

Kauri dieback

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New footwear cleaning station at the entrance to Tāne Mahuta track

Abstract

Kauri are under threat from microscopic spores, found in soil, that cause kauri dieback. The disease infects kauri roots. It kills kauri of all ages and nearly all infected trees die. The disease can be spread through the movement of contaminated soil on people's footwear. To help prevent the disease spreading the Department of Conservation is upgrading high use tracks in its kauri forest. This involves eliminating wet, muddy sections of track and protecting the roots of kauri near the tracks.

Kauri faces its greatest ever threat

Kauri plays a vital role in New Zealand's culture, history, landscape and ecosystems. Kauri are among the most spectacular trees in the world. They are environment-shapers, exerting a strong influence on the species that live with them, including humans.

When Captain James Cook first sighted New Zealand in 1769 the northern half of the North Island was covered with kauri forest. It is estimated there were 1.2 million ha of kauri forest and most of this was felled for timber and to clear the land for farming. Today only a few thousand hectares of original kauri forest remain. Our pockets of surviving kauri forest are a very precious taonga that needs our help. These iconic trees face their greatest ever threat – kauri dieback.

Kauri dieback can kill kauri of all ages. Nearly all infected trees die. There is no known cure and the disease has the potential to kill all kauri in Aotearoa New Zealand.



Kauri protected by boardwalk

Māori and kauri

In the beginning of time Rangi and Papa clung together, trapping their children in the darkness between them. The strongest child, Tāne Mahuta, the god of the forest, pressed his shoulders against his mother and pushed upwards with his powerful legs. He separated his parents allowing light to enter and bring life to the world.

The Te Roroa iwi of Waipoua forest believe Tāne's legs were the giant trunks of kauri. In 1950, a year before his death, Te Rangi Hiroa/Sir Peter Buck, Māori anthropologist, author, physician, World War I medical officer and MP said this:

Man and plants have a common origin. Māori saw plants as having senior status. Tāne created them before people and they were therefore respected as older relatives. They are the link between mankind and sacred ancestors, Papatūānuku and Ranginui.

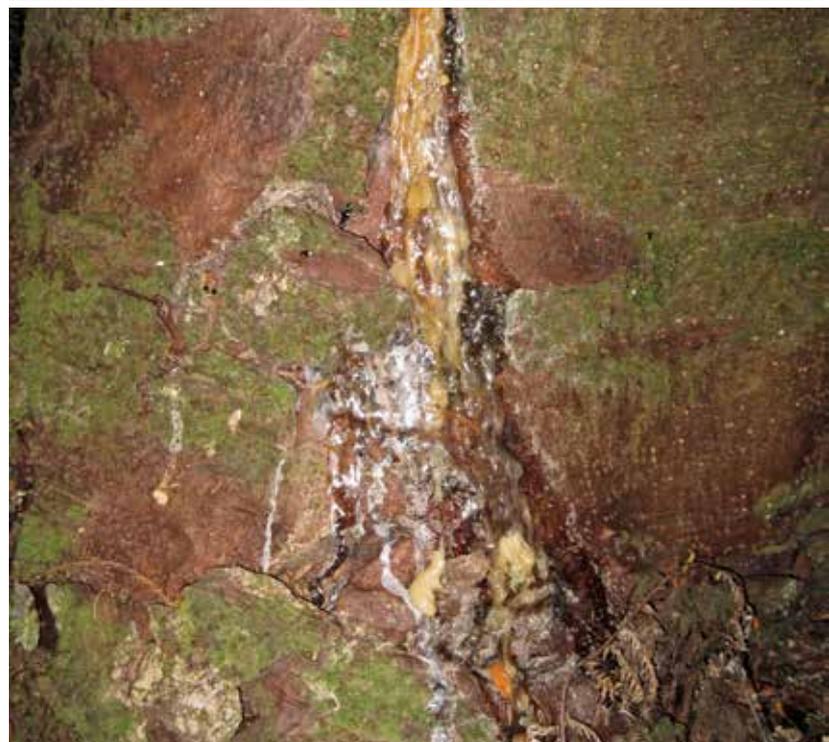
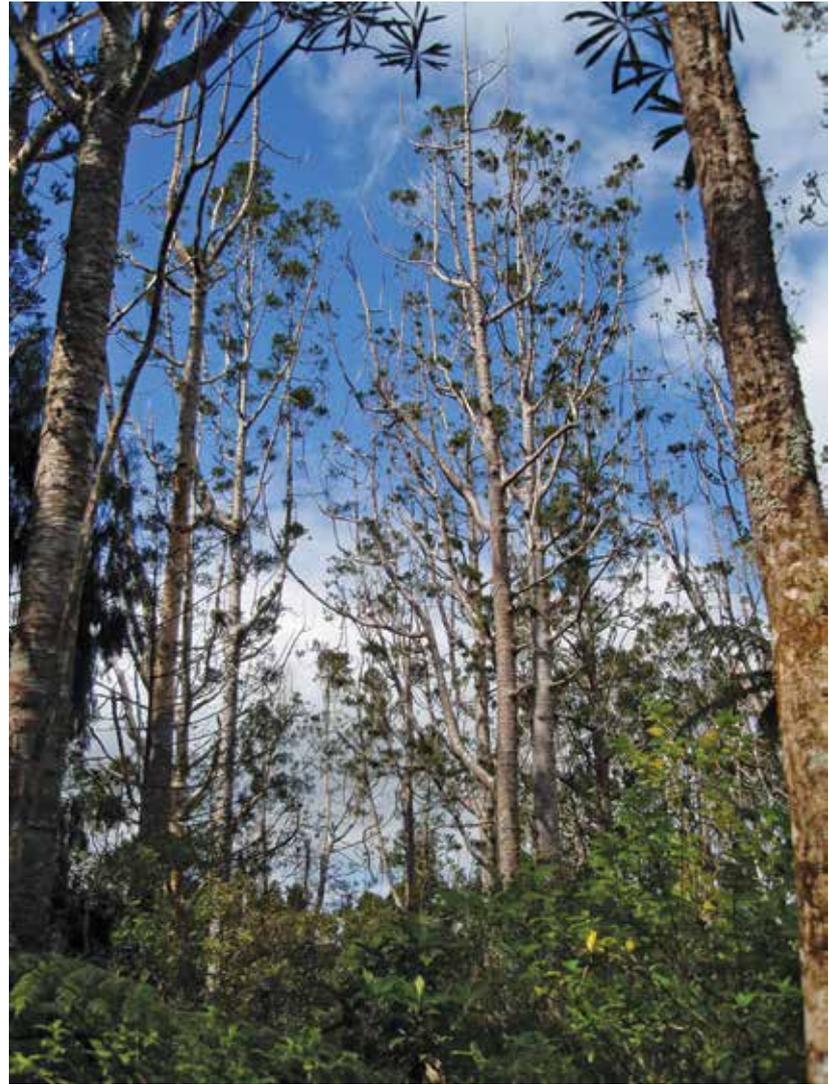
Kauri was ideal for making waka taua. It had a straight grain, it floated and it was durable at sea. Kauri gum was highly prized by Māori. It was burned as an insecticide in kumara plots. It was used as a fire starter and also wrapped in flax to make torches for night fishing. It was also used as a chewing gum or kapia. Kauri gum was burnt and mixed with animal fat to make a dark pigment for tattooing.

Kauri dieback

Kauri dieback is a disease caused by a microscopic organism, *Phytophthora agathidicida*. It infects kauri roots and damages the tissues that carry nutrients and water within the tree. Kauri dieback starves the tree to death. Under a microscope, the spores that cause the disease resemble a fungus. They actually belong to a distinct group of organisms commonly known as water moulds or oomycetes belonging to the eukaryote supergroup *Chromalveolata*. It was *Phytophthora infestans* that caused the Irish potato famine in the mid-19th century.

A paper on kauri dieback was first published in 1974 (Gadgil, 1974) based on an alert from the Officer in Charge of Great Barrier Island State Forest two years earlier. The pathogen was identified then as a species of *Phytophthora*, thought to be *P. heveae*. In 2006, Landcare Research scientists began investigating an alarming number of kauri deaths in the Auckland region. Over a two-year period, using advanced molecular DNA diagnostics, the pathogen was identified as *Phytophthora agathidicida*, a distinct, previously undescribed species unique to New Zealand. Its name was formally accepted in 2015 as *Phytophthora agathidicida* (Weir et al., 2015).

The origins of the pathogen are unknown. It is likely the microscopic spores arrived in New Zealand from overseas. At this point we do not know when or how the spores arrived here. They can remain in the soil undetected for a long period before any effect is seen in the environment. In 1974, it was noted that the pathogen was found not only in the area of diseased kauri, but from soil under healthy looking trees.



Kauri infected with kauri dieback

Kauri dieback has now been detected across kauri's natural range. It has been detected at sites in Northland, Auckland, Great Barrier Island and the Coromandel Peninsula.

How does kauri dieback spread?

The spores have a hard shell and can sit dormant in soil for more than three years and are spread when contaminated soil is moved. Any movement of contaminated soil can spread the disease, regardless of whether that soil came from around kauri trees or not. People are the main spreaders of kauri dieback spores and can spread contaminated soil on their footwear, backpacks, camping equipment, vehicles or other machinery. Animals such as wild pigs can also spread kauri dieback spores.

Combating kauri dieback

Kauri dieback was declared an unwanted pest by MAF Biosecurity New Zealand in 2008. In October 2008 a multi-agency programme, the Kauri Dieback Management Programme (KDMP), www.kauriedieback.co.nz, was established to combat the disease. The partners in the KDMP are:

- Ministry of Primary Industries (MPI)
- Department of Conservation (DOC)
- Tāngata whenua from the region where kauri grows
- Councils from the same region – Auckland Council, Northland Regional Council, Waikato Regional Council and Bay of Plenty Regional Council.

The KDMP is also overseeing a combined research effort with Plant and Food, Scion, Auckland University and Landcare to find control tools for the disease.

When it was set up in 2008 we did not know how to detect the disease in the soil, how it spreads or how to prevent it from spreading. The KDMP now has a detection tool that enables us to find kauri dieback spores in the soil. It has identified and mapped sites where the disease has been detected and has established an ongoing surveillance programme enabling us to keep track of where it is located. The KDMP agencies have also raised public awareness of kauri dieback and what the public can do to help prevent the disease spreading.

Kia toitū he Kauri

Keep Kauri Standing – Kia toitū he Kauri is the KDMP's strategy for managing the disease. The goals of the strategy are that by 2024:

- The mauri and integrity of kauri forests are sustained in the presence of kauri dieback
- We understand the disease
- Tāngata whenua, communities and stakeholders are all active in the management of kauri dieback.

The KDMP has an ongoing surveillance programme to tell us where kauri dieback has infected trees.

Knowing which kauri forests are healthy and which are contaminated is critical to managing the disease.

Preventing the spread of kauri dieback

Kauri dieback spores can be spread when contaminated soil or water is moved from one place to another. People walking through a kauri forest can spread the disease by getting contaminated soil on their footwear. This is why agencies like DOC, which manage tracks through kauri forests, invest in keeping high-use tracks dry and mud-free. Footwear cleaning stations are also being installed at the entrances to tracks through kauri forest.

In May 2014, the government announced an increase in funding to stop its spread. An extra \$26.5 million was allocated to DOC and MPI, the two government departments in the KDMP. The funding was allocated to be spent on a range of initiatives, which included upgrading tracks through kauri forest to prevent kauri dieback spread, researching potential surveillance and treatment methods, and engaging with communities so they would work to prevent the spread of the disease in their regions.

DOC's work to prevent the disease spreading

Of the \$26.5 million provided by the government in 2014, \$21.6 million was allocated to DOC to stop the spread of kauri dieback on public conservation land. DOC manages 735 km of walking tracks in kauri forest and staff have surveyed all 735 km of this track. They assessed the condition of the tracks, mapped all kauri within 1.5 m of a track, and developed a work plan covering DOC's entire network of kauri forest tracks. The plan includes a range of measures to reduce the spread of kauri dieback:

- Upgrading tracks to eliminate muddy sections and protect kauri roots
- Re-routing tracks to avoid kauri
- Changing the allowable recreational use of tracks
- Installing footwear cleaning stations at track entrances and, in some locations, closing the track.

Together these measures will help prevent the spread of kauri dieback.

DOC's track upgrades

There are two key elements to the work DOC is doing on its tracks to prevent the spread of kauri dieback: eliminating wet, muddy sections of track; and protecting the roots of kauri near the tracks.

The surface feeder roots of kauri are delicate and easily damaged by compaction. For maximum tree health, the root zone must be healthy and undisturbed. Many existing walking tracks disturb these root zones and upgrade work is being carried out to stop this from happening.



Installing geoweb on a DOC track in 2009 to trial the geoweb system

In some locations tracks are being re-routed away from kauri. Where the track cannot be re-routed, other measures are being taken to protect kauri roots and to ensure the track stays dry and mud-free. In some locations DOC is installing wooden boardwalks on tracks. This protects large kauri roots and ensures the track is always dry and mud-free.

At other sites, DOC is installing geoweb on tracks. This involves removing the existing gravel on the track and replacing it with plastic geoweb filled with lightly compacted bark chunks and gravel. It protects kauri surface feeder roots, allowing them to grow freely under and through the geoweb. The geoweb also protects kauri roots from the impact of people walking on the track. DOC developed the geoweb system, and testing shows it provides a high degree of protection for kauri surface feeder roots and keeps the track dry and mud-free.

DOC is in the second year of a three-year track upgrade programme using the extra funding provided by the government in 2014. Last year, DOC upgraded 26 high priority tracks through kauri forest on public conservation land. A total of 56 km of track was upgraded last year and this year DOC is upgrading another 37 high priority tracks. A total of 122.5 km of track will be upgraded this year.

New footwear cleaning stations are being installed at the entrances to tracks as part of the upgrade work. These

stations have brushes to remove mud from footwear and spray bottles with disinfectant. The disinfectant should be sprayed on footwear after all the mud has been brushed off. This will kill kauri dieback spores on footwear, but only if the shoes are mud-free. It will not kill kauri dieback spores that are embedded in soil.

What can I do to save our kauri forests?

The public can help combat kauri dieback by helping prevent the disease from spreading.

When you are around kauri:

- Ensure shoes, tyres and equipment are cleaned to remove all visible soil and plant material before and after visiting a kauri forest
- Always use footwear cleaning stations at the entrance to kauri forest tracks – remove all the dirt from your footwear then spray your footwear with the disinfectant provided
- Always stay on the track and off kauri roots
- Keep your dog on a leash at all times in a kauri forest.

What should I do if I have kauri on my land?

- Do not walk on kauri tree roots or compact soil around them and keep dogs and animals away from the trees
- Download a warning sign from www.kauridieback.co.nz and put it up to alert visitors about the dangers of spreading the disease.
- If you think your trees have symptoms of kauri dieback contact your nearest DOC office or MPI
- Fence off kauri on rural land to protect the trees from farm animals and to prevent stock from spreading kauri dieback – you may be eligible for grants to help with fencing stock away from native bush.

References

- Gadgil, P.D. 1974. *Phytophthora heveae*: A Pathogen of Kauri. *New Zealand Journal of Forestry Science*, 4: 59–63.
- Weir, B.S., Paderes, E.P., Anand, N., Uchida, J.Y., Pennycook, S.R., Bellgard, S.E. and Beaver, R.E. 2015. *A Taxonomic Revision of Phytophthora clade 5 Including Two New Species, Phytophthora agathidicida and P. cocois*. Available at: www.biotaxa.org/Phytotaxa/article/view/phytotaxa.205.1.2.

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