Gnangara Sustainability Strategy

An across-government initiative

Groundwater – Biodiversity – Land use

PHYTOPHTHORA DIEBACK INTERPRETATION REPORT OF YEAL NATURE RESERVE

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Phytophthora dieback interpretation report of Yeal Nature Reserve

Draft Report to the Department of Environment and Conservation and the Gnangara Sustainability Strategy

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Phytophthora Dieback Interpretation Report of Yeal Nature Reserve

Introduction

The banksia woodlands of the Swan Coastal Plain are especially at risk from the pathogenic root fungus *Phytophthora cinnamomi* as they contain many susceptible species. Dieback interpretation was undertaken to assess the impact of *P. cinnamomi* on the banksia woodland of the Gnangara Sustainability Strategy (GSS) study area. The Melaleuca forest block, proposed Melaleuca Nature Reserve (Pez and Swinburn 2009) and Yeal Nature Reserve (this report) were chosen as representatives of the banksia woodland occurring in the GSS. Field interpretation results of dieback infestations will not only assist the Department of Environment and Conservation (DEC) in the ongoing management of these native woodlands, but also provide on-ground baseline data for integration into associated dieback and remote sensing projects underway for the GSS.

Site location

Phytophthora dieback interpretation was undertaken in Yeal Nature Reserve by DEC interpreter John Meharry (Forest Management Branch). The total area of Yeal Nature Reserve is 11,300 hectares and of this 1,017 ha (203.4 km) were mapped. The nature reserve is bounded by private property to the north and east with access via Sandringham or Duffy Roads. To the west and south unallocated crown lands surround the nature reserve with access via Perry, Water and Tuart Roads. This area is within the low rainfall zone, having an annual rainfall of 700 mm to 800 mm.

Methodology

Previous Dieback Interpretation

Previous dieback interpretation of the area was undertaken in 2001 by Fieldview Nominees Pty Ltd. The interpretation was a broad area interpretation with no ground stripping of uninfested areas (ground stripping is commonly used in broad area interpretation where the entire area is traversed by foot to give 100% interpretation coverage of an area).

Recent Fire History

The most recent prescribed burn was in the area north from Tuart Road and east from Stewart Road in autumn 2005 resulting in a burn age of approximately 3 years (Figure 1). Burn ages less than 4 years since last burnt can render the area uninterpretable by removing indicator species and masking disease expression. Numerous prescribed burns or wildfires have occurred from 1982 through to 2005 in numerous locations with a variety of intensities and frequencies. These latter burns should not impact field interpretation surveys.

Threatened Flora

There are no corporate records of declared rare flora in the area, however a single population of the priority 3 species, *Dillwynia dillwynioides* occurs in the reserve (Atkins 2008). There are unconfirmed records of the priority 1 species, *Grevillea evanescens* and the priority 4 species, *Stachystemon axillaris* (Western Australian Herbarium 2008).

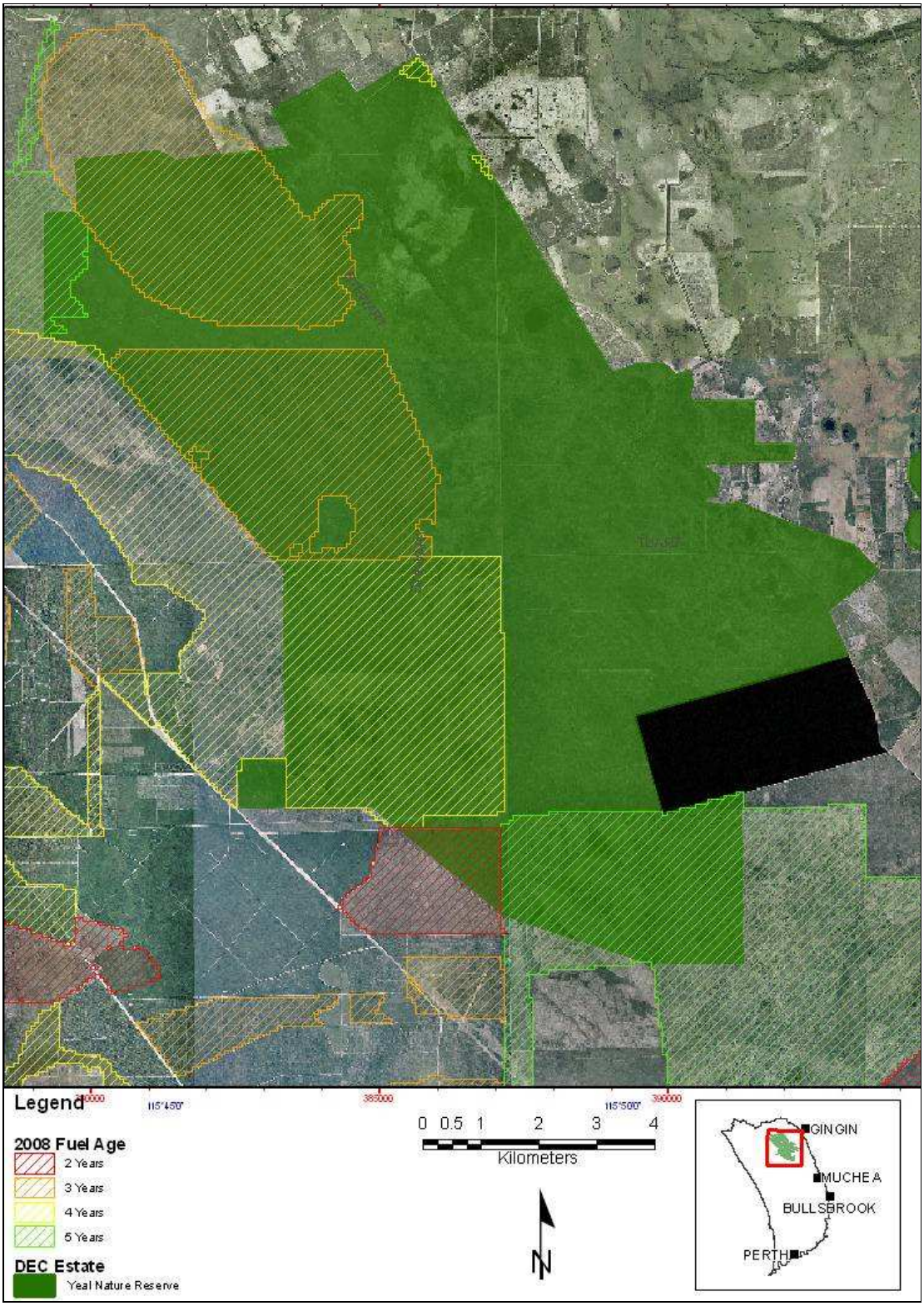

Figure 1: Fuel ages (<6 years) across proposed dieback assessment area based on the year since last burn (prescribed or wildfire).

Interpretation and Demarcation

In the field the area was interpreted by using linear survey techniques (along linear infrastructure such as roads, tracks and powerlines) with obvious infestations being recorded from aerial photography and then ground truthed. Presence or absence was determined not only through observation but by sampling of recently-dead indicator plant species. Field interpretation followed the standard methods and operating procedures for linear surveys described in the document titled "Volume 2 - *Phytophthora cinnamomi* and disease caused by it: Interpreter guidelines for detection, diagnosis and mapping" (CALM 2001). Interpretation commenced on the 2nd October, 2008 and was completed on the 7th of November 2008.

Non-differential, hand-held global positioning system (GPS) receivers were used for navigation and to record survey boundaries and waypoints for all linear demarcation boundaries. The infested areas were demarcated along all tracks interpreted using 50 mm day-glo tape with the knots facing the infestation.

Soil and Plant Sampling

Soil and tissue samples of recently dead or dying indicator species were collected to confirm the presence or absence of *Phytophthora* species, thereby assisting in the interpretation of the area. These soil and plant samples were forwarded to the DEC's Vegetation Health Service laboratory at Kensington, where diagnostic baiting was conducted. The sample point locations were recorded with GPS receivers (Table 2).

Mapping

Linear survey demarcation waypoints were captured using non-differential GPS receivers. The field observations, boundaries, waypoints and survey data were downloaded into a Geographic Information System from the GPS and tablet data to generate a *P. cinnamomi* occurrence map.

Areas are attributed to one of several definitions:

- Infested -with *P. cinnamomi;*

- Uninfested- (free of plant disease caused by *P. cinnamomi*);
- Uninterpretable- (those areas where the presence or absence of *P. cinnamomi* cannot be determined);
- Unprotectable- (infested areas and those areas where it is judged that autonomous spread of the pathogen will occur in the short term which is within a few years and up to 50 years); or
- Protectable- (free of plant disease caused by *P. cinnamomi* and likely to remain so with the current determination based on 50 years spread up-slope) (CALM 2001)

Uninfested areas 25 metres either side of the tracks are mapped. Only infested areas were mapped for the broad area surveys. As only obvious infestations were mapped from the photography it is highly likely that there are infestations within the unmapped areas which were not visible from the photography.

Results

Disease Distribution

The total linear length mapped was 203.4 km which equalled 1017 hectares of interpretation. Mapping identified 41 ha as being infested with *P. cinnamomi* with 969 ha interpreted as uninfested. A further 7 ha were uninterpretable. A large proportion of the area is assumed to be uninfested but was not surveyed to confirm this (unmapped areas) due to time and cost constraints.

P. cinnamomi distribution was mainly associated with open tracks and moisture gaining sites. The largest infested area was associated with Quin Brook which flows northwest from developed farmland on private property across the Yeal Nature Reserve towards Gingin Brook and the Moore River.

Table 1. Breakdown of areas interpreted for *Phytophthora* dieback by linear and broad interpretation survey

Category	**Area (ha)**
Uninfested	969
Infested	41
Uninterpretable	7
Total	**1017**

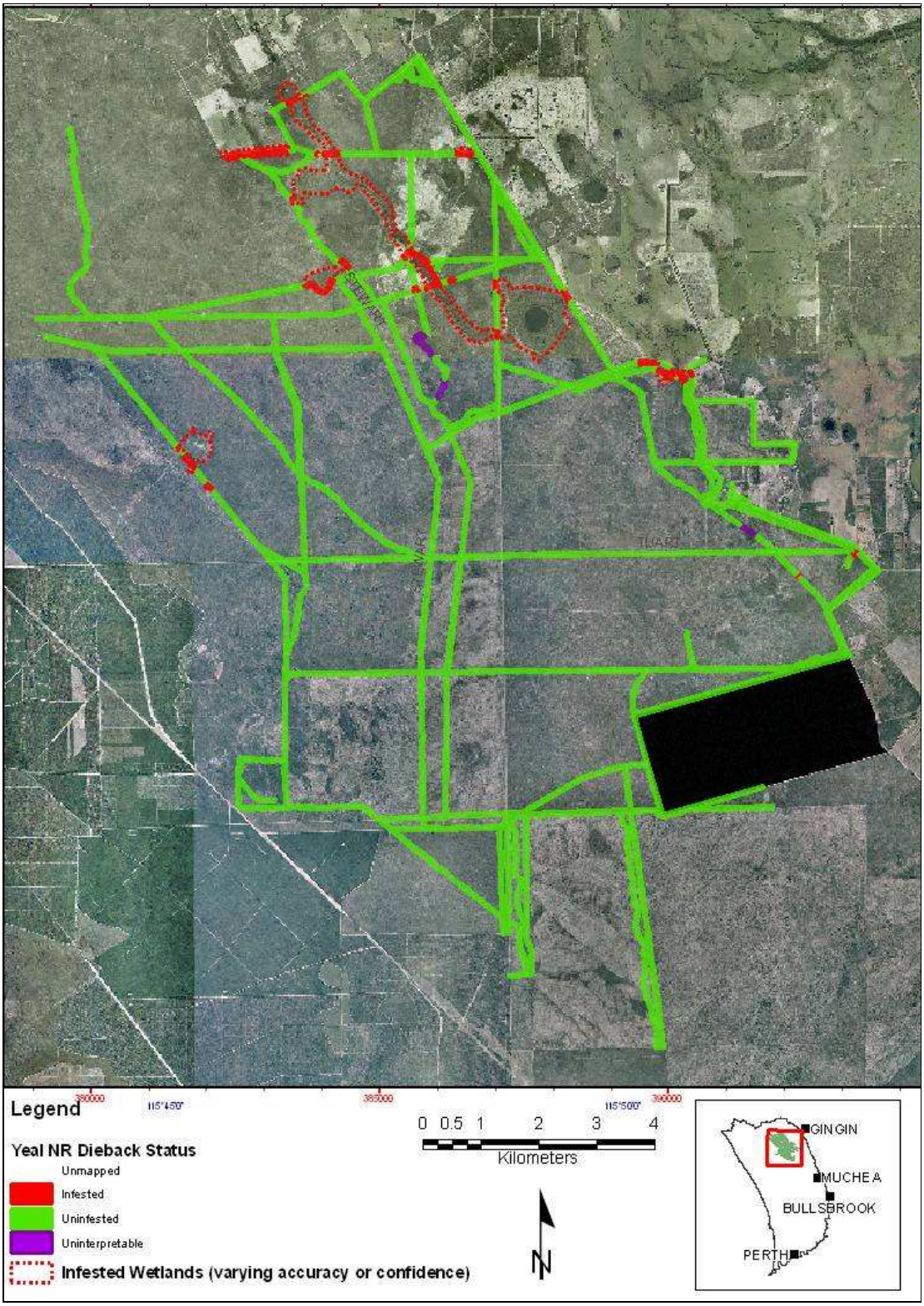

Figure 2. *Phytophthora* dieback interpretation map of Yeal Nature Reserve.

Disease Expression and Impact

The disease expression was generally poor with few fresh indicator species deaths along many sections of the infested boundary. There were also many background deaths which made interpretation in some areas more difficult. In some sections of the infestation an endemic or 'graveyard' effect was observed with a significant decrease in biomass and biodiversity.

Disease impact within the infestations is expected to be moderate to high in the *Banksia attenuata* and *Banksia ilicifolia* as the disease progresses. Other susceptible species are *Adenanthos cygnorum, Stirlingia latifolia, Patersonia occidentalis* and *Xanthorrhoea preissii.* Some of the infested swamps will show little or no obvious signs of disease due to a lack of susceptible species within the actual swamps. However disease expression in the surrounding vegetation can be seen, confirming these wetland areas are infested with *P. cinnamomi.*

Fire related deaths were observed through some of the area. Suspected drought deaths were also observed in many areas. Both fire and drought deaths can be separated from disease deaths by the lack of pattern and chronology.

Sample Results

Nine soil and tissue samples associated with dead or dying plants were taken throughout the area to confirm the presence or absence of the *Phytophthora* species (Table 2). The samples were taken where disease expression was less obvious. Only one sample (#3) was confirmed as *P. cinnamomi*. Sample five baiting identified a new, undescribed *Phytophthora* species (*P*. sp1) that seems to be confined to coastal areas and has so far been associated with the deaths of four *Banksia* species (Mike Stukely pers. comm.). Little is known about the host range or pathogenicity of this species and this is the first time it has been isolated from Yeal Nature Reserve. Baiting of sample eight identified the newly described *Phytophthora multivora* (Scott et al. 2009). This species was previously assigned as *P. citricola* in Western Australia. It has a known host range from 7 families and is widespread in the south west of Western Australia. Appendix I summarises the laboratory results of the sampling.

Table 2.

Sample No	Plant Sampled	Reference No	Result (cin, neg)
1	*Banksia attenuata*	**E** 384 252 **N** 6526 390	NEG
2	*Banksia attenuata*	**E** 384 430 **N** 6528 296	NEG
3	*Banksia attenuata / Stirlingia latifolia*	**E** 383 922 **N** 6528 282	***P. cinnamomi***
4	*Banksia ilicifolia*	**E** 390 524 **N** 6524 667	NEG
5	*Banksia attenuata*	**E** 390 025 **N** 6524 513	***P.* sp1**
6	*Banksia attenuata*	**E** 385 668 **N** 6525 796	NEG
7	*Banksia attenuata*	**E** 385 586 **N** 6524 388	NEG
8	*Banksia attenuata*	**E** 390 055 **N** 6524 430	***P. multivora***
9	*Patersonia occidentalis*	**E** 383 014 **N** 6528 304	NEG

Recommendations

Hygiene Management

Apply and maintain hygiene standards for movement of vehicles along all of the current tracks. Unmapped areas should be considered protectable and be treated with the same hygiene as uninfested areas.

Swan Coastal District to demarcate the tracks within 4 months of the interpretation with standardized dieback posts.

The following options should be considered to reduce the impact of *P. cinnamomi* in protectable areas:

1. Application of phosphite
2. Upgrade of tracks that intersect known infestations (e.g. with limestone base material), particularly tracks traversing wetland and moisture gaining sites.
3. Closure of tracks that intersect with known infestations

Use of Interpretation Map

A map has been prepared to show disease boundaries. This map is valid until November, 2011. However because *P. cinnamomi* has the ability to spread autonomously and through vectors such as machinery, vehicles and animals the map boundaries should be re checked if the map is more than 1 year old (November, 2009). A full interpretation is to be done after three years (after November, 2011), if there are continuing or new activities within the interpretation boundaries.

Conclusion

The Yeal Nature Reserve, on the Swan Coastal Plain was interpreted in October and November 2008 for the presence/absence of *P. cinnamomi*. A significant amount of the area infested is adjacent to Quin Brook. Large areas are probably uninfested but were not walked to confirm this (unmapped areas). It is possible that there are infestations within the unmapped areas that did not show up on the aerial photography and were therefore not mapped.

References

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Appendix

Table 3. Sample summary from Vegetation Health Service laboratory (DEC) analysis. ISD= indicator species death; M = Multiple; C = Cluster; S = Scattered and I = Isolated.

Species	**No. of samples**	**No. positive**	**Pc. %**	**ISD P.c positive**				**ISD P.c. negative**			
				M	**C**	**S**	**I**	**M**	**C**	**S**	**I**
Banksia attenuata	6	2	33	0	1	0	1	0	0	2	2
Banksia ilicifolia	1	0	0	0	0	0	0	0	0	1	0
Stirlingia latifolia	1	1	100	1	0	0	0	0	0	0	0
Patersonia occidentalis	1	0	0	0	0	0	0	0	0	0	1
TOTALS	**9**	**3**	**33**	1	1	0	1	0	0	3	3