the kauri dieback pathogen – evolution to diagnostics

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what is kauri dieback?

a root and collar rot

characterised by bleeding lower stem legions, crown thinning and tree death

first reported in 1972, but only after found on mainland was risk recognised

what is *Phytophthora agathidicida*?

a soil-borne oomycete

causal agent of kauri dieback – highly aggressive pathogen of kauri but there are non-terminal hosts

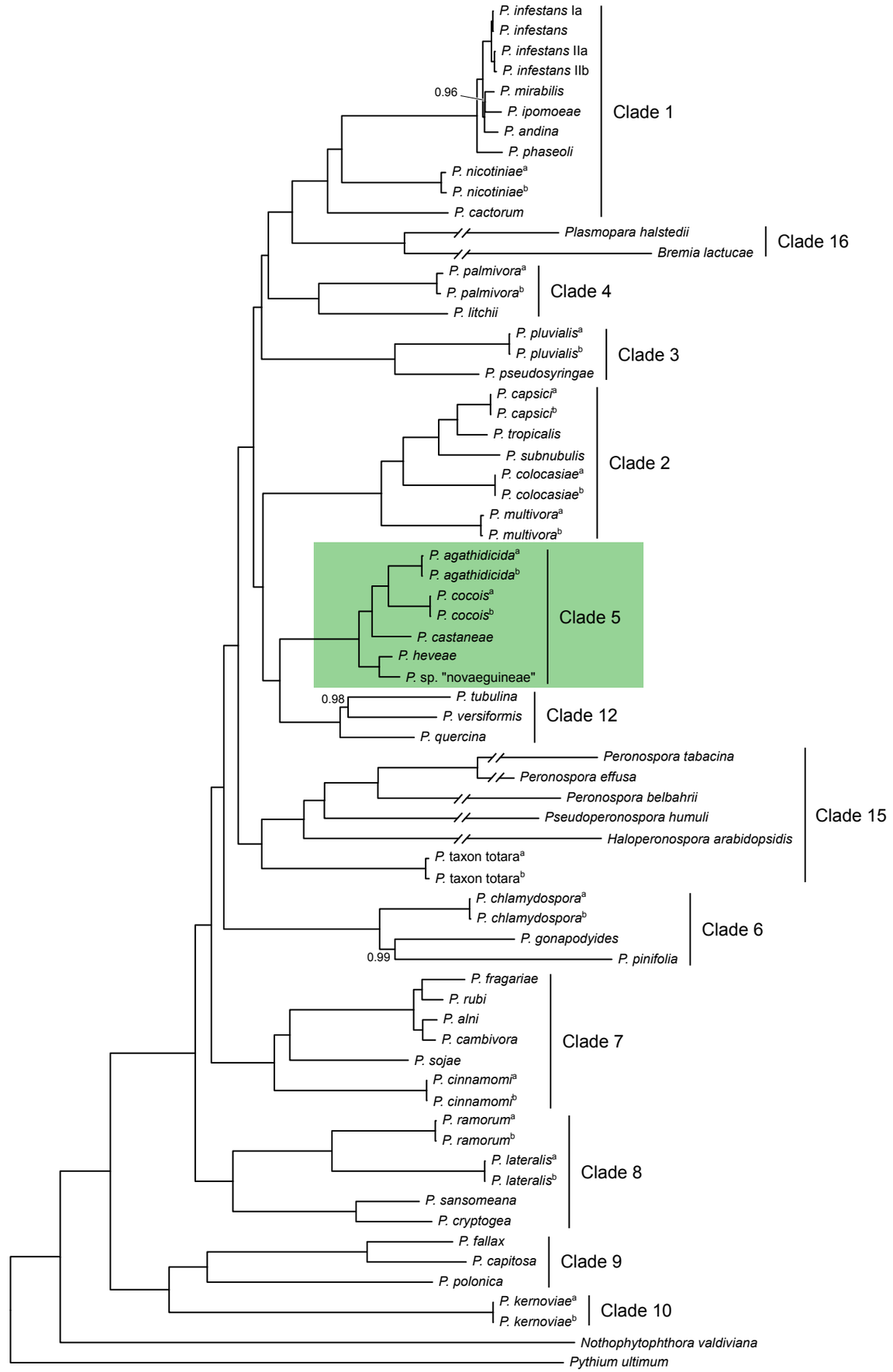
http://idtools.org/id/phytophthora/factsheet.php?name=15150

Phytophthora is a large group of plant pathogens – currently 180 species but discovery is accelerating

Clade 5 is small, ~5 recognised taxa but further diversity is known

diebacks of other *Agathis* species

at least 5 other *Phytophthora* as well as several other oomycetes reported from kauri forest soils



“invasive”

the pathogen arrives in New Zealand with “form”

“evolved”

the pathogen or host has changed

becoming more virulent/agressive or more susceptible

“native”

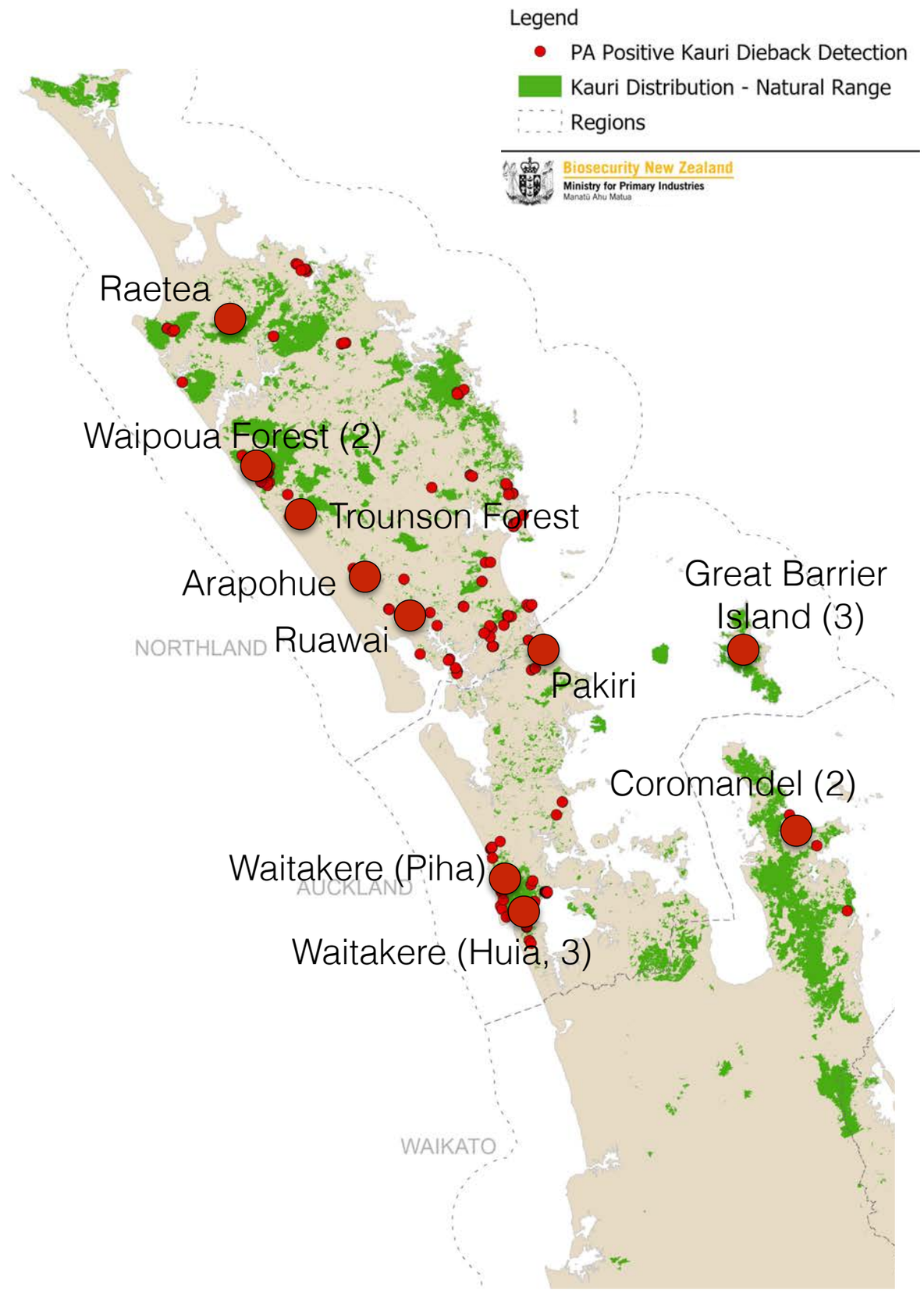
“released”

biotic or abiotic environments have changed

making host “weaker” or pathogen “stronger”?

samples cover geographic range and were collected 1972-2014

assembled whole mitochondrial genomes for each

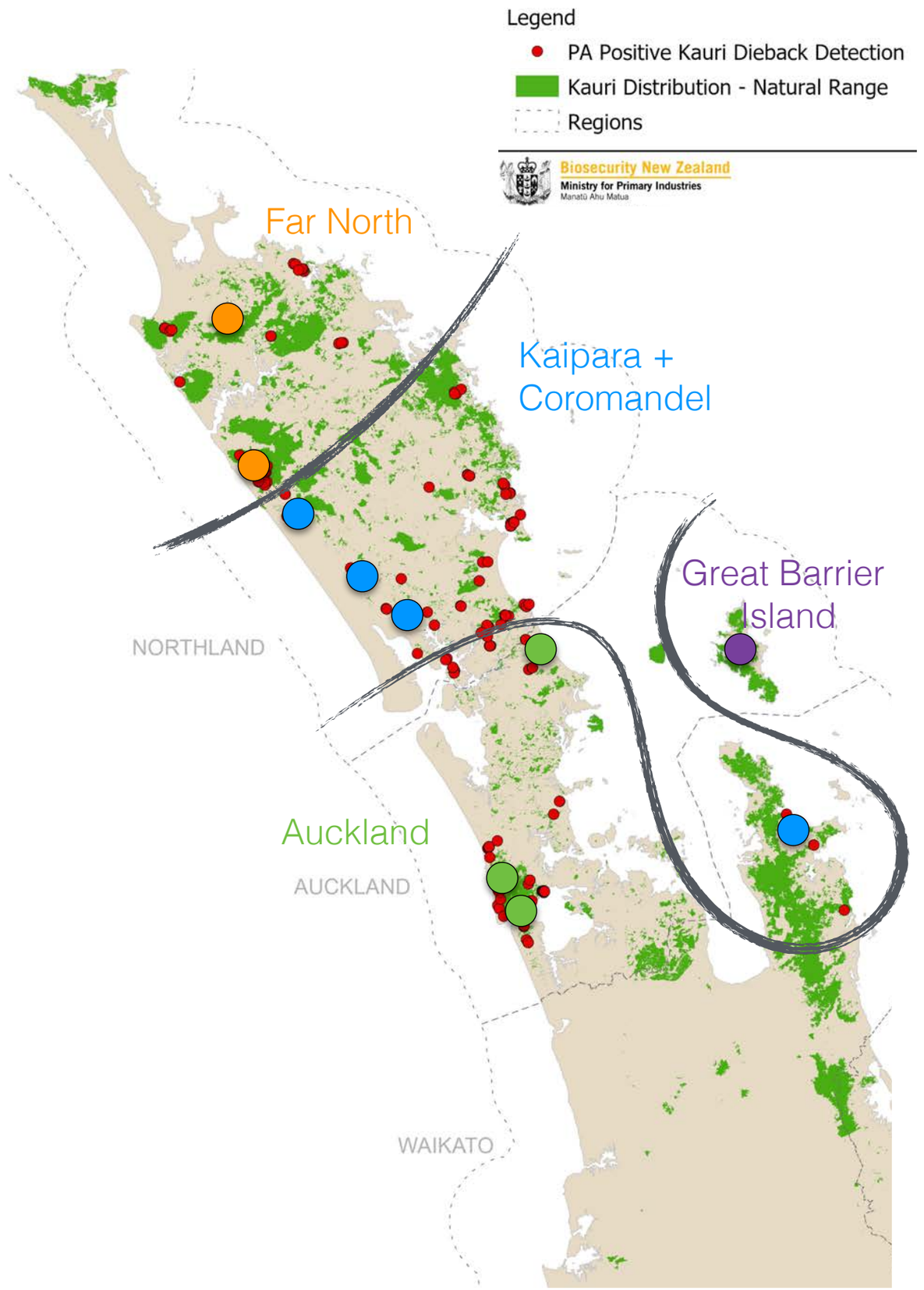


https://www.kauridieback.co.nz/kauri-maps/

geographic structure and suggests diversification began ~300 years ago

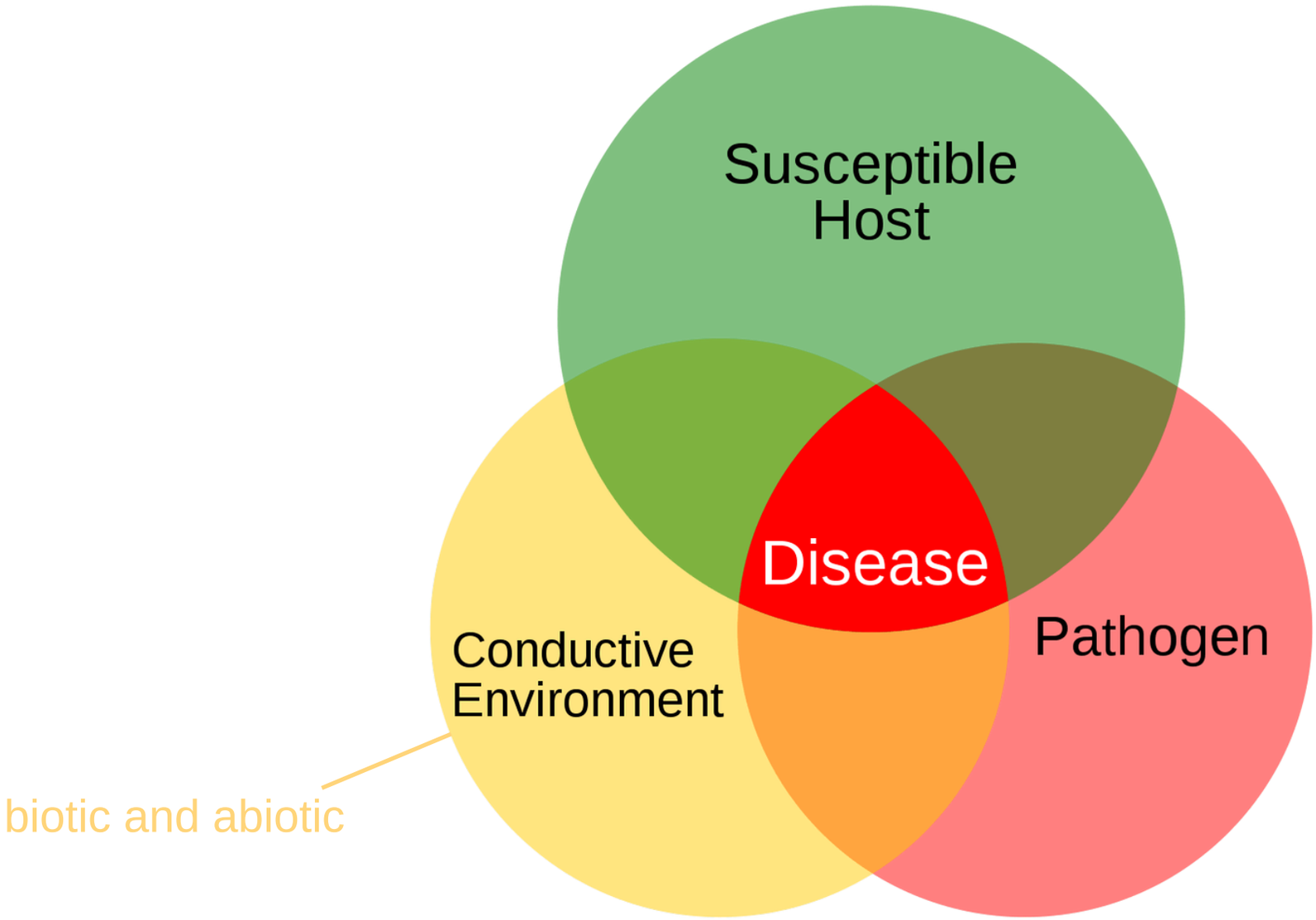
not easily explained by an arrival post-WWII (i.e., 14 genotypes)

consistent with an arrival several hundred to perhaps several thousand years ago



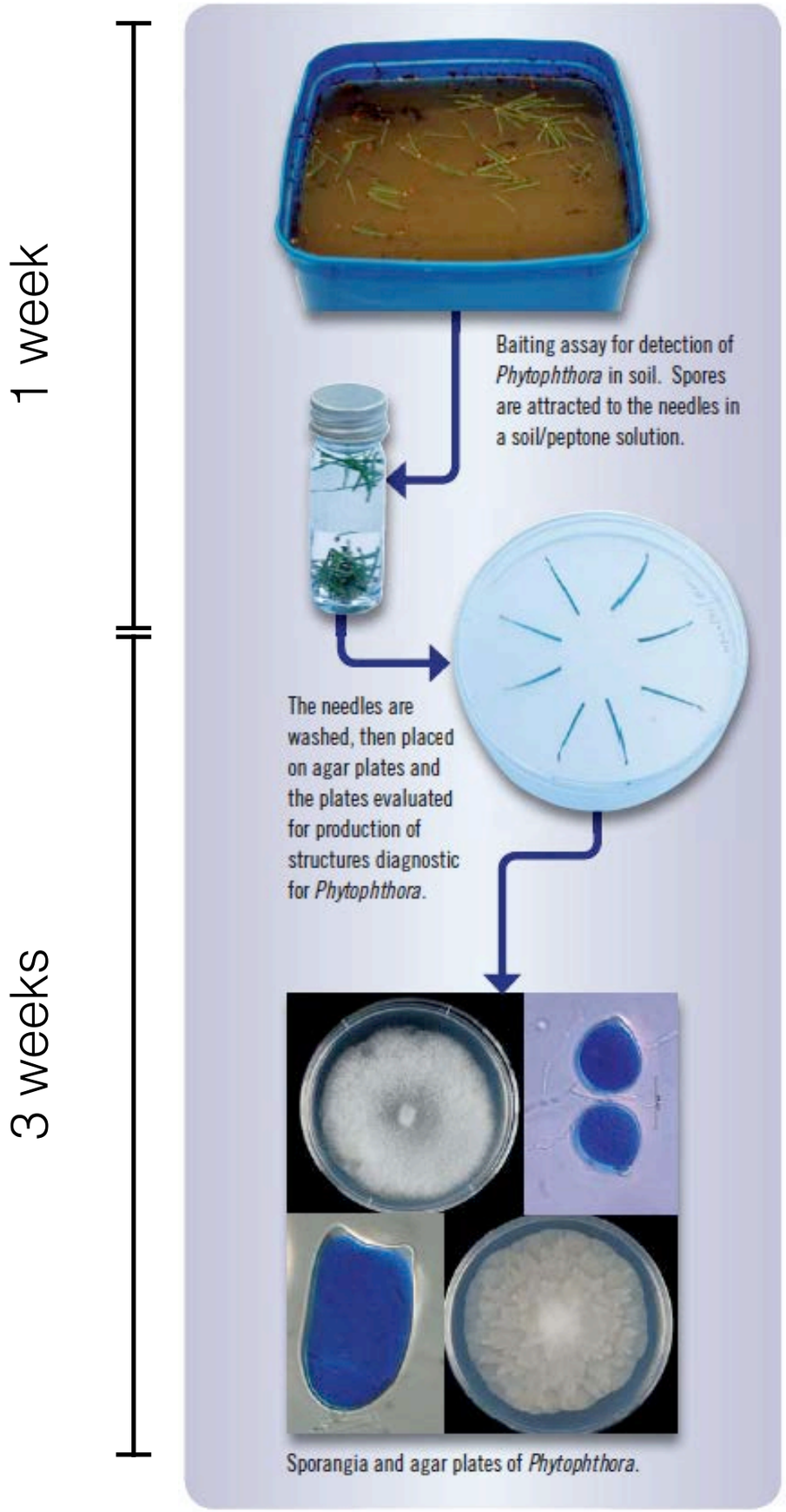
https://www.kauridieback.co.nz/kauri-maps/

https://johnkempf.com/thinking-deeper-on-the-disease-triangle/



a “naturalised” pathogen, recent disease appearance may imply “release” due to habitat fragmentation, climate change, disturbance, new introductions

will our current management strategies still work?

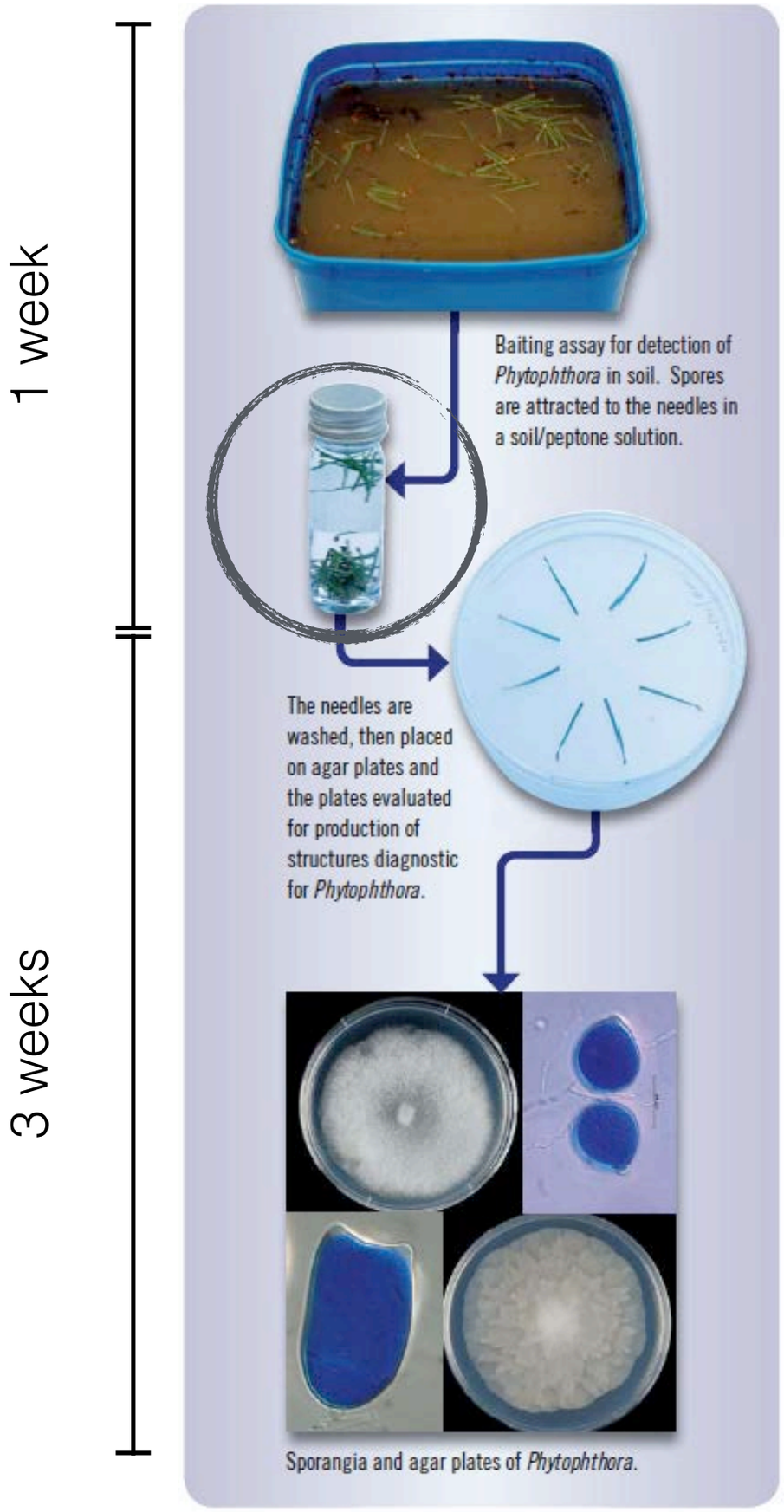


current standard bioassay costs $100's and 4+ weeks to complete, detection is subjective

testing only after disease appears but the lag period means that apparently healthy forest may be infected

we are playing catch up – and not very well

http://www.nzffa.org.nz/farm-forestry-model/the-essentials/forest-health-pests-and-diseases/diseases/Phytophthora/spotlight-on-new-species-of-phytophthora/



developed “hybrid” bioassay – advantages of baiting without disadvantages of plating

use a highly specific and highly sensitive LAMP assay to detect the pathogen from the bait

costs tens of dollars and takes a week – testing must still be conducted in a lab

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Phytophthora pluvialis


Phytophthora colocasiae


Phytophthora palmivora


Pseudocercospora fijiensis


Phytophthora cinnamomi


***Trichophyton* sp.**


Paranannizziopsis australis

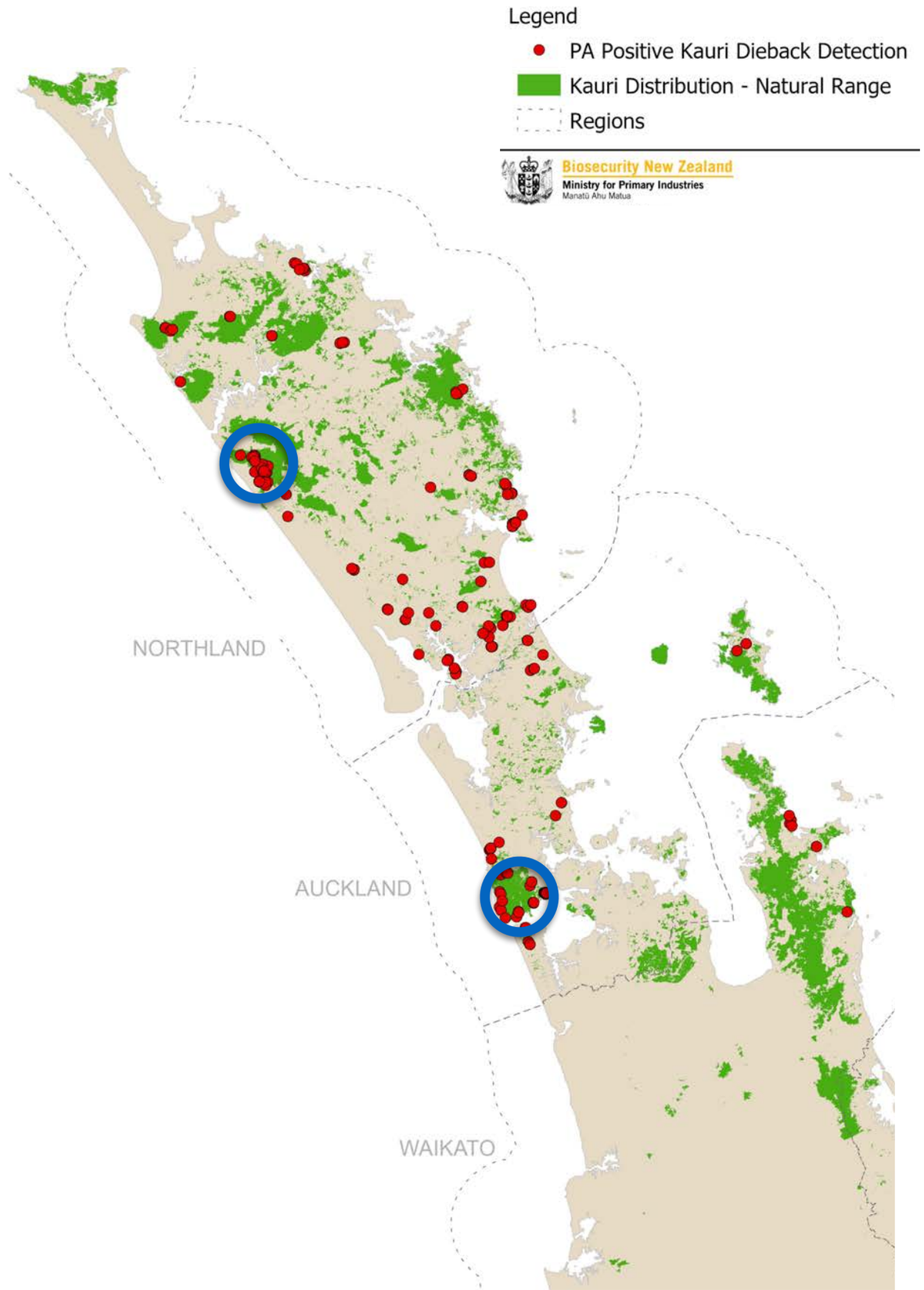

Austropuccinia psidii


Salmonid sp.

in side-by-side testing the hybrid bioassay outperforms the standard bioassay

for 14 samples, LAMP detected 8 but only two were detected visually

for a collection of ~660 samples results are similar, 18 detected visually v. 82 using LAMP



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~2700 tests, ~1700 for *P. agathidicida* and ~1000 for *P. cinnamomi*

landscape level monitoring – of diseased and non-diseased sites using combination of soil and, now, water sampling

includes working with Mana Whenua

https://ourauckland.aucklandcouncil.govt.nz/articles/news/2017/03/musical-campaign-to-help-kauri/

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