Te Rangahau Aroturuki i ngā Rākau Rangatira o Te Wao Nui ā Tiriwa

2021 Waitākere Ranges Kauri Population Health Monitoring Survey

June 2022, Technical Report 2022/8

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Karyn Froud[1], Yue Chin Chew[2], John Kean[3], Jane Meiforth[4], Sarah Killick[2], Edward Ashby[5], Robin Taua-Gordon[5], Alastair Jamieson[2], Lisa Tolich[2]

[1]Biosecurity Research

[2]Auckland Council

[3]AgResearch

[4]Manaaki Whenua – Landcare Research

[5]Te Kawerau ā Maki

Additional authors for specific chapters of this technical report are provided at the start of the relevant chapters.

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Name: Phil Brown Position: Head of Natural Environment Delivery, Environmental Services
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Glossary of Te Reo Māori words

Te rārangi kupu Māori

The list below defines Māori terms and concepts used within the text.

Te Ao Māori	The Māori world view
Hapū	Subtribe, the primary political unit in traditional Māori society
Hui	Meeting
Iwi	Tribe comprising a number of hapū (sub-tribes) related through a common ancestor and associated with a distinct territory
Kaitiaki	Guardians
Kaitiakitanga	Guardianship. The practice of looking after the environment, rooted in tradition
Mahaki	Blight; disease
Mātauranga Māori	The body of Māori knowledge; referring to all things physical, emotional and spiritual in a Māori context
Moana	Sea
Mana whenua	Territorial rights, power over the land / by extension: Māori who have customary authority over land through ancestral links
Ngahere	Forest
Rāhui	A temporary ritual prohibition to restrict access and separate people from things that are tapu; in this context, placed by Te Kawerau ā Maki on Te Wao Nui ā Tiriwa as a measure to protect and restore balance to the forest
Rākau rangatira	Chiefly trees
Rongoā	Traditional Māori medicines; cultural health measures
Tapu	Sacred or prohibited
Tohu	Indicator
Tikanga	Cultural values, customs and practices
Te Wao Nui ā Tiriwa	The Great Forest of Tiriwa, known as the Waitākere Ranges
Whakataukī	Māori proverb
Whānau	Family

Terminology
Ngā kupu whāiti

The definitions below are specified in accordance with standard epidemiological usage. Where the same word is defined differently between different disciplines, the definition used for this study and the alternative definition are provided for context.

Baseline	The first comprehensive measurement of symptomatic tree prevalence, pathogen prevalence and impact variables in a population. A baseline is set so that future measurements can be compared against it to detect a change over time.
Case definition	The consistent criteria by which the health condition of an individual tree is included as a 'case' in a disease outbreak or study.
Confounding	Refers to the distortion of the true association between an exposure and an outcome, because of the influence of a third factor. A key difference of confounding from correlation is that the exposure variable and confounder should have a separate causal relationship or association mechanism from the outcome variable.
Cross-sectional study	Cross-sectional studies are a type of observational study, rather than an experimental study. They provide a snapshot in time. Individuals in the study are examined for the presence of an outcome of interest, such as a pathogen or cases of disease. At the same time data is collected about the presence or absence of factors that may increase or protect from the risk of disease. These are called risk factors.
Delimiting surveillance	Surveys designed to determine the extent and distribution of a new biosecurity risk outbreak or incursion.
Disease	A dynamic development of abnormal life processes due to a pathogen or abiotic disorder, lasting long enough to cause vital disturbances in the life of the host, possibly leading to its death (Tronsmo et al., 2020).
Ill-thrift	Ill-thrift describes plants that fail to thrive. For the purposes of this study, ill-thrift refers to kauri trees that are not healthy, but their poor health is caused either by other biotic or abiotic causes, or very early kauri dieback, where conclusive symptoms are not yet apparent.

Incidence	The number of new cases of disease (i.e. trees that meet the case definition) in a defined population over a defined period of time. *NOTE: This should not be confused with incidence as defined in plant pathology, as the number of diseased/symptomatic individuals within a defined population at a point in time. This is much closer to the epidemiological definition of prevalence (Madden et al., 2007).*
Incubation period	The time between an individual (tree) being infected by a pathogen and when symptoms become visible (also referred to as the asymptomatic period).
Interaction	Interaction is said to be present when the association between an explanatory variable and an outcome variable differs between, or depends in some way on, the level of a third variable.
Latency / Latent period	The time period between an individual (tree) being infected by a pathogen and when the pathogen has completed its lifecycle and becomes infectious, in that it releases reproductive structures (e.g. zoospores) and can infect other trees. Note that the pathogen can spread prior to the host tree becoming symptomatic (during the incubation period).
Misclassification bias	A type of measurement error where a study unit (e.g., kauri tree) is classified into the wrong group e.g., being classified as diseased when healthy. Or when an imperfect test is used to detect a pathogen and the pathogen is classified as absent when it is present. Misclassification can bias estimates of disease or pathogen prevalence or measures of association between variables (Haine et al., 2018).
Monitoring	Repeated surveys to determine changes in the frequency and distribution of a disease over time.
Pathogen	An infectious agent that causes disease in a host. In plants, this includes oomycetes, fungi, viruses, virus-like organisms, bacteria, and nematodes.
Positive predictive value	The probability that an individual (tree) with a positive test is actually positive; e.g., the proportion of trees identified as kauri through remote sensing that are actually kauri.
Precision	A description of random error, a measure of statistical variability.

<table>
<tr><td>Prevalence</td><td>The number of individuals in a defined population having a specified outcome at a given point in time. Where the outcome may be presence of a pathogen (pathogen prevalence) or meeting the case definition for diseased (disease prevalence).

NOTE: This should not be confused with prevalence as defined in plant pathology, as the count of geographical sampling units where disease is present (e.g., fields, plots, regions, countries) divided by the number assessed.</td></tr>
<tr><td>Prevalence ratio (PR)</td><td>The ratio of the proportion of trees with the outcome (e.g., disease or pathogen detection) to the proportion of trees exposed to the risk factor.
Using a 2 x 2 table and disease as an example:

<table>
<tr><td></td><td>Disease +ve</td><td>Disease -ve</td></tr>
<tr><td>Risk factor -Yes (exposed)</td><td>a</td><td>b</td></tr>
<tr><td>Risk factor -No (unexposed)</td><td>c</td><td>d</td></tr>
</table>
Prevalence ratio: PR = $\frac{a/(a+b)}{c/(c+d)}$

Where:
a/(a+b) is the prevalence of disease among those exposed to the risk factor
c/(c+d) is the prevalence of disease among those that are not exposed to the risk factor
Where the prevalence is the same between the exposed and the unexposed PR equals 1.0</td></tr>
<tr><td>Risk factors</td><td>Any factor or variable that is associated with either an increase or decrease in disease prevalence or pathogen prevalence.</td></tr>
<tr><td>Sensitivity (Se)</td><td>This is the diagnostic sensitivity of a test.

Proportion of trees with the disease that will test positive.

$$\frac{True\ positives}{True\ positives + false\ negatives}$$

Where false negatives are trees that test negative but do have disease. Highly sensitive tests can be used to rule out disease because they will have few or no false negatives. Less sensitive tests such as the soil bioassay may fail to detect P. agathidicida even when it is present. Typically, if a test has high sensitivity, it</td></tr>
</table>

	will have lower specificity (i.e., you will find almost all cases of disease (high Se), but you will also call lots of things diseased that are not (low Sp). *NOTE: Diagnostic sensitivity should not be confused with analytical sensitivity which is the lowest level of target agent that can be measured accurately by the test (Cardwell et al., 2018).*
Specificity (Sp)	This is the diagnostic specificity of a test. Proportion of healthy trees that will test negative $$\frac{True\ negatives}{True\ negatives + false\ positives}$$ Where false positives are trees that test positive but do not have disease. Highly specific tests will have very few or no false positives e.g., if we detect *P. agathidicida* in a soil sample using culture and sequencing it is almost certain that *P. agathidicida* is present. Typically, if a test has high specificity, it will have lower sensitivity (i.e., the cases you find are truly diseased, but you will miss quite a few cases of disease). *NOTE: Diagnostic specificity should not be confused with analytical specificity, which is similar, but is concerned with performance around excluding non-target species and cross-reactions (false positives) in laboratory testing (Cardwell et al., 2018).*
Surveillance	Surveillance is the systematic ongoing collection, collation and analysis of information related to health (plant health in this case) and the timely dissemination of that information to those who need to know so that action can be taken.
Symptoms/ symptomatic	Physiological or structural changes in a plant that indicate the presence of disease by reaction of the host, e.g., canker, leaf spot, wilt, lesion, dieback.