

Kauri Dieback Science Frequently Asked Questions

Q1. What is kauri dieback caused by?

- A. A microscopic water mould called *Phytophthora agathidicida*. It is new to science and lives in the soil and has two forms. The soil form is in tough spores called oospores that can survive in dried soil on boots and equipment for up to 8 years (and counting). It also has a water borne spore with a tail that can swim called a zoospore. However this is short lived and is killed by seawater, but can move through the water film in the soil up to 3m per year.

Q2. How does kauri dieback spread?

- A. Almost exclusively by soil disturbance. The greater amount of disturbance the greater risk of spread. Large animals like humans & pigs move kilos of soil around the forest on feet and equipment (and in pig guts) and are the primary vectors. Small animals like birds, rats, possums etc move only miniscule amounts of soil and are a negligible risk. Dogs are a moderate risk and should be on leads at all times in forest areas. The water borne zoospore can swim downhill in water films in the soil and in watercourses. The “natural” spread of the disease via water is estimated at 3m per year.

Q3. Aren't pigs and possums spreading this disease?

- A. There is no evidence that possums and other small animals spread the disease. Pigs have been confirmed as a vector, but not anywhere near as significant as humans. Humans have been shown by monitoring to be at least 70% of the problem in the Waitakere Ranges because 70% of the infection is along the track network. 48% of the infection is within 50m of a baitline, so again humans are the vector here. 59% of the infection is within 50m of a watercourse. In some cases watercourses run down tracks and so do baitlines, so poorly maintained tracks with water in them are a serious risk. Pigs cause a large amount of soil disturbance when rooting for food on the forest floor, they do this when there is nothing else to eat. Evidence has shown that when pig numbers in the Waitakere Ranges were significantly reduced by intensive hunting (pre 2014, Jack Crow pers comms) the vegetation began to regenerate and the pigs then fed on that rather than rooting and this reduced the soil disturbance impact of pigs by 90-95%. Possums are small animals that spend most of their lives in trees and eat vegetation not roots, so they are a negligible risk for soil disturbance. Effective pest control can easily eliminate or reduce the risk of vertebrate pests spreading kauri dieback.

Q4. Do all trees that get kauri dieback die?

- A. Yes all trees of all ages die. There is an experimental treatment using injections into the tree of a chemical called phosphite which has been shown by research over the last 5 years to keep trees alive. It is not a cure and does not remove the infection, immunise

the tree or treat the disease in the soil. You can find out more and join the treatment programme at www.kaurirescue.org.nz if you have kauri dieback on your property.

Q5. What about natural resistance? Won't kauri recover like the cabbage tree did?

- A. No resistant trees have yet been found but there is a research programme ongoing at Scion to investigate this <https://www.scionresearch.com/>. The disease that killed cabbage trees was a bacteria spread by an insect. There is no similarity to kauri dieback. It is unlikely that kauri will be resistant to this disease because they comprise such a small gene pool now. Since logging cleared 99.9% of kauri from their natural range we now only have 0.1% of the gene pool for kauri remaining. Kauri live for 800-5000 years, so it is impossible for a species with that lifecycle to evolve resistance to a pathogen which is killing them within a few years. Also when existing trees die, all other species relying upon kauri die with them. So in the unlikely event of resistant kauri being found, we would need to replant them everywhere and wait 200 years or more for a forest to be created. We simply cannot rely on any of this.

Q6. Can we get a kauri seed bank so we can replant kauri if we find a cure?

- A. Kauri seeds don't survive long and must germinate within about 4 months. In the forest kauri seedlings germinate quickly and then remain small for decades waiting for a gap in the canopy to appear and then they all shoot up towards the light. This is why you find groves of kauri rickers that are all the same age, they are brothers and sisters. Where *Phytophthora agathidicida* is in the soil the seedlings don't survive so we may be seeing the last generation of kauri if we don't stop the spread of this disease around our forests. If you replant kauri into infected soil they will die so we cannot replant infected areas.

Q7. Why do we need to worry about an area or close tracks if the trees are already dead?

- A. *Phytophthora agathidicida* remains in the soil after kauri die and can still be moved to other areas to infect new trees. It may also infect other species so containing and preventing spread from infected areas is a priority.

Q8. Does kauri dieback kill other trees?

- A. We know that *Phytophthora agathidicida* can infect other native plant species such as tanekaha and rewarewa, which was discovered through a recent MSc project completed in 2016 (Jessica Ryder University of Auckland / Auckland Council). No other research work has been done on the host range for this disease in 9 years. Evidence from other similar *Phytophthora* in Australia (Professor Giles Hardy) shows that a single host is highly unlikely and that when levels of the pathogen reach higher levels in the soil they will start to show symptoms and kill other species.

Q9. How widespread is kauri dieback in New Zealand?

- A. Many other forests are already known to be infected but the extent of that infection within those forests is not known because insufficient surveillance and monitoring has been done. Only forests in the Auckland Region have been systematically monitored using air

surveillance and ground truthing in both 2011 and 2016. This is how we know how much the spread has increased in the Waitakere Ranges (more than doubled in 5 years from 8% to 19%). Over 22,400 individual trees have been surveyed in the Waitakeres. See Auckland Council's Monitoring Report:

<http://ourauckland.aucklandcouncil.govt.nz/media/14014/kauri-dieback-waitakere-ranges-report.pdf> The only forests in the country known to be free of kauri dieback are the Hunua Ranges, most of the Coromandel and most offshore islands. Keeping the infection out of these forests has to be the top priority.

Q10. What about Glyphosate, 1080 or other toxins, is that causing kauri dieback?

- A. No. The water mould *Phytophthora agathidicida* is causing this disease, nothing else. Anything that compromises tree health and stresses trees such as climate change, drought, excess water, pests, driveways and buildings on their roots, soil compaction and herbicides sprayed on their roots will make individual trees more susceptible to a pathogen, but these factors are not the cause of the disease. They may be contributing to why kauri are succumbing so quickly to this pathogen, but for each individual tree it is a complex picture of a combination of factors. The majority (70%) of infected trees in the Waitakere Ranges are within 50m of a walking track which clearly indicates that humans are the main vectors for spreading this disease.

Q11. Why does it matter if we lose kauri, it's just one species?

- A. Kauri is a keystone species and an ecosystem engineer. Kauri create their own soil type called a podsol in which only certain other species can survive. At least 17 other plant species depend entirely on kauri, so if we lose kauri we will lose them too. The assemblage of plants in NZ kauri forest is unique, there is nothing else like it on earth. If kauri become extinct we will lose these forests forever. Kauri is a taonga to Māori, a scenic treasure and an historic resource (e.g. waka, yachts, houses, furniture).

Q12. What about the other forests that don't have kauri, won't they be ok?

- A. We don't know because little research has been done on the host range for *Phytophthora agathidicida* so we don't know what other species it affects. It is highly likely that it will affect other species and kill them, so if we continue to spread it around all our forests we may find in the future that it threatens the survival of other species and other forests all over the country.

Q13. How can we stop the spread?

- A. By removing the main vector humans from risk areas where there are infected and healthy kauri, in other words keeping people out of kauri forests. This will remove at least 70% of the problem in the Waitakere Ranges. At the same time pigs, the other main vector, need to be eradicated. Fencing off areas of healthy kauri ecosystem to prevent pigs and humans from bringing the disease into them is necessary and a priority. Upgrading the track infrastructure to make the tracks dry and get them off kauri roots will minimise the risk of moving soil around and spreading the disease. Boardwalks and

engineered tracks that are convex and allow water to run off them instead of pooling and creating a mud slurry is what is required urgently. Tracks should be rerouted away from kauri if possible.

Q14. How effective is the sterigene spray and is it the right thing to use?

- A. We don't know because the research to investigate what kills *Phytophthora agathidicida* has not been completed, despite being a priority for almost 10 years. However we do know that the oospores can survive in just a pinhead of soil, so if you don't clean your boots and equipment (bikes, walking sticks etc) first to completely remove all soil particles then spraying on top of soil will not kill the disease. Proper cleaning is far more effective than spraying. A quick spray without cleaning achieves nothing. You should scrub and clean your shoes and equipment thoroughly under an inside tap (not in the garden) before and after visiting any forest.

Q15. How effective are the cleaning stations?

- A. The basic ones (crate / brush / spray bottle) are not at all effective because they are difficult to use and the diseased soil is being brushed onto the track surface for others to stand in. It is recognised that these need to be upgraded urgently.

Q16. How long must we stay out of the forest?

- A. Until the required track upgrades have been completed to make them dry and improved cleaning stations are put in place. The amount of money invested in these upgrades will dictate how long that will take. You can lobby your Councillors and MPs to provide the money for this work.

Q17. How do we deal with dead kauri trees, can we chop them up and remove them?

- A. No. Dead trees with kauri dieback must remain on your property and not be chopped up. They will still be infectious (as will your soil) and cutting them up will release millions of spores of the pathogen that can easily be spread to other sites. There are Standard Operating Practices (SOP) from Auckland Council & the Kauri Dieback Programme that define how you should work around kauri. All kauri should be assumed to be infected and the relevant SOP followed. You can find SOPs for all sorts of situations here: <https://www.kauridieback.co.nz/more/documents-and-resources/>

Q18. What about predator or weed control work, can this continue?

- A. Yes. Under the rāhui a warrant can be issued to a group undertaking essential work to look after the forest. The warrant requires the group to be trained in both cultural understanding of the rāhui and compliance with the strict phyto-sanitary requirements for working among kauri. Compliance can then be monitored and audited. If you want to help look after the forest please join one of the many groups undertaking this work that have been warranted to do so by Te Kawerau a Maki or apply for your group to get a warrant via the website at <http://tekawerau.iwi.nz/contact>

Q19. The Council has closed some tracks, can I still use the ones that are open?

- A. No. The rāhui has closed all the tracks in the forest, not just the ones the Council has closed. It is very important to keep humans out of all the tracks because they will continue to spread the disease and thereby increase the scale of the problem by continuing to use them. The Council closures are sending mixed messages and causing confusion. All tracks are closed by the rāhui. Please respect the rāhui and stay out of the Waitakere Ranges and any other forests which have kauri. It is not safe for people to walk near kauri on inadequate track infrastructure. It will just result in the death of more trees. Thank you for your understanding and support.

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