The effects of *Phytophthora* Taxon *Agathis* (PTA) on kauri forest ecosystem processes

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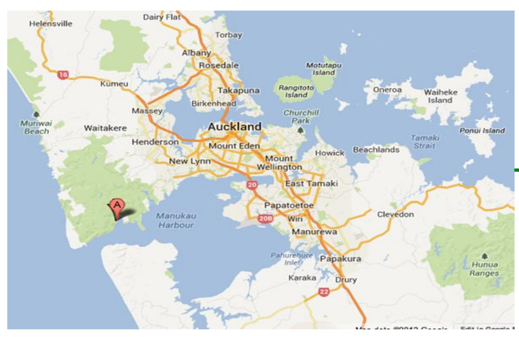
Introduction

- *Phytophthora Taxon Agathis* – known as PTA is a water mould (or oomycetes)
- First discovered in 1972 on Great Barrier Island (Gadgil, 1974). Since 2006, PTA has been identified in many remaining Kauri stands in Auckland and Northland
- Symptoms include yellowing of the leaves, thinning of the canopy and lesions on the lower stem (Beauchamp et al., 2011). PTA kills Kauri seedlings and tree of all ages.

'poses a threat to kauri, both at the individual and the population level, with flow on effects to kauri ecosystems' (Beever et al., 2007).

Aim and Objectives:

- To investigate changes in major carbon fluxes and regenerative vegetation within a kauri stand affected by PTA in the Waitakere ranges.
- Quantify total litter fall and litter fractions underneath trees of different degrees of infection
- Estimate the amount of carbon lost via CO_2 efflux
- Conduct vegetation surveys on the regenerative vegetation and compare the composition changes between infection classes



Study Site:

- Located near Huia, in the southern Waitakere Ranges
- Two infection classes ('Minimal' (n=6) and 'High/Medium' (n=7))
- Rainfall and atmospheric temperature/humidity sensors(n=4)

Litterfall - Litter Quantity and Fractions

Methodology:

- Litter traps randomly placed within the drip line of each measured tree (n=2 per tree)
- Collected weekly - monthly
- Dried, sorted into litter fractions and weighed

Results:

- Decrease in total litter biomass in the 'medium/high' infection class (Figure 1.1)
- Changes in litter composition (increase in Angiosperm leaf litter) in medium/high infection trees
- Decrease in reproductive litter in 'medium/high' infection class (Figure 1.2)

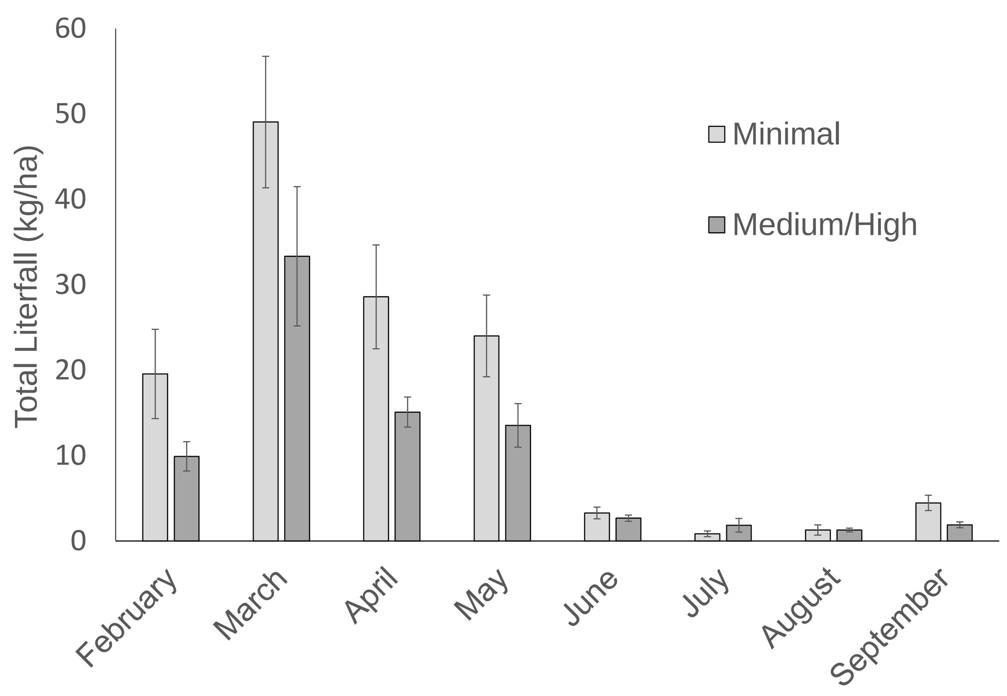


Figure 1.1
Average total monthly litterfall (kg/ha) (±SE) across 8 months during the year 2013 for two PTA infection classes. 'Minimal' infection trees (n= 6) and 'Medium/high' infection trees (n= 7)

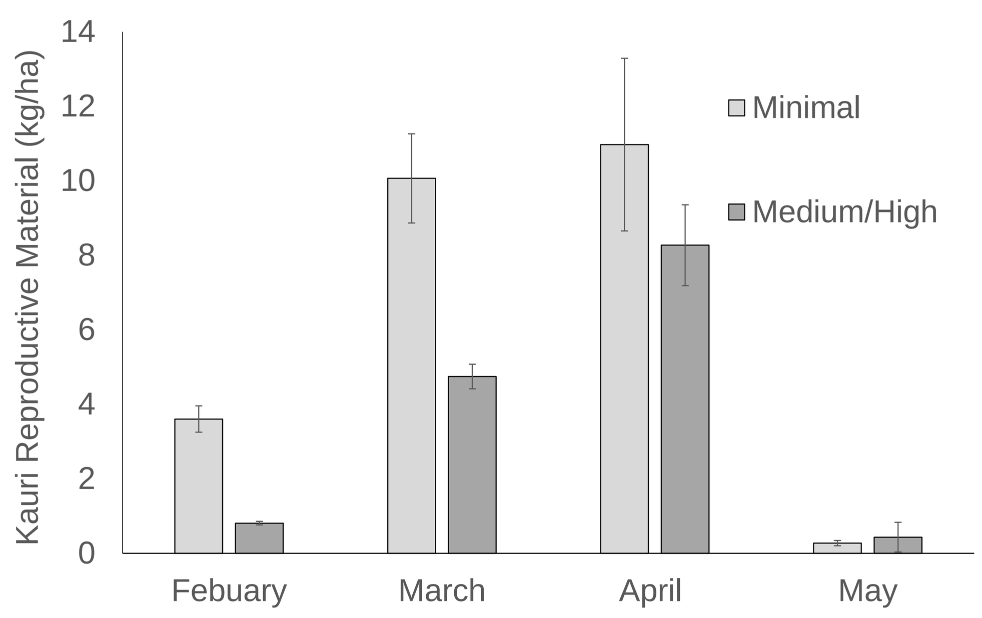


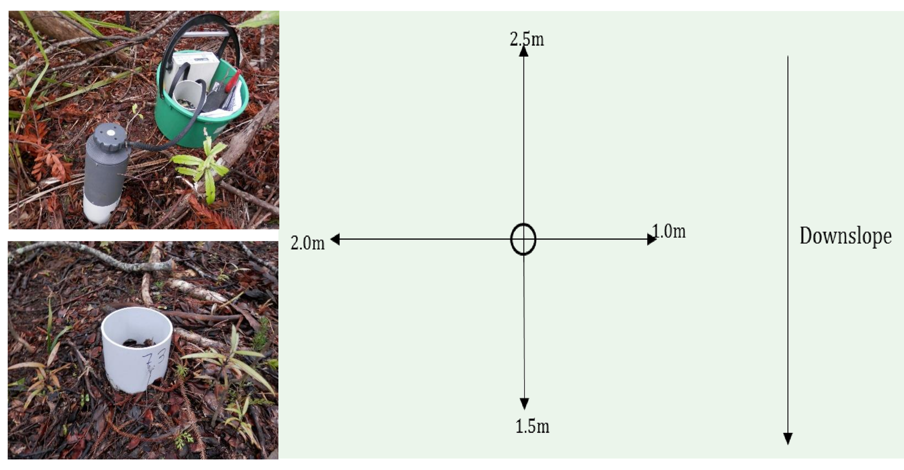
Figure 1.2
Average monthly reproductive litterfall (kg/ha) (±SE) across 4 months during the year 2013 for two PTA infection classes.

Conclusions:

- Changes in litterfall quantity and composition may result in long term changes in decomposition rates and soil chemistry
- Decreased reproductive capacity of infected kauri may affect the succession of Kauri

Soil CO_2 Efflux (Soil Respiration)

Methodology:



- PVC collars inserted into the forest floor around the trunk of each measured tree (n=4 per tree).
- Measured weekly – monthly
- Other measurements: soil moisture, soil temperature and photosynthetically active radiation

Results:

- No significant differences in soil CO_2 efflux between infection classes (Figure 2.1)
- Significant positive relationship between soil temperature and soil CO_2 efflux in 'Medium/High' infection trees (Figure 2.2)

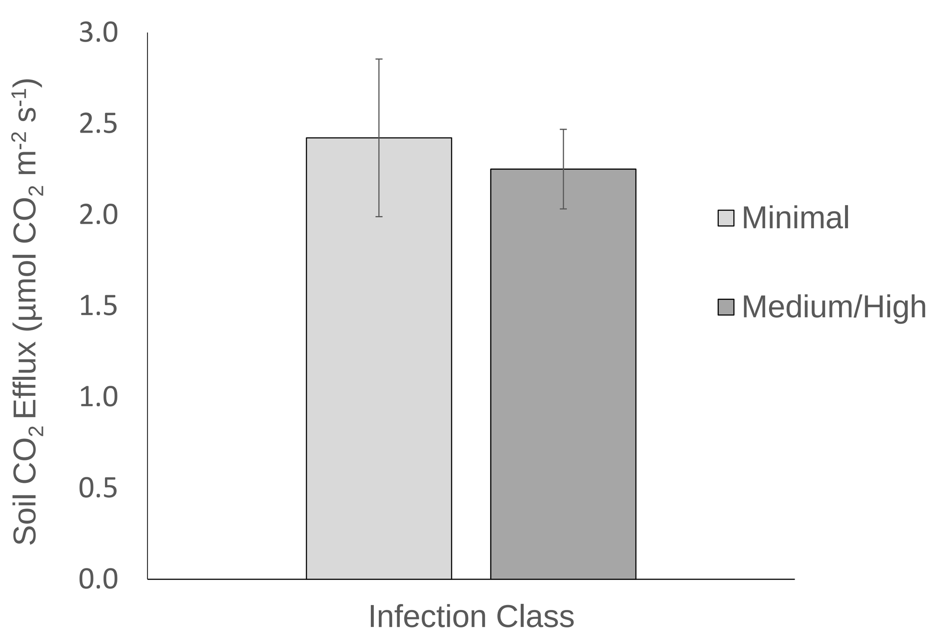


Figure 2.1
Average total soil CO_2 efflux (kg/ha) (±SE) across 9 weeks (March - June) during the year 2013 for two PTA infection classes. 'Minimal' infection and 'Medium/high' infection trees.

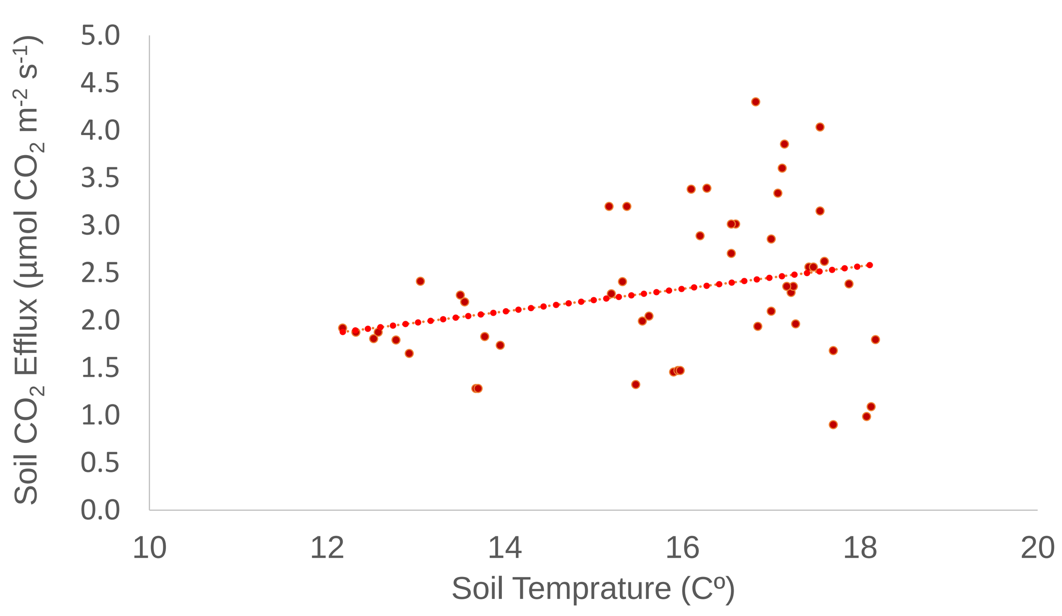


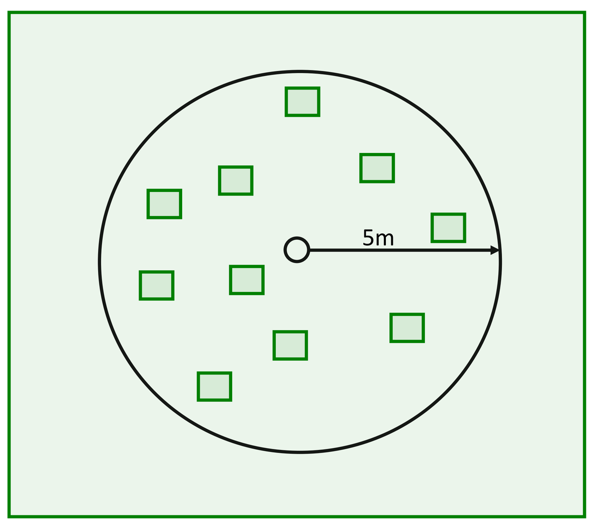
Figure 2.2
Soil temperature vs soil CO_2 efflux of medium/highly infected trees across 9 weeks (March - June) during the year 2013

Conclusions:

- No difference in soil CO_2 efflux suggests that roots still respire and/or accelerated microbial activity in the medium/highly infected sites
- Differences in temperature sensitivity indicates a change in root versus microbial respiration

Understory Vegetation Survey

Methodology:



- 1x1 meter quadrates located within a 5m radius of each tree (n=10)
- Total individuals counted of each species present and varying height classes (10-30cm, 31-50cm, 51-100cm, 101cm+)
- Litter depth randomly measured within each transect (n=5 per transect)

Results:

- Differences apparent in regenerative vegetation composition (Figure 3.1)
- Large increase in *Coprosma arborea* abundance around 'Medium/High' infected kauri
- Increased presence of *Leptospermum scoparium* (Manuka) and *Leptecophylla juniperina* (Prickly Mingimingi) around 'Medium/High' infected kauri

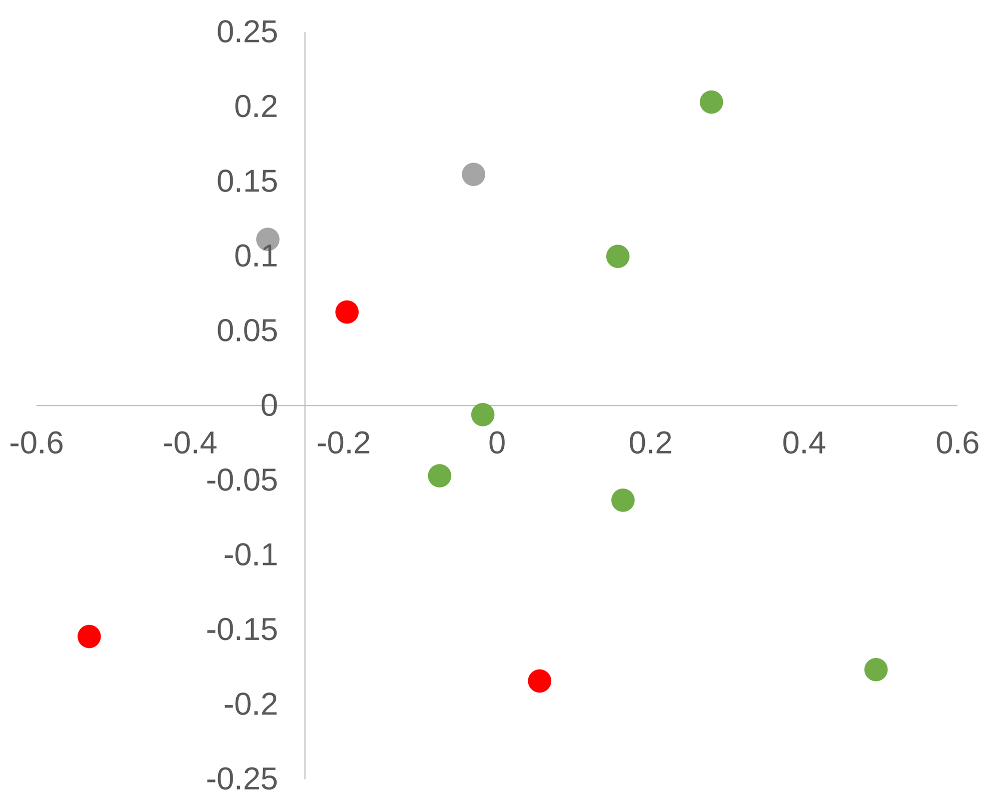


Figure 3.1
nMDS similarity plot. Bray-Curtis (Stress: 0.1643). 'Minimal' (Green), 'Medium/High' (Red), 'Dead' (Grey).

Conclusions:

- Changes in surrounding regenerative vegetation may result in long term changes in forest composition.

References:

Beauchamp, T., Dick, M.A., Bellgard, S., 2011. Preliminary survey for *Phytophthora taxon Agathis*. Unpublished internal report prepared for the kauri Dieback Long-term Management Programme. March, 2011.

Beever, R.E., Waipara, N.W., Ramsfield, T.D., Dick, M.A., Horner, I.J., 2007. Kauri (*Agathis australis*) under threat from Phytophthora? In: Proceedings of 4th IUFRO. Phytophthora in Forests and Natural Ecosystems, August, 2007. Monterey, California, USA.

Gadgil, P.D. 1974. Phytophthora heveae, a pathogen of kauri. New Zealand Journal of Forestry Science, 4:59-63.

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