu is Matua te Mana, the guardian of mana (prestige/authority) who uses volcanic activity to share part of his mana with the people, and to replenish and revitalise the land and Ngāti Rangi.

Traditional practices and cultural traits have allowed iwi to endure within New Zealand. Maintaining aspects of their cultural and spiritual traditions and oral narratives have also aided the ability for iwi to adapt to external changes such as colonialism. Ulluwishewa et al. (2008) and Harmsworth and Awatere (2013) maintain that iwi hold a distinct worldview that guides their daily lives. This worldview can be described as an outlook that is heavily embedded in the past but merges with the present; a combination of traditional and modern concepts and beliefs. This worldview is often used as a basis for future decision-making and involves looking to the past to better plan for the future. The teachings of ancestors are prominent in this worldview. There remains a close connection with the local environment, which is representative of a link to the wider holistic aspect of whakapapa (simply defined as genealogy) and whānau (family). Iwi also take this focus on and reverence of their history and fuse it with modern lifestyles. Thus this worldview demonstrates a mixture of both modern and traditional aspects that represent iwi and the Māori culture.

Both Durie (2005) and Walker (2004) describe Māori resilience to natural hazards, more specifically as endurance. They both discuss the struggles of Māori throughout the colonisation phase and the later stages of growth within Aotearoa/New Zealand. Their work highlights the endurance of Māori to survive and adapt specific cultural traits and practices to

flourish and be present in this day and age within Aotearoa/New Zealand.

5.1 Traditional Knowledge as a Tool for Building Resilience

To adequately prepare for hazards specifically with indigenous communities, traditional knowledge should be used to provide a unique insight into information on historical events, as well as previous response methods. It has long been acknowledged that communities residing in hazard prone areas over a number of generations understand hazard processes, and potentially some previous methods of response towards hazards (Campbell 2009; Cashman and Cronin 2008; Cashman and Giordano 2008). Traditional knowledge and oral traditions, which derive from oral narratives (Cashman and Cronin 2008), are valuable tools that represent an awareness and understanding of the locality. They provide an account of historical methods used to avoid, mitigate or reduce the impacts associated with natural hazards. In Iceland, historical accounts of ash fall indicated the level of severity and the resulting impact on visibility (Bird and Gísladóttir 2012), therefore demonstrating for example, what work needs to be done prior to the lack of visibility setting in. These historical accounts can provide local communities with moral support. In the study by Bird and Gísladóttir (2012) one participant said: *'I just thought about the past, the stories. How good it was that we had heard the stories, I knew that it had happened again, I knew that it wouldn't last forever'* (Bird and Gísladóttir 2012, p. 1271).

Recounting those stories from Iceland outlined a natural hazard event, its impacts on the local communities, mitigation measures to undertake and perhaps some indication of its duration. Place names also hold some merit in indicating further insight into a location and its history (King et al. 2007), as representative of an event that left an imprint on the landscape and the people. In contrast, there is still a lack of understanding on the nature of the hazards in volcanic zones, as well as a real understanding of

all possible hazard types. In Java, Indonesia, Lavigne et al. (2008) identified that there was little to no actual understanding of volcanic processes; therefore the local population was not aware of the entire volcanic hazard types, their associated risks and more importantly the areas they impacted. This research highlights peoples' perceptions of risks and the importance of bringing into account the human dimension with regards to natural hazard management.

It has been heavily emphasised of late how imperative the human dimension is to natural hazard management (Bird et al. 2011). Understanding the interaction and relationship local communities have with the land may describe the continued existence of people in the vicinity of volcanoes. Lavigne et al. (2008) supports this view by noting the rise in research relating to the human dimension of natural hazard management and more specifically, the behaviour of people in the face of natural hazards. They outlined three significant areas to further understanding the human dimension of hazards and the reactions to natural hazard events: (1) the perception of risk, (2) cultural beliefs and (3) socio-economic constraints.

Individual and community perception of risk is based on a number of differing factors, such as the nature of the hazard, its frequency, duration, past experiences and exposure to the hazard. These factors do contribute to risk perception; however, the lack of understanding of volcanic processes, their low frequency and duration combined with limited or no exposure to past events despite living in an active volcanic zone all contribute to lower perception of risk regarding volcanic hazards. Hazard knowledge and risk perception of Katla by locals in Iceland demonstrated the results of hazard knowledge inherited from their forebears (Bird et al. 2009). This study indicated that exposure to and experience of volcanic hazards was discussed and recognised by the younger generation and contributed to their level of risk perception. Gregg et al. (2004) note that, in some cases, hazard awareness is not an indication of hazard knowledge and does not carry over to preparedness or responsiveness. Limited knowledge of the threat

that Kona in Hawai'i has on the local population is mirrored with the low level of preparedness at the individual level (Gregg et al. 2004).

The cultural belief system of the human dimension as described by Lavigne et al. (2008) focuses on the ties that individuals and communities have with their local environment. These cultural beliefs can often dictate the decisions of the individuals regarding their residence in these hazard zones, and can also act as an avenue to describe the events.

6 Conclusions

Ngāti Rangi have resided at the southern side of Ruapehu from time immemorial. Their exposure to volcanic activity throughout the generations has meant that they have adjusted their livelihoods and developed strategies and practices to live safely with a volcano. Subsequently, their traditional kainga and pā (traditional homes and fortified villages) are located in areas considered safe by the people. Ngāti Rangi are the human voice of their maunga, and they speak for him when needed but will watch and listen for the tohu (indicators) that will indicate to them their level of safety. Any precautionary measures against the potential impacts of volcanic activity and eruptions that involve alterations have the ability to distort their connection to their maunga. Therefore, Ngāti Rangi is adamant in their stance to protect Mt. Ruapehu against any human alteration. It goes against Iwi cultural constructs (or termed their tikanga) to demean the mana of Matua te Mana by altering his geomorphological nature. People chose to settle in areas along flood plains and along lahar channels, perhaps without prior knowledge and understanding of volcanic processes. People chose to position themselves on the landscape and therefore make the maunga and its natural processes hazardous. However, from the perspective of Ngāti Rangi, moving a mountain to protect their home is unacceptable; people should move their homes to protect the mountain. Finally, their belief is Ruapehu is their ancestor (tūpuna), their koroheke (most senior elder) and as such, he is the key to their cultural

identity, and history and the link to the realm of ngā atua through whakapapa. Matua te Mana provides strength to the iwi, who are strong in the belief that Ruapehu is a maunga and has the right to be able to erupt, shake, and express his emotions without restraint from humans.

The gap between western-scientific based hazard management/monitoring frameworks and mātauranga Māori adaption strategies can be bridged by determining mātauranga Māori-based cultural descriptors or indicators that are traditionally used to monitor volcanic hazards and plan for risk. Combined with the documentation of strategies of recovery/adaptation by Māori communities in volcanic landscapes utilising Māori researchers, Māori language/Te Reo and applying participatory research techniques, Ngāti Rangi has developed its own mitigation, response and recovery strategies to be applied in the future, alongside and in tandem with western-science based hazard management plans. The recognition and application of traditional knowledge and practices to act as a basis for future planning and decision making in volcanic emergencies will ultimately increase participation of the indigenous communities and contribute to increasing resilience of the community.

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Glossary

Māori Term Description

Ahi tipua Fire demons who brought volcanic activity to Aotearoa ‘Te Hoata’ and ‘Te Pupū’ according to Ngāti Tūwharetoa tradition

Ahi-kā-roa Burning fires of occupation

Aotearoa New Zealand

Atua Gods/deities

Hapū Sub-tribe

Haungaroa Sister to Ngātoroirangi (Ngātoroirangi—tohunga of the Te Arawa waka)

Hawaiiki The ancestral homeland of Māori

Iwi Tribe

Karakia Incantation/prayer

Kawa Protocols

Kōrero Speakspeech, narrative

Koroua Elder/grandfather

Kuiwai Sister to Ngātoroirangi

Mana Prestige/authority

Marae Term used to describe the traditional meeting house and entire complex of Māori

Mauri Life force

Mouri See ‘Mauri’

Ngā atua ‘The gods’ but refers to the gods in Te Ao Māori (the Maori World)

Ngāti Turumakina Hapū of Ngāti Tūwharetoa

Ngāti Tūwharetoa Iwi in the central North Island/New Zealand, of the Te Arawa Waka

Ngauruhoe Mountain of the central North Island

Paerangi-i-te-Whare-Toka Paerangi’s house of stone (Paerangi—the eponymous ancestor of Ngāti Rangi)

Papatūānuku Earth mother

Pareitaitonga Shelter from the southern winds. Peak on Ruapehu

Pēpeha Proverb

Ranginui Sky father

Ritenga Customs

Ruapehu Mountain of the central North Island

Rūaumoko God of earthquakes

Tane Mahuta Son of Rangi and Papa/God of the Forest

Tangata Whenua People of the land

Tangihanga Funeral

Tapu Sacred

Tawhirimatea God of the Wind
Te Ao Marama The world of light
Te Arawa Waka and iwi of the Bay of Plenty
Te Ika ā Māui The big fish of Māui (also known as the North Island of New Zealand)
Te kore Nothingness energy, the void
Te po The night
Te reo Māori The Māori language
Te Wai-ā-moe Ruapehu's Crater Lake
Tikanga Customs
Tohu Signs
Tohunga Spiritual leader
Tongariro Mountain of the central North Island
Tupuna Ancestor (Tūpuna = Ancestors)
Tūrangawaewae Place to stand
Uri Descendants
Waiata Songs
Waka Canoe or rather, the large double hulled waka that journeyed from Hawaiiki to Aotearoa
Wānanga Specific gathering devoted to learning and sharing knowledge
Whakapapa Genealogy (simple translation)
Whānau Family
Wharepuni Meeting house of a marae
Whenua Land

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