



Report: Survey of the distribution of *Phytophthora cinnamomi* in bushland of the Hawkesbury Nepean Catchment Management Authority area

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Background

Phytophthora cinnamomi is

the key organism associated with dieback of native plant species in Australia.

Infection of native plants by *P. cinnamomi* has been listed as a key threatening process on Schedule 3 of the NSW Threatened Species Conservation Act 1995 and under the Australian Government's Environmental Protection and Biodiversity Conservation Act 1999. The delicate ecological balance of natural ecosystems is disrupted when this pathogen kills susceptible plant species, altering species composition and floristic structure with subsequent losses of food and habitat for native fauna.

Over the past few decades, *Phytophthora cinnamomi* or "root rot pathogen", has been detected and identified in various areas within NSW and is believed to be widely distributed.

It has been identified in natural vegetation communities throughout the state including Barrington Tops National Park, Jervis Bay, Royal National Park and Sydney Harbour National Park. Determining the distribution of this pathogen is fundamental to assess the risk it poses to natural ecosystems and to focus management resources to where they are most needed. Knowledge of the distribution of *P. cinnamomi* within the HNCMA area is lacking.

Purpose of this document

This report is of the survey for *P. cinnamomi* undertaken by Royal Botanic Gardens for the Hawkesbury Nepean Catchment Management Authority area (HNCMA area) commencing October 2007 and finishing February 2008. It is part of a larger project aimed at addressing the management of *P. cinnamomi* in the natural bushland of the HNCMA area.

Objectives of the survey

The purpose was to survey for *P. cinnamomi* within the major native vegetation remnants in the HNCMA area in order to facilitate the development of management strategies and to further understand the biology and epidemiology of *Phytophthora* dieback disease.

Survey Strategy Methodology

- Soil sampling was targeted to bushland areas considered to be of high recreational and conservational value National Parks within the HNCMA
- Park managers and council officers were contacted prior to sampling date to gain local knowledge, regarding presence of dieback, track quality, usage and access
- Park managers and council environmental officers were invited to submit samples as part of the project, supplied with sampling kits and instructions
- A data sheet was completed at each sampling site to obtain comprehensive site information including geographic coordinates, soil, site disturbance and disease severity, host plant species (see appendix 1)

- As it was not possible to sample all areas of bushland within the time frame of the project, the survey was refined by sampling areas likely to act as a source of introduction of the pathogen and more likely to be infested. This includes high traffic areas such as bushwalks, nature trails, fire trails and other access points into bushland
- Surveying was conducted when environmental conditions were conducive to pathogen activity, namely in autumn and spring. Wet summertime conditions in January 2008 allowed for some sampling to be undertaken over summer.
- Each sample was taken from 4 points around the plant host. Total sample volume was approximately 2 cups of soil. To reduce the likelihood of false negative results, samples were taken from plant species thought to host the pathogen or species exhibiting dieback symptoms such as wilt, chlorosis and branch death
- Samples were placed in sealed plastic bags and stored at room temperature (21deg) until baiting
- Excess soil was removed and footwear, tools and gloves were sprayed until runoff with 70% methylated spirits between sample sites to prevent spreading the pathogen during the survey process
- Soil disturbance was kept to a minimum and no sampling was undertaken when the soil was saturated or during rain
- Soil baiting was conducted using susceptible Lupin Seedlings, plating out on Phytophthora Specific Medium (PSM) and identification was based on microscopic examination of characteristic fungal morphology. Samples were double baited with 3 replications of each. Samples were placed in mid term storage for future assessment
- A total of 407 samples were taken as part of the project

Results

P. cinnamomi is highly prevalent along walking and vehicle tracks within National Parks and included in the project for the HNCMA area. A total of 360 samples from 143 sites were taken by officers employed by the Royal Botanic Gardens; 3 samples from 1 site were submitted by council environmental officers from Hawkesbury Council; and 44 samples from 2 sites were submitted by environmental officers from the Department of Environment and Climate Change (DECC) as part of the project. See Tables 1a, 1b, 1c. The positive and negative results from the soil samples as well as the information obtained from the data sheet were mapped using Arc-Gis software. See Figure 1.

Location	Site	Sample date	P. cinnamomi (+)
Agnes Banks NR	Agnes Banks NR	15/11/07	0
Bargo SCA	Little river track	2/11/07	+
Berrowra Valley RP	Gt North Walk	5/06/07	+
Berrowra Valley RP	Gt North Walk to Cherrybrook	5/06/07	0
Berrowra Valley RP	Jungo to fishpond w alk	5/06/07	0
Berrowra Valley RP	Jungo track	5/06/07	0
Blue Mountains NP Blackheath	Braeside w alk near Govets Leap	5/02/08	+
Blue Mountains NP Blackheath	Bridle Vale Falls	5/02/08	+
Blue Mountains NP Blackheath	Evans LO picnic area	5/02/08	0
Blue Mountains NP Blackheath	Govets Leap LO	5/02/08	0
Blue Mountains NP Blackheath	Grand canyon Loop Track	5/02/08	+
Blue Mountains NP Blackheath	Hat Hill Road, Anvil Rock	5/02/08	0
Blue Mountains NP Blackheath	Perry's Lookdown	5/02/08	+++
Blue Mountains NP Blackheath	Evans LO	12/10/07	+
Blue Mountains NP Blackheath	Govetts leap LO	12/10/07	++
Blue Mountains NP Blackheath	Grand canyon Loop Trck	12/10/07	+
Blue Mountains NP Blackheath	Start of Braeside w alk	12/10/07	0
Blue Mountains NP Katoomba	Cliff Top Walk	6/02/08	0
Blue Mountains NP Katoomba	Echo Point	6/02/08	0
Blue Mountains NP Katoomba	Giant Staircase	6/02/08	+
Blue Mountains NP Katoomba	Prince Henry Cliff Top Walk	6/02/08	0
Blue Mountains NP Katoomba	Cliff Top	12/10/07	0
Blue Mountains NP Katoomba	Cliff w alk	12/10/07	0
Blue Mountains NP Katoomba	Giant stairway east of 3 sisters	12/10/07	+
Blue Mountains NP Katoomba	Golden stair Case	12/10/07	0
Blue Mountains NP Katoomba	Narrow , neck locked gate	12/10/07	+
Blue Mountains NP Glenbrook	Campfire Creek Trail	9/10/07	0
Blue Mountains NP Glenbrook	Entrance to Jack evans track	9/10/07	+
Blue Mountains NP Glenbrook	Euroka campsite	9/10/07	+
Blue Mountains NP Glenbrook	Euroka w alking trail Nth	9/10/07	0
Blue Mountains NP Glenbrook	Jelly bean pool	9/10/07	+
Blue Mountains NP Glenbrook	Oak ridge picnic area	9/10/07	0
Blue Mountains NP Glenbrook	Psgah rd track entrance	9/10/07	0
Blue Mountains NP Glenbrook	To redhands cave	9/10/07	0
Blue Mountains NP Glenbrook	Track to Bluepool	9/10/07	+
Blue Mountains NP Lawson	Empire pass track	9/10/07	+
Blue Mountains NP Leura	Golf Links Track	6/02/08	++
Blue Mountains NP Leura	Prince Henry Cliff Top Walk	6/02/08	0
Blue Mountains NP Leura	Sublime Point LO	6/02/08	+
Blue Mountains NP Mt Banks	Mt Banks	27/11/07	+
Blue Mountains NP Mt Wilson	Cathedral crk/fern w alk	11/10/07	+
Blue Mountains NP Mt Wilson	Du Faur's Rd	11/10/07	+
Blue Mountains NP Mt Wilson	Wallangambe w alking track	11/10/07	0
Blue Mountains NP Wentworth Falls	CharlesDarw in Wlk	10/10/07	++
Blue Mountains NP Wombeyan Caves	Wombeyan caves Rd	19/10/07	0
Blue Mountains NP Mount Victoria	Mt Piddington LO	5/02/08	+
Blue Mountains NP Mount Victoria	Victoria Falls Lookout	6/02/08	0
Blue Mountains NP Mount Victoria	Victoria Falls Road	6/02/08	+++

Table 1a

Location	Site	Sample date	P. cinnamomi (+)
Brisbane Waters NP	Pearl beach picnic site	31/10/07	+
Brisbane Waters NP	Scout camp gate	31/10/07	0
Brisbane Waters NP	Staples LO picnic area	31/10/07	+
Brisbane Waters NP	Tony Doyle Track	31/10/07	0
Brisbane Waters NP	Track to Aboriginal site	31/10/07	+
Brisbane Waters NP	Track to Pearl Beach	31/10/07	+
Brisbane Waters NP	Warrah LO	31/10/07	0
Burratorang SCA	Burratorang LO	2/11/07	+
Castlereagh NR	Barbara's Track	22/11/07	+
Castlereagh NR	South Trail	22/11/07	++
Castlereagh NR	Woollybutt Track	22/11/07	+
Cattai NP	Cattai w harf	15/11/07	0
Cattai NP	LO historic homestead	15/11/07	0
Cattai NP	Mitchell Park Track	15/11/07	0
Cattai NP	Mitchell Park Track	15/11/07	0
Cattai NP	Near historic homestead	15/11/07	0
Cattai NP	Near historic shed	15/11/07	0
Cattai NP	Old man Banksia Track	15/11/07	0
Cattai NP	Picnic area	15/11/07	0
Cattai NP	Picnic area near riverside	15/11/07	0
Dharug NP	Large grp camping area	22/10/07	0
Dharug NP	Mill Creek, GT circuit	22/10/07	0
Dharug NP	Mill crk camping area	22/10/07	0
Dharug NP	Picnic area	22/10/07	0
Dharug NP (sampled by DECC officer)	Simpson Track	22/11/07	+++
Hawkesbury Council	Comleroy Road, Kurranjong	21/11/2008	0
Kanangra Boyd NP	Easy w alk	10/10/07	+
Kanangra Boyd NP	Jenolan Caves	10/10/07	0
Kanangra Boyd NP	Kanangra Boyd Campground	10/10/07	0
Kanangra Boyd NP	Plateau w alk track	10/10/07	+
Kanangra Boyd NP	Road to lookout	10/10/07	+
Kanangra Boyd NP	w aterfall w alk track	10/10/07	+
Marramarra NP	Canedlands Trail	8/11/07	0
Marramarra NP	Gentlemans Halt Trail	8/11/07	+
Marramarra NP	Haw kins LO picnic area	8/11/07	+
Marramarra NP	Historic site	8/11/07	0
Marramarra NP	Marramarra ridge Track	8/11/07	0
Marramarra NP	Old Northern Rd LO	8/11/07	0
Marramarra NP	Paddy's blight	8/11/07	0
Marramarra NP	Singleton Rd cemety	8/11/07	0
Marramarra NP Coba Point	Neverfail Fire Trail	8/11/07	0
Mittagong	Mittagong LO	17/10/07	0
Morton NP Bundanoon	Echo point LO	17/10/07	+++
Morton NP Fitzroy Falls	East rim track	17/10/07	0
Nattai NP	Wombeyan caves Rd	19/10/07	0
Parr Conservation Park	Bicentennial Rd	29/11/07	++
Parr Conservation Park	Heartbreak Hill Camping	29/11/07	0
Parr Conservation Park	Near Jacks Track	29/11/07	0

Table 2b

Location	Site	Sample date	P. cinnamomi (+)
Popran NP	Flynn's Rd Track	23/11/07	0
Popran NP	Ironbark picnic area	23/11/07	+
Popran NP	Mt Olive Trail	23/11/07	+++
Popran NP	Mt White Area	23/11/07	+
Popran NP	Mt White trail	23/11/07	+
Popran NP	Popran Track fire trail	23/11/07	+
Popran NP	Road to caravan park	23/11/07	+
Scheyville NP	Avondale Rd	14/11/07	+
Scheyville NP	Horse riding path	14/11/07	0
Scheyville NP	Longneck Laggon Reservee	14/11/07	0
Scheyville NP	Trail intersectionScheyville & Old Pitt tow n F	14/11/07	0
Scheyville NP	Trail intersectionScheyville & Old Pitt tow n F	14/11/07	0
Scheyville NP	Trail off Old Pitt tow n Rd	14/11/07	0
Scheyville NP	Trail off old stock route Rd	14/11/07	++
Tarlo River NP *Only 2 samples from 1 site	Roadside, Grenw ich park	19/10/07	0
Thirlmere Lakes NP	Couridjah Lake (picnic area)	2/11/07	0
Thirlmere Lakes NP	Roadside(unsealed)	2/11/07	0
Thirlmere Lakes NP	Werri Berri picnic area	2/11/07	0
Windsor Downs NR	Hakea trail	22/11/07	0
Windsor Downs NR	Mr Corns Track	22/11/07	0
Windsor Downs NR	Surprise trail	22/11/07	0
Wollemi NP Capertree Valley (sampled by DECC	Capertree valley	15/11/07	0
Wollemi NP Crebra (sampled by DECC officer)	Crebra' via Glen Davis	15/11/07	0
Wollemi NP Glen Davis (sampled by DECC officer	Glen Davis	15/11/07	0
Wollemi NP Wolgan Valley	Wolgan valley	27/11/07	0
Wollemi NP Colo Heights	Bob Turners Track	16/11/07	++
Wollemi NP Colo Heights	Craw ford LO	16/11/07	0
Wollemi NP Colo Heights	Culoul Track	16/11/07	0
Wollemi NP Colo Heights	Grass Hill Trail	16/11/07	0
Wollemi NP Mt Lagoon	Tootie Creek Trail	27/11/07	+
Wollemi NP Newnes	campsite across river	11/10/07	++
Wollemi NP Newnes	To industrial ruins	11/10/07	0
Wollondilly NR	Wombeyan caves Rd	19/10/07	0
Yengo NP	Big Yango Homestead	23/10/07	0
Yengo NP	Bluegum campsite	23/10/07	0
Yengo NP	Convict Trail	23/10/07	0
Yengo NP	Finchley Camping area	23/10/07	0
Yengo NP	Finchley Trail	23/10/07	0
Yengo NP	Finchley Trck, Aboriginal site	23/10/07	0
Yengo NP	Finchley Trig LO	23/10/07	0
Yengo NP	Mogo Crk camping	23/10/07	0
Yengo NP	Mountain Arm	23/10/07	0
Yengo NP	St Albans	23/10/07	0
Yengo NP	Wheelbarrow Ridge Rd	29/11/07	0
Yengo NP	Womerah Range	29/11/07	0
Yengo NP	Yango Trail	23/10/07	0
ZigZag Railway St	Pcnic area	27/11/07	0

Table 1c

Phytophthora cinnamomi in the Hawkesbury Nepean Catchment Management Authority Area

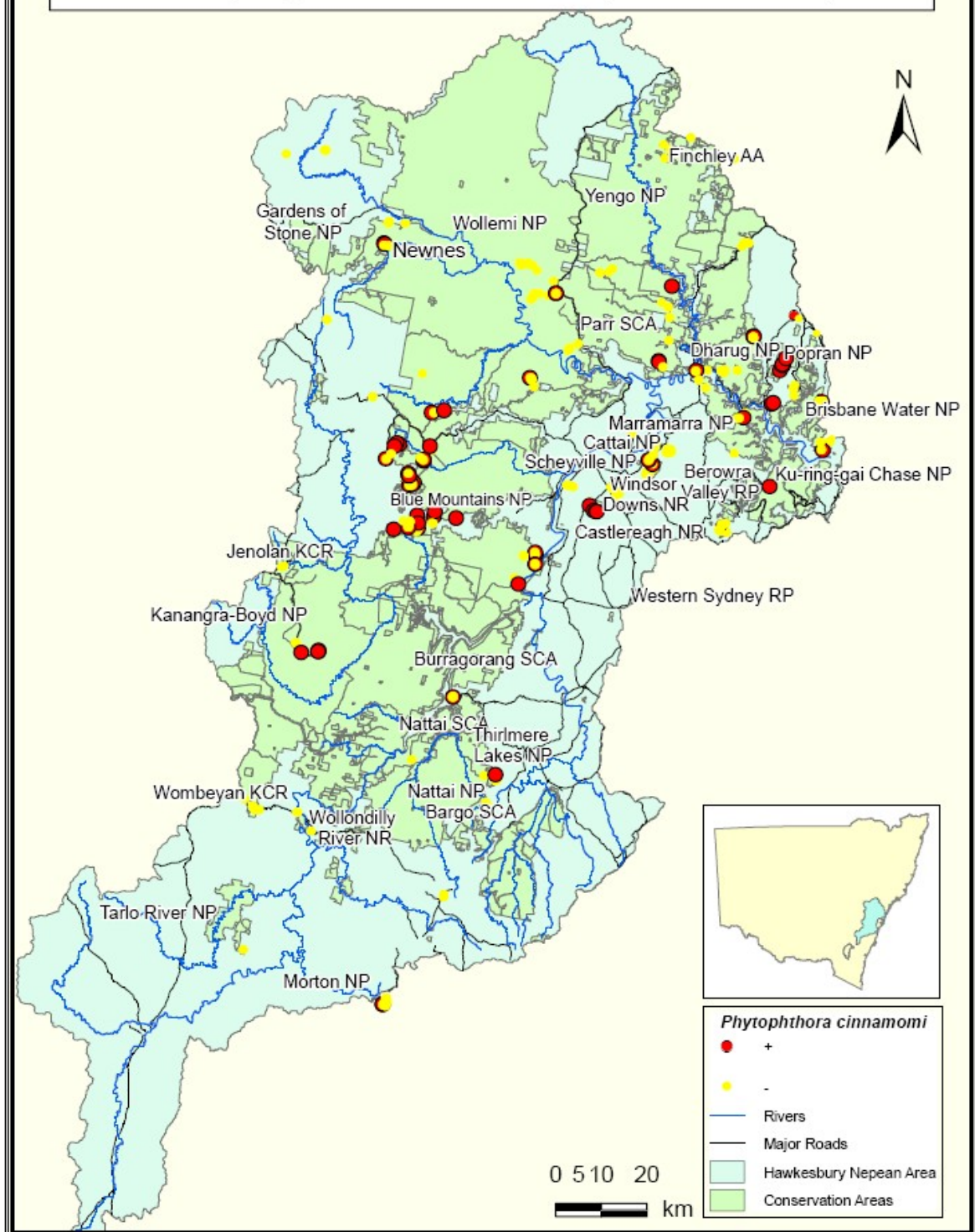


Figure 1 Map produced from the survey of the distribution of *P. cinnamomi* within in the Hawkesbury Nepean Catchment Management Authority area. Showing the positive (red) and the negative (yellow) *P. cinnamomi* sites

Conclusion

P. cinnamomi is highly prevalent along walking and vehicle tracks in the highly visited areas in National Parks within the HNCMA. It is important to understand that negative sampling results for *P. cinnamomi* do not prove that *P. cinnamomi* is absent from the sites sampled. Testing for the absence of the *P. cinnamomi* requires high resolution sampling and was outside the scope of this project, although it is likely that the pathogen is less prevalent in the northern Yengo and the Wollondilly areas.

The sampling resolution between bushland reserves was highly variable. Some bushland reserves were surveyed at a relatively higher resolution than others and this resulted in more positive returns for *P. cinnamomi*. Therefore it is important to recognise that sites showing high pathogen presence on the map are not necessarily more infested than areas tested at a lower resolution and showing a lower density of *P. cinnamomi*.

Outcomes

Further surveying at a local level is recommended in order to assess the extent of the spread of this pathogen into native vegetation and the threat that this pathogen poses to endangered ecological communities. As knowledge about the distribution and impact of *P. cinnamomi* at the local level within the HNCMA area improves, it will be possible to target hygiene and disease control measures at specific sites. Until then, implementing basic hygiene protocols before entering areas containing plant genera or species thought to be highly susceptible to *P. cinnamomi*, endangered ecological communities and wilderness areas will contribute to the abatement of the

threat of *P. cinnamomi* and will also reduce the risk of spreading other pathogens and invasive plants within the catchment.

References

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Appendix 1. Data recording Sheet

DATA RECORDING SHEET					
Date:		Sample number:			
Name:		(sampler assigns a number)			
1. Site identification (Essential)					
Location:			Aspect:		
Latitude eg -33.454545			Altitude:		
Longitude eg 151.454545			Datum (eg WGS84)		
2. Site health (Severity of Dieback) (Optional)					
0 insignificant (<5%)					
1 slight (5-25%)					
2 moderate (25-50%)					
3 severe (>50%)					
3. Site Drainage (Optional)					
1 poorly drained			Soil: eg. Sandy, clay,		
2 well drained					
3 rapidly drained					
4. Plant species (Optional)					
Species		Plant health		Notes	
Select no more than 5 species		1 <10% dieback		Symptoms? Other things of interest?	
		2 10-50% dieback			
		3 >50% dieback			
		4 tree dead, leaves			
		5 tree dead, no leaves			
Other notes:					