5.1 NOKE ENGINEERING OUR SOILS

SCOTT BARTLAM (MANAAKI WHENUA)

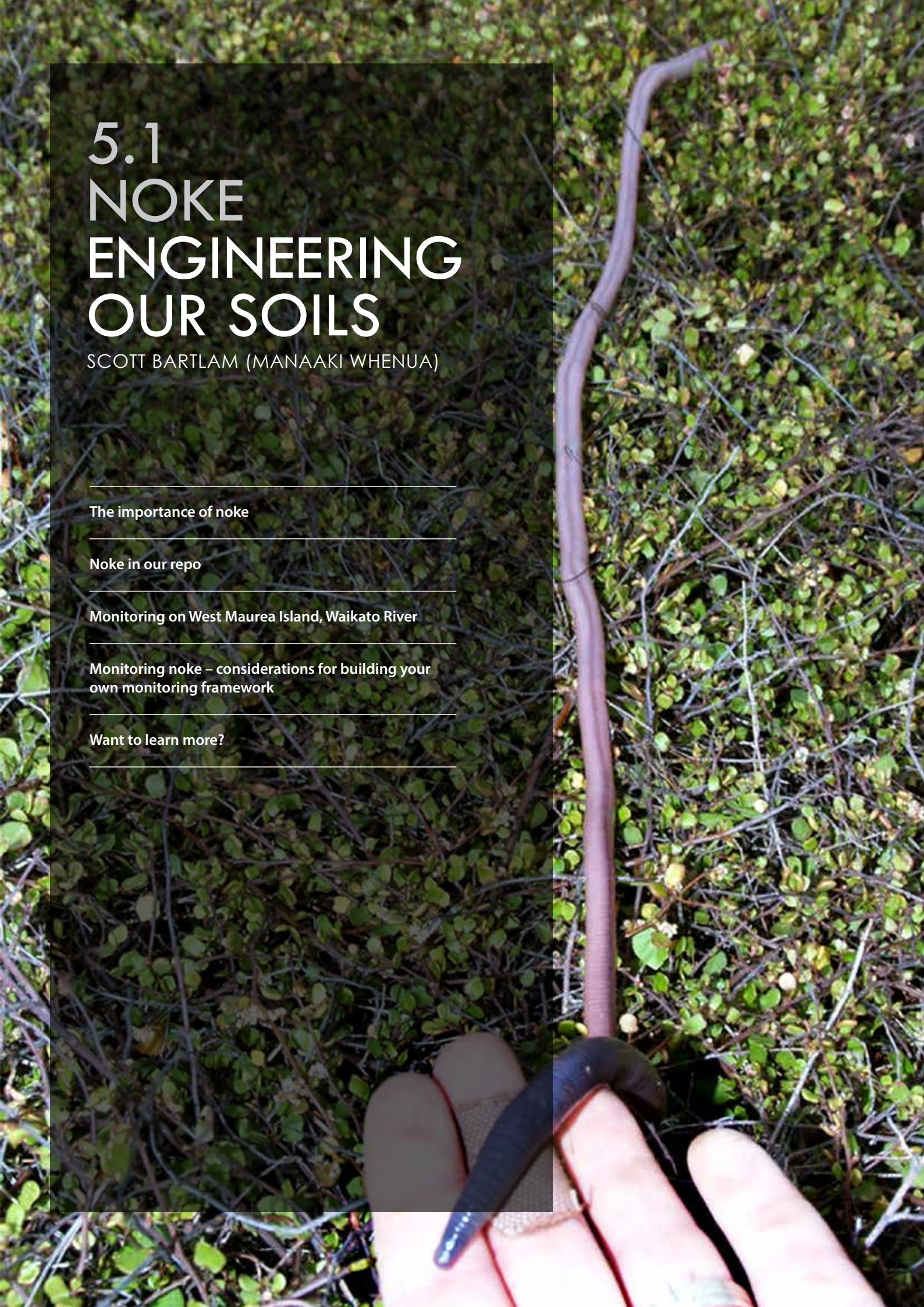
The importance of noke

Noke in our repo

Monitoring on West Maurea Island, Waikato River

Monitoring noke – considerations for building your own monitoring framework

Want to learn more?



He painga tō te noke

Even earthworms have their value (good things take time)

THE IMPORTANCE OF NOKE

Earthworms around the world are known to be extremely important in building new soil, keeping soils resilient to droughts, recycling leaf-litter/organic matter, and as food for many animal species.

Aotearoa New Zealand has more than 200 species of native earthworms or noke (also known as toke) with many more of our diverse native noke species yet to be discovered and named. Some of our incredible noke can glow in the dark, possibly to scare away foraging kiwi and other hungry predators. We also have some extremely small noke, about 15 mm long and other species that are huge, up to 1.4 m long!

Noke constantly burrow and recycle nutrients in our forest soils and is a crucial element in keeping our native plants, birds, and other animals thriving. Our forest noke living below the ground appear to be intrinsically connected to the forests above the ground, so when the native forest is cleared and converted to intensive agriculture, native noke die.

Despite their importance, we still have much to learn about noke. There are many new species of noke to discover, important relationships with our soils, plants and other animals to reveal, and possible risks to uncover. What we do know is that native noke are common in our forests, up to 333 kg/ha, and that together they can outweigh all the insects, possums, rats, birds, and other animals weighed together!

We also know that Aotearoa has more than 20 introduced exotic earthworm species from Europe and Asia that are mostly found in our pasture and weedy areas. From what has occurred in other countries we can learn that exotic earthworms can invade and alter intact native ecosystems but that the ecosystems most at risk of large-scale changes are those that have not evolved with earthworms.

Noke (*Megascolides maoricus*). Photo: Gonzalo Giribet

In North America, Hawaii, and Eurasia some of the same exotic species that are found in our pastures are invading their forests and changing their soils dramatically. These introduced earthworms have changed the soil microbiological and invertebrate communities, as well as the rates of nutrient cycling, soil carbon levels. They have also reduced the soil nutrients available to plants, and are mixing the soil layers. In North America these changes to the soils threaten the existence of some of the native plants, and are also thought to have caused the destruction of habitat for a rare fern species.

In constructed wetlands overseas, the addition of earthworms has been linked with nitrogen cycle changes and a consequent nutrient change in the leaves of the wetland plants. Further observations, monitoring, and research are needed to understand whether in Aotearoa these exotic earthworm species are changing the nature of our wetland soils and what can be done about such change.

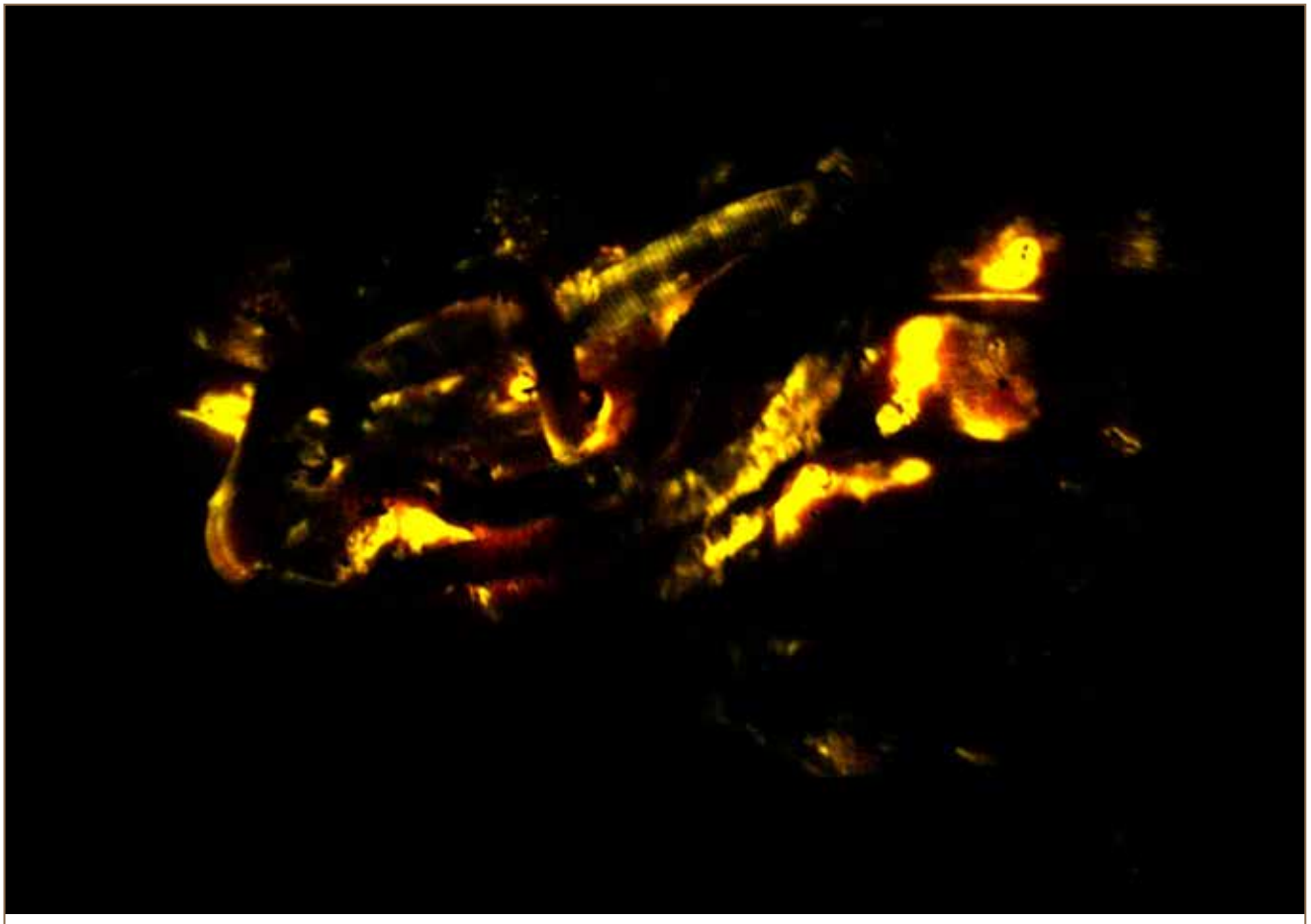
Previous page: Noke (Te Tai Tokerau), North Auckland Giant Earthworm (*Spenceriella gigantea*), Hauturu Island. Photo: Scott Bartlam

NOKE IN OUR REPO

Despite native noke being common and remarkably diverse in our forests, our undisturbed (natural state) repo (wetlands) have relatively few native noke species. With the burning, draining, and converting to pasture of our lowland wetlands since humans arrived in Aotearoa, this lack of earthworms in our wetlands may be changing.

Along with the invading exotic plants like grey willow, crack willow, alder, and numerous pasture weeds, introduced European and Asian earthworm species appear to be invading some of our lowland wetlands. Recently, populations of European earthworms have been discovered in wetlands in Hawke's Bay, Bay of Plenty, and Waikato. In 2014 introduced earthworms were discovered while monitoring an island restoration project in the Waikato River (see inset box).

Carefully searching soil during sampling for Maurea Island noke. Photo: Beverley Clarkson



Native noke (*Octochaetus multiporus)* glowing orange/yellow. Photo: Ross Gray

MONITORING NOKE CONSIDERATIONS FOR BUILDING YOUR OWN MONITORING FRAMEWORK

Key actions we can take to build our understanding of noke based on our collective mātauranga (knowledge):

1. **Kōrero (speak) with kaumātua (elders) and other whānau (family) members about their memories of noke.**
   - What did they look, smell and taste like? These memories can give clues about the health of the noke.
   - A change in colour or size might suggest the species of noke may have changed, which can be linked to changes to the environment.
   - A change in smell might indicate a change in the soil or water, or vegetation (waterbodies and plants can have their own unique smell, which maybe absorbed by the noke).

2. **Elsdon Best, the well-known ethnographer, recorded in 1902 that several species of noke were once a highly valued food source by tangata whenua (indigenous people).** There is no harm in asking if this was actually the case with your own whānau:
   - Where did they find them, and why did they look for them (e.g. using them to catch tuna (freshwater eels) or for medicinal benefits)? Places where the noke might have been found can give clues to the whakapapa (connections) associated with the noke, i.e. certain tree or plant species; ledges under sedge-lined streams. It is also important to consider what tikanga (values and practices) may have been associated with the noke, because those links can help increase understanding about any changes to the practice and other animals or plants with which they are connected.
   - Can they remember if they were found under certain trees or plants? Again, this helps increase overall understanding about the habitat and wider whakapapa of the noke. Perhaps those trees and plants are no longer there? If this is the case, have the noke also gone?
   - Were there other practices (e.g. collecting harakeke (NZ flax) or paru (dyeing mud) when they may have seen them? Sometimes the observations we make when we are not meaning to can tell us a lot about the health and wellbeing of the larger system. Noticing noke where they may not have been before or vice versa, including observations of the health and wellbeing of other animals and plants in the area can provide clues about patterns that may need to be monitored over a longer time scale.
   - Long-term observation and monitoring were natural for our tūpuna (ancestors), so when applied today, can help us better understand if what we are seeing is 'normal', or if something more concerning is happening.

3. **Identify your own monitoring areas based on what you may have learnt from your people.** Think about the areas where noke used to be found, and choose areas to monitor them under different plant types, e.g. ngahere (bush) versus a repo (marsh wetland) versus a paddock.

4. **Talk to worm scientists** (Manaaki Whenua – Landcare Research and Āta mātai, mātai whetū – AgResearch, and others) and work with them to support whānau and community monitoring programmes by offering advice (e.g. data collection and recording) and training in noke identification and ecology.

Excavating a 50 cm x 50 cm pit during sampling of Maurea Island noke. Photo: Beverley Clarkson

MONITORING ON WEST MAUREA ISLAND, WAIKATO RIVER

A survey from 2014 on West Maurea Island (10.89 ha) on the Waikato River showed clearly that exotic earthworms can definitely colonise and inhabit areas that get very wet and boggy.

The Maurea River Islands, recently returned to Waikato-Tainui in the Waikato Raupatu River Settlement (2010), are located near the important historical pā site (fortified place) at Rangiriri, north of Huntly. The islands have gradually formed in the main stream of the Waikato River from the sediments deposited by the river in this part of the catchment. Very little is understood about their age (i.e. when they started to be formed), but local information suggests they have been there for at least 80 years, and the local people have interacted with the islands during the past 50 years.

The Waikato River periodically floods the lower areas of the islands', creating a marsh wetland ecosystem during autumn, and winter. By mid-late summer, the islands start to dry out with small boggy areas scattered across the largest of the islands. Over time, the islands have become colonised in exotic tree species such as willow, alder (also called 'rākau Pākehā' by some Waikato peoples), privet, and a range of highly invasive plants such as reed sweetgrass and yellow flag iris.

Small pockets of native trees, ferns and groundcover plants exist on the islands, which have been further supported by a small control and restoration trial led by Waikato-Tainui and Maurea Marae in conjunction with Manaaki Whenua, Taihoro Nukurangi (NIWA), the Waikato Regional Council, and Te Papa Atawhai (DOC) (see section 6.3: Maurea Islands, for more on this project).

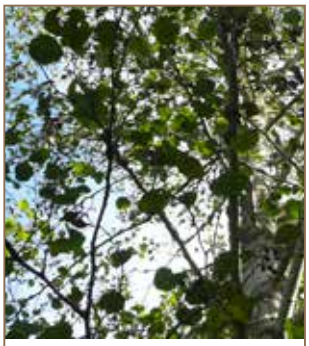
Despite ten separate locations across the mostly exotic plant-covered island being surveyed for earthworms, no native noke were found. However, three species of exotic worm were discovered: large numbers of toke momo rāwaho (*Octolasion tyrtaeum tyrtaeum)*; an Asian snake-worm species, also known as toke momo rāwaho (*Amynthas cortices*) that has spread to large parts of the world; and a common pasture species, toke tūtae tawhiti, dung worm (*Lumbricus rubellus*). Overall, the results highlighted that marsh wetlands like those found on the Maurea River Islands can be invaded by introduced earthworm species.

Overseas research has shown that when earthworms are introduced into constructed wetlands they can modify or engineer significant changes to those wetlands. Further observations, monitoring, and research are needed to understand whether in Aotearoa these exotic earthworm species are changing the nature of our wetland soils and what can be done about such change.

Grey willow.
Photo: Trevor James

Grey willow.
Photo: Paul Champion

Alder.
Photo: Trevor James



Alder canopy.
Photo: Paul Champion

Reed sweetgrass.
Photo: Paul Champion

Reed sweetgrass.
Photo: Trevor James

Yellow flag iris.
Photo: Paul Champion

Yellow flag iris.
Photo: Paul Champion

WANT TO LEARN MORE?

Note: If you are having problems with the hyperlinks below, try copying and pasting the web address into your browser search bar.

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Useful Websites

AgResearch
http://agpest.co.nz/wp-content/uploads/2016/02/EARTHWORM-ID-BROCHURE-Jan2016.pdf

Massey University
http://soilbugs.massey.ac.nz/oligochaeta.php

Manaaki Whenua – Landcare Research
www.landcareresearch.co.nz/resources/identification/animals/bug-id/what-is-this-bug

Science Learning Hub
https://beta.sciencelearn.org.nz/resources/20-native-and-introduced-earthworms

T.E.R.R.A.I.N (Taranaki Educational Resource, Research Analysis and Information Network)
www.terrain.net.nz/friends-of-te-henui-group/local-snails-slugs-worms.html

The New Zealand Organisms Register (2011) NZOR.
http://nzor.org.nz

Help to Make Contact with your local iwi, hapū or marae

Tūhono
www.tuhono.net/en/iwi-info

Department of Conservation – Contact your local office to talk to the regional Pou Kura Taiao (iwi liaison staff) – look under the "Regional Enquiries" tab for local DOC office contact numbers
www.doc.govt.nz/footer-links/contact-us

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