It's the Lagoon!
Using the Mauri Model to Understand the Impacts of Natural and Anthropogenic Changes to Te Awa o Te Atua Lagoon in Matata, New Zealand Over the Past Century

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Abstract
Te Awa o Te Atua Lagoon has been subject to intense anthropogenic and natural pressures over the past century. The impact of these changes to the lagoon was assessed using indigenous knowledge; the Mauri Model was used to quantify mauri (the life force) of the lagoon at four formative points: before drainage of the Rangitaiki Plains, after drainage, after the 2005 debris flow, and present day. The mauri of the lagoon was found to be seriously depleted, with the separation of the lagoon from the Tarawera River having the most negative impact on the lagoon's life force. Throughout time, environmental and cultural wellbeing have been the most compromised, while economic wellbeing has displayed the most resilience to natural and anthropogenic pressures. This mauri analysis was performed on behalf of Ngati Rangitihi, the kaitiaki (guardians) of the lagoon, to provide direction for a recovery plan for Te Awa o Te Atua.

Key Words: Kaitiaki; mauri; Mauri Model; science and indigenous knowledge; Te Awa o Te Atua Lagoon

Introduction

Indigenous knowledge, which has the potential to enhance our understanding of our landscapes, is a resource often left untapped by scientific research. As indigenous understanding of ecosystems draws from a large knowledge base of information accumulated over many generations, it has the potential to inform, and complement, scientific inquires based on strictly empirical data (Gadgil et al., 1993). In recent decades, such indigenous knowledge has been termed "Traditional Ecological Knowledge"—TEK (Huntington, 2000). Although TEK has been successfully integrated into impact assessments and ecological inquires on local scales, its wider use has been hindered, in part, by difficulties in describing TEK in Western scientific terms (Huntington, 2000).

In the New Zealand context, the wisdom of the indigenous people—the Maori—is termed matauranga. The Maori understanding of the environment has been incorporated into scientific undertakings through the use of the Mauri Model, which offers a means of quantifying TEK (Morgan, 2006). Mauri is a prominent concept in Maori thinking, as it refers to the life force of

an entity (Morgan, 2006). It is the attraction, or binding force, between the physical and the spiritual (Barlow, 1991). Without this attraction, livings things die and inanimate entities (e.g., soil) lose their ability to support life (Morgan, 2006). It thus follows that mauri is important to protect, because without mauri, there is no life. The Mauri Model allows this concept to be quantified and incorporated into scientific research, such as impact analyses (e.g. Hikuroa et al., 2011).

One such analysis was performed on the Te Awa o Te Atua lagoon in Matata, Western Bay of Plenty, North Island, New Zealand (Figure 1). The lagoon is a site of great cultural importance to the local Maori population. Once composed of the estuarial waters of the Tarawera and Rangitaiki Rivers, today Te Awa o Te Atua has been cut off from all water inputs; its once pure and productive waters have been stagnated and polluted. Anthropogenic pressures, compounded by natural processes, have lead to these drastic changes over the past century. Camp (2010) performed an abbreviated mauri assessment which indicated that these changes had significantly depleted the mauri of Te Awa o Te Atua, but that the life force could be slowly recovering. The local iwi, Ngati Rangitihi, requested a more robust mauri analysis to illuminate how the mauri of the lagoon has been impacted over time. As kaitiaki—guardians—of Te Awa o Te Atua, they felt they could not heal the harm inflicted in the past century without a more complete understanding of the lagoon's mauri.

Figure 1. Map of Bay of Plenty. Te Awa o Te Atua Lagoon is located on the coast in Matata. (NZ Accommodation Online)

This project expands on the work of Camp (2010) by conducting a complete mauri assessment of Te Awa o Te Atua. The assessment aimed to provide Ngati Rangitihi with a better understanding of both (1) the current status of the lagoon, and (2) the resilience of the lagoon to different pressures over time; the analysis will aid the iwi as they develop a recovery plan, respond to resource consent applications, and continue to serve as kaitiaki. The Mauri Model was used to quantify mauri at four formative points in the lagoon's history. The trends found matched predictions, with mauri declining dramatically after the diversion of its feed waters and showing some recovery in recent years. The assessment indicated that the management of the lagoon thus far has not reflected the priorities of Ngati Rangitihi, with economic interests being better protected than environmental, cultural, and social considerations.

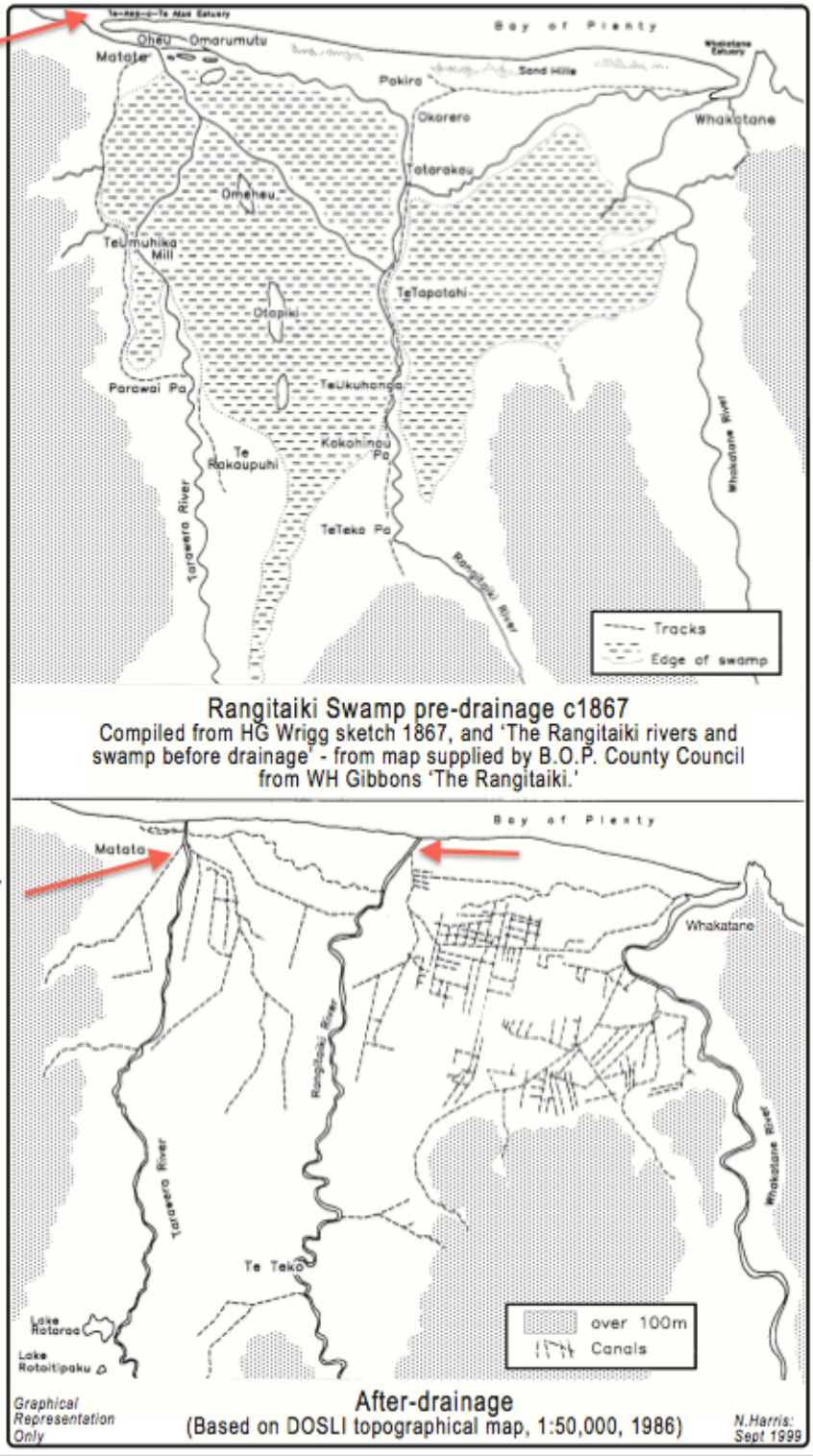
Background

The Te Awa o Te Atua lagoon is located in the Rangitaiki Plains, near the town of Matata, in the Bay of Plenty, North Island, New Zealand (Figure 1). The lagoon is part of the Matata Wildlife Reserve established by the Department of Conservation, which extends from the mouth of the Tarawera River to the Matata Township (DOC, 2010). The lagoon is part of a unique land-wetland-open water ecosystem, and is recognized as having high wildlife habitat value (DOC, 2010). The lagoon is considered to be "extremely important form an ornithological point of view," as it provides ample food sources, roosting sites, and access to the sea for a variety of birds (Bioresearchers Ltd., 1976, p. 6).

Three iwi, Ngati Rangitihi, Ngati Tuwharetoa, and Ngati Awa, have sacred lands in the region surrounding Te Awa o Te Atua. The lagoon's significance stems in part from events associated with the lagoon, as well as cultural traditions that make use of its waters. The battle of Te Kaokaoroa occurred near Te Awa o Te Atua (Te Mana o Ngati Rangitihi Trust [TMNRT], 2009). An urupa (burial ground) for the fallen was constructed at the battle site, giving the lagoon great spiritual importance (Hikuroa, 2013). Furthermore, the lagoon and its connection to the Tarawera River provided Ngati Rangitihi with a link to their mountain, Mount Tarawera; the spiritual connection of Ngati Rangitihi with their mountain was reflected in the connectivity of the landscape. The connection of the lagoon and its estuaries is described in a korero (story) about the wheke, octopus; the octopus's head forms Te Awa o Te Atua, while its eight tentacles form the rivers of the Rangitaiki Plains.

Te Awa o Te Atua also draws cultural and social meaning from its utility; historically, the lagoon provided safe transportation (calm waters compared to sea-routes), food (mahinga kai), as well as bathing and recreation waters (TMNRT, 2009; Hikuroa, 2013). Matata used to have a port on Te Awa o Te Atua, bringing economic activity to the region. Additionally, the lagoon enhances quality of life for Matata residents through its aesthetic value (DOC, 2010). Unfortunately, the lagoon has undergone many changes—both natural and anthropogenic—in the past century. Three events were particularly devastating to lagoon health: (1) the diversion of the Tarawera River, (2) releasing of pulp and paper waste into the feed-waters of the lagoon, and (3) a debris flow in 2005.

In 1917 the Tarawera River, which feeds Te Awa o Te Atua, was rerouted by the Ministry of Works to help drain the Rangitaiki Plains and create new land for agriculture (DOC, 2010). This diversion both prevents the waters of the Tarawera and Rangitaiki Rivers from meeting and severs their connection with Te Awa o Te Atua, changing the once life-rich estuary into an enclosed lagoon (Figure 2). Furthermore, this has broken Ngati Rangitihi's connection to their mountain.



new river routes

Figure 2. Rangitaiki Plains Pre (top) and Post (bottom) Drainage. Annotations added by author. (Waitangi Tribunal, 1999)

Without the natural inflow of water, sediments rapidly accumulated in the lagoon. These new conditions were not suitable for many of the animals previously living in Te Awa o Te Atua; the once abundant food source, the mahinga kai, was seriously impacted. The pa tuna (eel) population was

particularly hard hit (Gibbons, 1990; TMNRT, 2009). Furthermore, the rerouting of the Tarawera River elevated levels of erosion along the eastern side of the channel, jeopardizing the sacred urupa (TMNRT, 2009).

Another anthropogenic impact on the lagoon came from the Tasman Pulp and Paper Mill, established in the 1950s. For years the plant's industrial waste, including chemicals and wood fiber, was carried down the Tarawera from Kawerou to Matata; over the years, a variety of pollutants (including carcinogenic dioxins) have settled in the stagnant water and are now present in the sediment of the lagoon (TMNRT, 2009; DOC, 2010). The dioxins in the lagoon exceed standards set by the Canadian Interim Sediment Quality Guidelines for aquatic ecosystems (Dempsey, 2009). The pollution further harmed the wildlife in the region, as the toxins tainted the small populations of kai remaining in the drainage (TMNRT, 2009).

These toxic sediments from Tasman Pulp and Paper Mill were covered with new fine sediments in 2005, when a great debris flow poured into Te Awa o Te Atua via the Awatarariki and Waitepuru Streams. The sediments did not impact the lagoon symmetrically; the eastern portion of the lagoon was left relatively unharmed by the flow, while the western portion was completely in-filled by debris and silt (Figure 3) (DOC, 2010).

Figure 3. Sedimentation in the western lagoon after the debris flow in 2005 (Smith, 2010).

The debris destroyed habitat for marsh birds, as it covered the raupo reed and *Carex* sedge lands in the western lagoon (DOC, 2010). The siltation of the lagoon also displaced many of the area's water birds (DOC, 2010). This siltation, infilling, and a lowering of the lagoon's water level necessitated an excavation (DOC, 2010). Remediation efforts have also included planting programs, which are attempting to restore native vegetation to the lagoon and mitigate contamination issues (Dempsey, 2009).

Methods

The mauri of Te Awa o Te Atua was quantified using the Mauri Model, analyzing the cultural, social, economic, and environmental status of the lagoon at four different times (Morgan, 2006). The analysis was based on literature review and correspondence with the Environmental Manager of Te Mana o Ngati Rangitihi Trust, Kura Paul-Burke. She relayed information passed on from other members on the iwi regarding koreros, the cultural significance of the lagoon, and how the use of the lagoon has changed over time. Speaking directly with members of the iwi allowed matauranga to be integrated into the impact assessment

After conducting the interviews, the mauri of the lagoon was assessed using the Mauri Model, as developed by Dr. Kepa Morgan (2006). Specific indicators of lagoon health were identified and the sorted into environmental, economic, social, and cultural categories. After selection, the indicators were approved by the Environment Committee of Te Mana o Ngati Rangitihi to ensure they were comprehensive. Each indicator was then scored on a scale -2 to +2. In this value scale, -2 indicates that the mauri has been fully depleted, while +2 indicates that the mauri is at its full state. -1 and +1 indicate partial changes in mauri (negative and positive, respectively). A zero indicates no change in mauri, or that the indicator is not relevant at that time period (Figure 4) (Morgan, 2006).

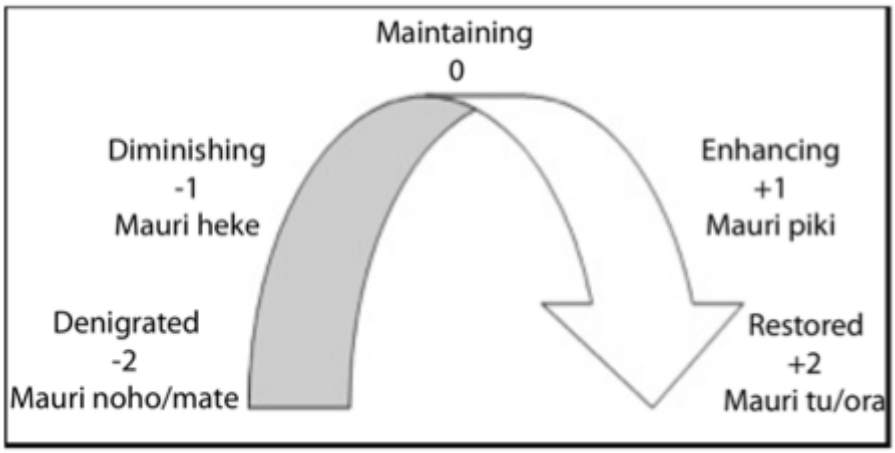


Figure 4. Graphical representation of the mauri scale (Hikuroa et al, 2011)

After performing the mauri assessment, the worldview of Ngati Rangihiti was determined using an Analytic Hierarchy Process (AHP). The AHP asked Ms. Paul-Burke, representing Ngati Rangihiti, to rank the relative importance of the four dimensions of mauri—environmental, cultural, social, and economic. Each dimension was rated as more or less important in pair-wise comparisons using the scale shown in Figure 5.

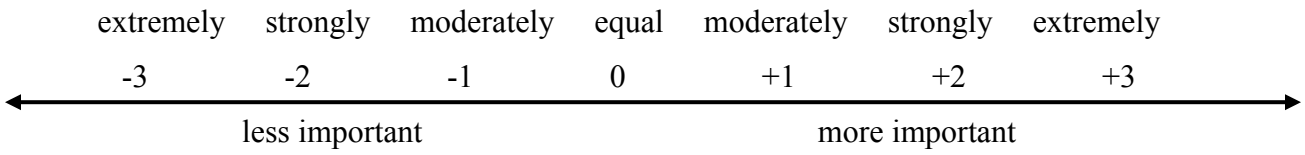


Figure 5. Representation of AHP/Worldview Assessment Scale.

Scores were then normalized and each dimension was given a weighting. These weights were the applied to each indicator score to portray the bias/worldview of Ngati Rangihiti (see Appendix). Following the methodology of Camp (2010), the indicators were scored at four different time periods: (1) before the 1917 rerouting of the Tarawera River, (2) post-rerouting, (3) post-2005 debris flow, (4) present day. After rating each indicator, an average mauri value was calculated for each time period.

Indicators

Environmental Indicators

- Physical separation of lagoon from its feed waters.
- Ecosystem health. Referring to pa tuna and avian life, as well as vegetation.
- Anthropogenic contaminants. Primarily the industrial waste from Tasman Pulp and Paper Mill.
- Sedimentation. Including impact from sand dunes and the 2005 debris flow.

Cultural Indicators

- Mahinga kai. Referring to the lagoon as a food rich land, with a particular abundance of eel.
- Urupa (sacred lands). Burial site for the battle of Te Kaokaoroa.
- Link to Mount Tarawera. Connection of Ngati Rangitihi to their mountain, represented by the connectivity of the landscape.
- Wheke. Korero of the octopus explaining the many tributaries on the Rangitaiki Plains, with Te Awa o Te Atua as the octopus's head.

Social Indicators

- Aesthetic quality.
- Recreation. Including swimming, fishing, gatherings.

- Transportation. Historic canoe use, throughway for many people.
- Feeling of helplessness. Arose in the iwi after their lands were manipulated and degraded without their consultation.

Economic Indicators

- Food costs. Loss of mahinga kai.
- Transportation. Must use alternate means.
- Local economy. Including commerce associated with the Matata Port and agricultural opportunities.
- Local employment. Including jobs associated with the port, agricultural, and restoration.

Results

The mauri assessment for each indicator is shown in Table 1 below. The AHP for Ngati Rangihiti revealed environmental, social, and cultural mauri to be of equal importance. Economic mauri was rated as 'moderately' less importance than the other three dimensions (see Appendix).

Table 1. List of Indicators and Mauri Assessment

	Indicator	Pre-drainage (1910)	Post-drainage (1925)	Post-debris Flow (2005)	Present Day (2013)
Environmental	Physical connection	2	-2	-2	-2
	Ecosystem health	2	-1	-2	1
	Anthropogenic contaminants	0	-1	-1	-1
	Sedimentation	2	-1	-2	-1
Cultural	Mahinga kai (food)	2	-2	-2	-1
	Urupa (sacred lands)	2	-1	-1	-1
	Link to Mount Tarawera	2	-2	-2	-2
	Wheke (identity)	2	-1	-1	-1
Social	Aesthetic quality	2	-1	-2	1
	Recreation	2	-1	-2	1
	Transportation	2	-1	-2	-1
	Feeling of helplessness	2	-1	-1	-1
Economic	Food costs	1	-1	-1	-1
	Transportation costs	2	-1	-1	-1
	Local employment	1	1	1	1
	Local economy	2	1	-1	1
	Mauri Assessment (without weighting)	1.75	-1.06	-1.38	-0.63
	Mauri Assessment (with weighting)	1.60	-1.01	-1.32	-0.63

Figure 6 shows the change in average mauri of Te Awa o Te Atua over the past century. Mauri was strongest before the rerouting of the Tarawera River, and since rerouting mauri has remained below 0. Overall, the draining of the Rangitaiki Plains reduced the mauri of Te Awa o Te Atua by -2.61. The debris flow diminished mauri by only -0.31. Mauri shows a positive trend in recent years, with mauri increasing +0.69.

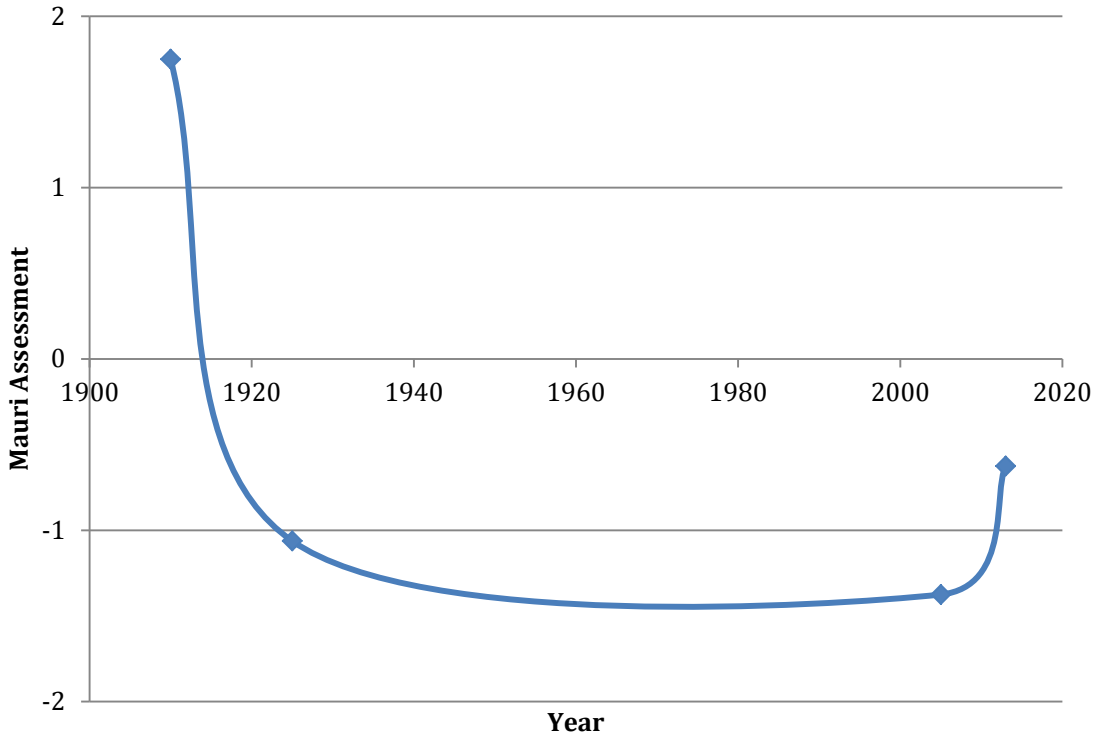


Figure 6. Average mauri of Te Awa o Te Atua from 1910-2013.

An analysis of the individual dimensions of mauri revealed more specific impacts of natural and anthropogenic changes to the lagoon. Before rerouting, every dimension was at mauri ora, full mauri, except economic mauri (Figure 7). This is because flooding of the Rangitaiki Plains negatively impacted farming operations in Matata, leading to -1 scores in local employment and food costs. Despite starting with the lowest value, economic mauri currently has the highest mauri, along with social mauri. Environmental and cultural mauri, two dimensions of the most importance to Ngati Rangitihi, have not increased substantially since rerouting.

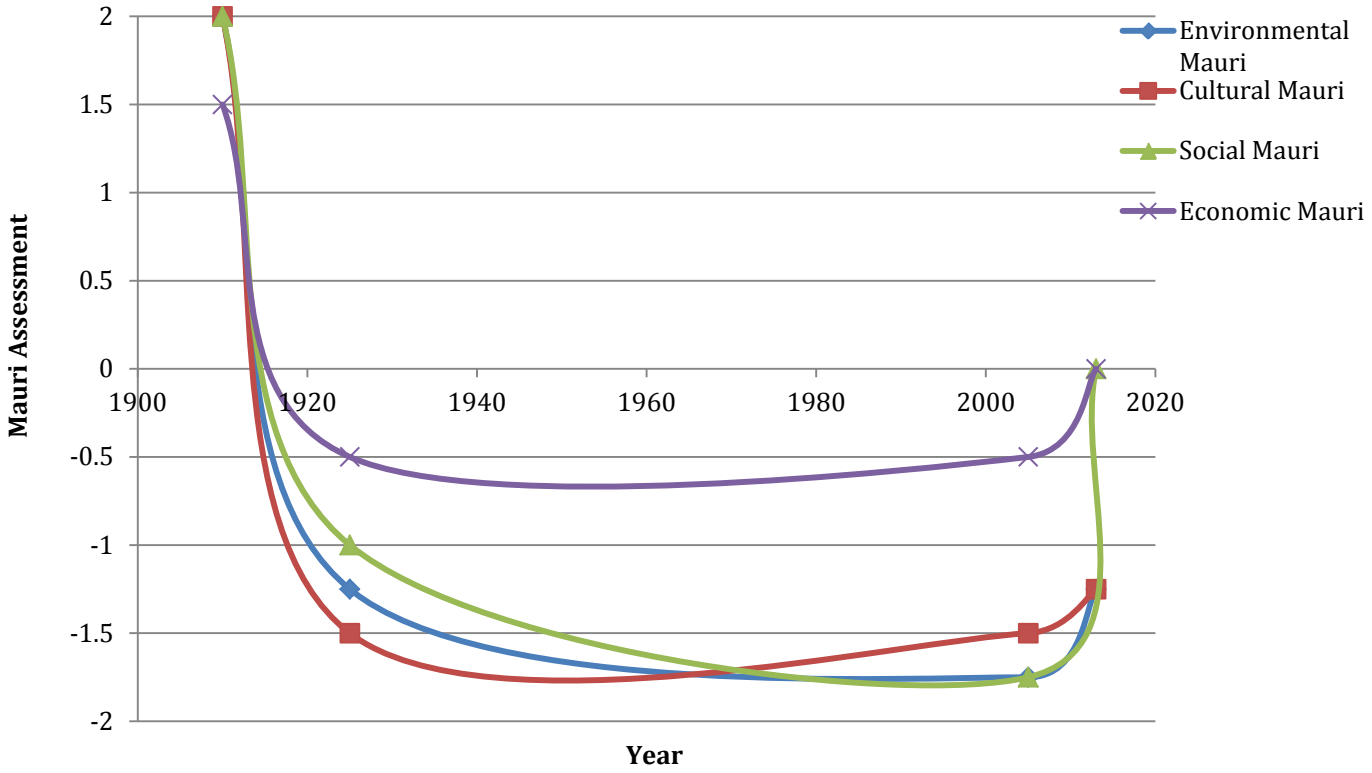


Figure 7. Average mauri value for each dimension evaluated at Te Awa o Te Atua, from 1910-2013.

Discussion

The Mauri Model Analysis indicates that the mauri of Te Awa o Te Atua has changed greatly over the past century. Mauri was severely depleted by both the rerouting of the Tarawera River and the debris flow in 2005. However, draining of the Rangitaiki Plains had a much more serious impact on mauri than the 2005 debris flow, reducing mauri by 8x as much as the debris flow; this implies that anthropogenic changes to the lagoon, rather than natural pressures, have been the most serious issue for Te Awa o Te Atua throughout time. This result is not surprising, as environments have been long adapted to deal with natural pressures, while anthropogenic changes, especially on the scale of the Rangitaiki Plains drainage, are often out of harmony with the earth system. As hypothesized, mauri has recovered somewhat since the debris flow, although it remains far below mauri ora. These trends mimic those seen by Camp (2010).

The partial recovery of mauri since the debris flow indicates that restoration efforts were somewhat effective, although not all dimensions of mauri were equally addressed. Social mauri showed the most notable recovery, as removing the sediment from the lagoon greatly improved both aesthetic quality and recreation opportunities (Figure 7). On the other hand, restoration did little to improve environmental and cultural mauri. These two dimensions, the priorities of Ngati Rangitihi, were the most negatively impacted by rerouting and still show the lowest state

of mauri today. In contrast to this, economic mauri, the lowest priority of Ngati Rangitihi, has been the most resilient to natural and anthropogenic pressures over the past century.

These results have important implications regarding the management of the lagoon. The current restoration efforts do not address the dimensions of Te Awa o Te Atua that are most important to Ngati Rangitihi. Cultural and environmental mauri have been neglected, showing minimal improvement since rerouting occurred in 1925. The analysis indicates that the mauri of the lagoon will not be able to fully recover unless the estuary ecosystem is restored, thereby connecting Te Awa o Te Atua to its feed waters and connecting Ngati Rangitihi to their land. The devastating impact of the rerouting of the Tarawera River is reflected in this quote from a member of the Environment Committee of Ngati Rangitihi: "The lagoon has been dead to the community since the River was redirected. It is an environmental catastrophe that has been swept under the carpet" (Paul-Burke, 2013). In this way, the Mauri Model has helped identify a divergence in the viewpoints of the DOC and local iwi. Recovery after the 2005 debris flow was focused on returning Te Awa o Te Atua to its pre-debris flow state, to a wetland ecosystem. This reflects DOCs worldview, as their baseline for lagoon health takes the rerouting of the Tarawera as a given. On the other hand, Ngati Rangitihi's baseline for the lagoon lays pre-drainage, when Te Awa o Te Atua was an estuarine system. The draining of the Rangitaiki Plains severed both physical and cultural connections, and mauri cannot be fully restored until these connections are rebuilt. This has huge implications for future restoration efforts, as it implies that re-establishing Te Awa o Te Atua as an estuary ecosystem is vital for the mauri of the lagoon.

The mauri assessment used in this research may be useful as a measure of the health of the lagoon in the future, both for impact assessments and evaluation of future restoration efforts. Re-assessing the mauri of Te Awa o Te Atua as restoration continues is essential to ensure the life force of the lagoon is maximized. Remediation projects should make an effort to address the environmental and cultural indicators of lagoon health, as they have been the most depleted. Addressing the contaminants from Tasman Pulp and Paper Mill may be an important first step, as it would improve both ecosystem health and mahinga kai populations, thereby addressing environmental and cultural needs.

To maximize the utility of the model, further research should be done to address limitations of this study. Identification of additional indicators, perhaps through additional

interviews members of Ngati Rangitihi, would provide further insight into the issues preventing the recovery of the lagoon's mauri. Additionally, future analyses should score mauri at more than four time periods; it may particularly helpful to include assessments in the mid-twentieth century, after rerouting (1925) and before the debris flow (2005). An assessment of the mauri of the lagoon immediately before the debris flow should be included, as it would allow the impact of the debris flow alone to be better teased apart from other influences. The impact of the debris flow may have been partially masked in the current analysis by the intense depletion of mauri associated with the rerouting of the Tarawera River. Furthermore, empirical data should be used to corroborate mauri-o-meter scores where appropriate; this may be particularly useful in determining scores for economic and environmental dimensions. Use of empirical data would provide objective support for mauri-o-meter scores as well as furthering the incorporation of indigenous knowledge with Western scientific undertakings.

Conclusion

This research aimed to use indigenous knowledge to assess changes to the health of Te Awa o Te Atua lagoon over the past century. Mauri was used as a measure of lagoon health, and was quantified using the Mauri Model (Morgan, 2006). Mauri was analyzed at four formative points in the lagoon's history: before rerouting of the Tarawera River, post-rerouting, post debris flow, and present day. By quantifying how the mauri of the lagoon has changed over the past century, this project aimed to provide Ngati Rangitihi, an iwi to whom Te Awa o Te Atua holds great significance, with information to help develop a recovery plan.

The analysis revealed that after a century of change, the mauri of Te Awa o Te Atua has been severely diminished. The rerouting of the Tarawera River was the most damaging event to the mauri of the lagoon in the past 100 years, and the lagoon has only made minimal improvements since 1925. The impacts of the 2005 debris flow have been somewhat mediated by restoration efforts; however, mauri of the lagoon remains below 0 in present day. Economic wellbeing has been the most resilient to anthropogenic and natural pressures, while environmental and cultural wellbeing have suffered greatly. Future restoration efforts should prioritize the environmental and cultural dimensions of mauri, as they have been largely neglected over the past century and are of great import to Ngati Rangitihi.

The indicators identified and the mauri assessment performed in this research can be used in the future to monitor the mauri of the lagoon and assess the effectiveness of recovery measures. Additionally, it may be useful resource for Te Mana o Ngati Rangitihi as the trust evaluates resource consent applications; the quantitative nature of the Mauri Model may help Ngati Rangitihi communicate their concerns to those less familiar with the concept of mauri. In this way, indigenous knowledge can be incorporated into decision-making and future scientific studies. By revealing the fluctuation of mauri over the past century, this research hopes to have aided Ngati Rangithi in their role of kaitiaki of this important cultural site by providing a means of understanding, and a method of communicating, the current health of their lagoon. Lastly, by using Maori knowledge as the basis of this impact assessment, this research hopes to promote the use of indigenous knowledge in scientific inquiry.

References

Barlow, C. (1991). *Tikanga Mori*. Oxford University Press: Auckland.

Bioresearchers Ltd. (1976). *Ecology of Matata Lagoon*. Bioresearchers Ltd.: Bay of Plenty.

Camp, E. (2010). *Documenting the Natural and Anthropogenic Changes to Te Awa o Te Atua During the Past 100 Years*. University of Auckland.

Dempsey, B. (2009). Planting Day a Huge Success at Te Awa o Te Atua Lagoon. *Matata Project News, 58*.

Department of Conservation (2010). *Report on Debris Flood Recovery and Rehabilitation of Matata Wildlife Refuge Reserve (Te Awa O Te Atua Lagoon)*. DOC, East Coast Bay of Plenty Conservancy: Rotorua.

Gadgil, M., Berkes F., Folke C. (1993). Indigenous knowledge for biodiversity conservation. *Ambio*, *22*(2/3), 151-156.

Gibbons, W. (1990) *The Rangitaiki 1890-1990: Settlement and drainage on the Rangitaiki*. Whakatane & District Historical Society: Whakatane.

Hikuroa, D. (2013, February 11). Background Information on Te Awa o Te Atua (J. Clark, Interviewer).

Hikuroa, D., Slade, A., & Gravley, D. (2011). Implementing Maori indigenous knowledge (matauranga) in scientific paradigm: Restoring mauri to Te Kete Poutama. *Mai Review, 3*.

Huntington, H. (2000). Using traditional ecological knowledge in science: Methods and applications. *Ecological Applications*, *10*(5), 1270-1274.

Morgan, T.K.K.B. (2006). Decision-support tools and the indigenous paradigm. *Engineering Sustainability, 159*, 169-177.

Paul-Burke, K. (2013, June). Personal Communication (J. Clark, Interviewer).

Te Mana o Ngati Rangithi Trust (2009). *Nga ra o mua – Our history*. Retrieved April 12, 2013, from Te Mana o Ngati Rangitihi Trust: http://www.ngatirangitihi.iwi.nz/history.html

Figure References

Hikuroa, D., Slade, A., & Gravley, D. (2011). Implementing Maori indigenous knowledge (matauranga) in scientific paradigm: Restoring mauri to Te Kete Poutama. *Mai Review, 3*.

New Zealand Accommodation Online. *Bay of Plenty Map*. Retrieved February 25, 2013, from New Zealand Accommodation Online: http://www.nzaccommodationonline.com/new_zealand/map/index.jsp?showMap=BayOfPlenty.

Smith, I. (2010). Figure 1. In DOC (2010). *Report on Debris Flood Recovery and Rehabilitation of Matata Wildlife Refuge Reserve (Te Awa O Te Atua Lagoon)*. DOC, East Coast Bay of Plenty Conservancy: Rotorua.

Waitangi Tribunal (1999). *The Ngati Awa Raupatu Report*. Wellington, NZ: Legislation Direction.

Author Notes

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Appendix

Analytical Hierarchy Process/Worldview Assessment

Normalization:
After rating each dimension on the -3 to + 3 scale, scores are normalized.
The weighting can then be expressed as a percentage: $\frac{\sum \text{row} + 9}{36} \times 100 = \text{weighting}.$

Table 2. Analytical Hierarchy Process Worldview Assessment for Ngati Rangitihi

Dimension	Environmental	Cultural	Social	Economic	Normalization (sum + 9)	Weight (%)
Environmental	0	0	0	1	10	27.8
Cultural	0	0	0	1	10	27.8
Social	0	0	0	1	10	27.8
Economic	-1	-1	-1	0	6	16.6