



NZASE
resource

Regenerating Papatūānuku

Testing soil fertility.
Photo: Agrisea.

Science Communicator Mike Stone (Ngāti Pākehā) starts an investigation into caring for whenua (land) using a Te Ao Māori understanding of principles based on mātauranga Māori.

Te ao Māori on land and soil

Te toto o te tangata he kai, te oranga o te tangata, he whenua, he oneone. (While food provides the blood in our veins, our health is drawn from the land and soils.)

Māori whakapapa links people to each other and to the taiao. Māori descend from the primordial parents, Ranginui (Sky Father) and Papatūānuku (Earth Mother) to the present generations where all land, people, and ecosystems (down to microbes) are connected through ancestral relationships.

These connections are often recited through pepeha which relate people to their ancestral lands, such as their mountains, lakes, rivers, and seas. These give people a sense of identity, connection, and mana.

Whakapapa also gives Māori responsibilities of kaitiakitanga. In this role as kaitiaki it is important to care for the environment and sustain resources through explicit actions and practices based on tikanga and kawa.

Manaaki Whenua Landcare Research (MWLR) scientist and Toi Rangahau Garth Harmsworth (Te Arawa, Ngāti Tūwharetoa, Ngāti Raukawa) has a good understanding of soil health from a te ao Māori perspective.

He says Māori have been growing food crops here for centuries, and have built up a deep knowledge of the land. Ngā kupu that describe and differentiate soils number over 100, highlighting the best soils for certain uses.

Garth says that Māori regard a healthy soil as one “capable of supporting, maintaining, and enhancing life and well-being” through “maintaining and enhancing the mana, mauri and wairua” of its essential qualities and components. Other core indigenous values integral to understanding soil health include taonga tuku iho and tau utuutu, as well as kaitiakitanga. Soil management based on mātauranga Māori values and principles can include –

- Giving land a rest from intensive agricultural use through rotation
- Mulching with natural compost; eg, animal manure, seaweeds, food scraps, dead plants
- Using minimum tillage
- Adding sand, gravel and stones to improve soil moisture levels, aeration and stability
- Suppressing weeds
- Reducing artificial pesticides and fertilisers
- Planting diverse species to improve soil biodiversity
- Using maramataka to guide the timing of practices; eg, planting, cultivating, harvesting
- Embedding wairua into all practices; eg, using karakia, kawa, and tikanga.

Researching these practices

Oriwa Tamahou (Tūhoe, Tainui) and Naomi Aporo (Ngāti Kahungunu ki Wairarapa) work for AgResearch, incorporating

Māori soil and cropping terms			
Oneone	General name for soil	Maara kai	Gardens
Kenepuru	Sandy silt	Paru	Mud
Keretū	Heavy clay soil	Kīrea	Land exhausted by frequent cropping
Onepū	Sand	Koraha	Infertile, barren land
Onemata	Dark fertile soil	Mōmona	Rich fertile land, in good condition
Parakiwai	Silt, sediment	<i>Links to Te Ara Maori Dictionary</i>	



NZASE

New Zealand Association of Science Educators

Representing the needs of science teachers

principles of mātauranga Māori into their approach.

Oriwa sees some practical applications of this role as kaitiaki. “I look at soil as the skin of Papatūānuku. How do we protect our own skin from UV, drying out, chemicals? We need to do the same for the whenua, see the environment as an extension of ourselves.”

Naomi says: “On some farms when you put a spade in the ground, it will be teeming with life, and on other farms not. A lack of vitality often reflects the impact of super-loading nitrogen” (ie, with synthetic fertilisers).

One of Oriwa’s projects investigates how a focus on enhancing the mana and mauri of the soil might change a farmer’s response to environmental issues on their farm. The ten dairy farms in the project are exploring the use of natural fertilisers made from seaweed, which is supported by science.

This project, Rere ki uta, rere ki tai (honouring the mana and mauri of the soil), draws on the knowledge of tangata whenua, inter-generational farmers and scientists. It is part of the Revitalise te Taiao programme, funded through the Our Land & Water National Science Challenge.

Nitrogen and the soil

Plants need nitrogen to grow well. Legumes get nitrogen from bacteria inside their root nodules, which convert nitrogen gas from the air into soluble substances like nitrates, a process called nitrogen fixation.

The balance of nitrogen in the soil is delicate – too little and plants do not grow optimally; too much and the excess leaches into our waterways, and some is lost as gases.

MWLR scientist Surinder Saggar says that as the amount of nitrogen fertiliser increases, the amount of fixed nitrogen decreases, so plants become more reliant on fertilisers. And addition of nitrogen from other sources can upset this balance.



Dairy cows release 2-3L each time they urinate and the cumulative effect of the nitrogen in that urea can mean the soil has much more nitrogen than needed, with the excess seeping through the soil and into our rivers, lakes and wetlands.

Pakake, common kelp, by Anthony Kurek, iNaturalist, EntSocVic, CC BY-NC.

Seaweed biostimulants

The Rere ki uta, rere ki tai project is led by Agrisea. This 25-year-old, Māori-owned family business makes many seaweed products.

Their biostimulant is applied to farmland to stimulate soil bacteria to fix nitrogen. It is made using the common kelp, *Ecklonia radiata*, a brown alga that grows on rocks and can wash up on the beach. The seaweed is collected, washed, dried and a mix of herbs and spices added in barrels, where it ferments for three months.

Nicole Clare, a teacher from Waihi College, was hosted by Agrisea in 2021 for her Royal Society teacher leadership programme. Nicole thoroughly enjoyed her time with Agrisea, where she learnt about whanaungatanga being at the heart of being a leader. She was involved in several research projects using different seaweeds, some of which she is still helping with after school.

Nicole described one farm that was trialling Agrisea biostimulants. They used two next door paddocks, one where conventional fertiliser is applied and the other using only Agrisea biostimulants. Each spring the farmer and scientists assessed the soil and plant roots visually, and sampled the soil to test for macro- and micronutrients and carbon quantity.

Nicole says that these farmers have seen the benefits of Agrisea’s product, in soil, pasture and animal health as well as lower costs. While the trial will continue, their preference would be to stop the trial and use only the biostimulant.

Nicole Clare, with seaweed collected by Agrisea.



NZASE

New Zealand Association of Science Educators

Representing the needs of science teachers

Te ao Maori and farming

Naomi Aporo says: “Te ao Māori is having an increasing role in national agricultural policies, not just because of the principles of the Treaty of Waitangi, but also driving action on waterways”.

The 2020 [National Policy Statement on Freshwater Management](#) has been developed from a te ao Māori worldview, focused on te mana o te wai. Naomi describes te mana o te wai as having three core principles:

- “The first right of water goes to water”; ie, the wellbeing of water is paramount
- Once water has what it needs, anything left over can be shared as a gift.
- If we have broken it, we are obliged to fix it.

Farming operates within holistic and connected systems – whenua, wai (water), āhuarangi (climate) and koiora (biological life). The wellbeing of one affects the wellbeing of all. And while there will be different priorities for every farm, this interconnection is the key.

Know your farm

Most farmers know a lot about their land, its history and characteristics. However, modern techniques in soil and water analysis and management, combined with mātauranga Māori values and principles and historical information, can add to this knowledge.

The broader the knowledge, the more responsibly the land can be farmed, says Naomi.

Farmers can look at historical records, MWLR information (eg, [their soil portal](#)), and Google maps; and talk with neighbours and past owners to find out more about the history of the property, and how the land has changed.

They can identify the details of soil types – low pumice soils in Waikato are very different to stony soils with poor drainage in Taranaki.

From 2025, farms need environmental plans, especially about waterways. So part of understanding the landscape



includes where the farm sits in its catchment and how local waterways have changed over time. If part of the land was originally wetland, it is possible to restore that. The details of the water’s biodiversity and chemistry on individual farms and nearby areas can be found from regional councils, which test waterways and make that data available (see [the LAWA website](#)).

Some farmers test their own creeks and rivers, comparing the water coming into the farm with the water leaving.

Farmers also need to look at the historic microclimate of their area, and at projections of climate change, to enable them to plan for crops likely to be viable in 30-40 years.

Māori farms have their own approaches and practices with a view to kaitiakitanga. “But it’s not so much about what a Māori farmer does, it’s about a way of thinking,” Naomi reflects. “It’s about preserving the land for future generations and seeing themselves as just one part of an interconnected living world.”

A complex mixture of grasses, legumes and herbs. Photo: Max Purnell, Waitakaruru.

Ngā Kupu

Kaitiakitanga – Environmental guardianship

Karakia – Prayer, sacred chant

Mana – Power, authority

Maramataka – Māori lunar calendars

Mauri – Vitality, essence, life force

Taiao – Environment

Taonga tuku iho – Treasures passed down

Tau utuutu – Returning what you take

Wairua – Spiritual connection, soul.

Te Aka Māori Dictionary

References

- G. Harmsworth, 2022, [Exploring indigenous Māori soil health concepts in Aotearoa-New Zealand](#). Discussion paper, MBIE project ‘Soil health and resilience: Oneone ora, tangata ora’ (C09X1613).
- A. Gillingham, 2008, [Soils and regional land use](#); Central and western North Island, *Te Ara*.



This article benefited from critique by Kerry Allen; Dan Park, MWLR; and Mere Manning, Ngāti Kahungunu ki te Wairoa.

Worms are an indicator of soil health.

Photo: USDA, Flickr.