IMPACT OF PHYTOPHTHORA CINNAMOMI ON THE CRITICALLY ENDANGERED 'EASTERN SHRUBLANDS AND WOODLANDS OF THE EASTERN SIDE OF THE SWAN COASTAL PLAIN' (SCP 20c) THREATENED ECOLOGICAL COMMUNITY

Photo by Val English

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SWAN COASTAL DISTRICT

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CONTENTS

INTRODUCTION

The Department of Environment and Conservation's (DEC's) Swan Coastal District has established a monitoring program for four Critically Endangered Threatened Ecological Communities, specifically those occurring within the Swan Catchment Council boundary of DEC's Swan Region. The project was established in 2003-04 with funds received from the Natural Heritage Trust and has continued to receive support in 2004-05 and 2005-06 from this source. The aim of undertaking a monitoring program for the communities is to determine the impact of threatening processes upon them including the introduction and/or spread of dieback, weed invasion and inappropriate fire regimes over a period of time.

A threatened ecological community may be defined as a naturally occurring biological assemblage that occurs in particular type of habitat and whose existence is threatened by processes acting upon the community (English and Blyth 1997). A threatened ecological community is listed under one of the following categories of threat: 'presumed totally destroyed', 'critically endangered', 'endangered' or 'vulnerable' (CALM 2006 – 'unpublished data).

Four 'critically endangered' community types have been selected for detailed monitoring as part of this NHT funded project – implementing a recovery action identified in the four Interim Recovery Plans (IRPs) for these TEC's. This monitoring report is for one of the four TEC's known as 'Eastern shrublands and woodlands (Swan Coastal Plain Community type 20c)' (Gibson *et al.* 1994).

Swan Coastal Plain community type 20c as identified in Gibson et al. 1994 occurs mainly on the transitional soils of the Ridge Hill Shelf, on the Swan Coastal Plain adjacent to the Darling Scarp, but also extends marginally onto the alluvial clays deposited on the eastern fringe of the Swan Coastal Plain. Typical and common species that occur in this community include *Banksia attenuata* and *Banksia menziesii*, occasionally with *Allocasuarina fraseriana*, *Adenanthos cygnorum*, *Hibbertia huegelii*, *Scaevola repens* var. *repens*, *Allocasuarina humilis*, *Bossiaea eriocarpa*, *Hibbertia hypericoides*, *Stirlingia latifolia*, *Conostylis aurea*, *Trachymene pilosa*, *Lomandra hermaphrodita*, *Burchardia umbellata*, *Patersonia occidentalis*, *Mesomelaena pseudostygia* and *Lyginia barbata* (Gibson *et al.* 1994).

The above listed community type is listed on DEC's Threatened Ecological Communities database and is endorsed by the WA Minister for the Environment and Heritage as 'Critically Endangered'. The community is also listed on the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* as 'Endangered'.

The purpose of establishing monitoring transects in areas of the reserve that are infested and not affected by *Phytophthora cinnamomi* is to determine, over time, the impact of the disease upon this plant community and to identify management actions that are required to ensure the conservation of the TEC into the future. In this early stage of the project, the purpose of this report is to provide a summary of the methodology used in establishing the monitoring project and to present a 'snapshot' of the findings to date.

METHODS

A total of eight transects, each measuring 10 metres in length were established within an occurrence of this 'critically endangered' community type at Talbot Road bushland in Stratton. There are only two known occurrences of this community type remaining on the Swan Coastal Plain, the second located on Commonwealth land. Each of the transects were established in October of 2004 and permanently marked with two dumpy pegs.

Upon analysis of the data and after a brief site inspection in January of 2006, it was determined that three transects had been located in the incorrect community type. As a result of this the three transects was subsequently removed from the analysis, resulting in a total of five transects, each 10 metres in length being used in the analysis.

Figure 1 below illustrates the location of the five transects within the Talbot Road Bushland.

Figure 1. Approximate location of transects within infested and un-infested portions of Talbot Road Bushland in Stratton

In 2003-04 a survey was undertaken for Talbot Road Bushland in Stratton to identify and map the presence of *Phytophthora cinnamomi* throughout the TEC. The survey detected the disease in the majority of the reserve however a small area in the central western portion was determined to be free of plant disease symptoms that indicate the presence of *P.cinnamomi.* A map showing the extent of the disease is presented in Figure 2 below. Two of the transects were established in a portion of the community that is known to be infested with *Phytophthora cinnamomi* and the remaining three placed in an area that is not infested with the disease.

A map showing the location of the reserve within DEC's Perth Hills District is presented in Figure 3 below.

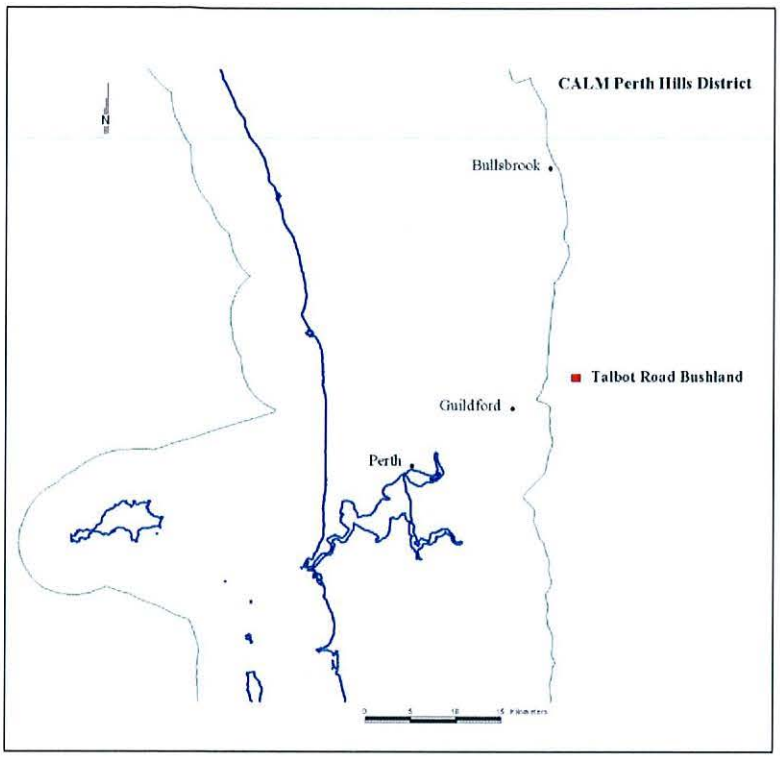

Figure 3. Map showing location of Talbot Road Bushland, Stratton

Within the community the following information was recorded for each transect:

- Date transect established and monitored
- GPS location
- Presence or absence of dieback
- Photograph of the transect
- Vascular plant species, strata layer and height
- Ranking of vegetation condition
- Ranking of recreational use at the site
- Fire history
- Site data (including slope, soil, drainage, leaf litter)

All vascular plant species, including introduced taxa, were recorded at 10 centimetre intervals along the length of each transect where the plant either intersected the transect directly or occurred as overhang. A total of 100 points were recorded.

Plant voucher specimens were collected for all taxa recorded along the transects and were identified by experienced botanists. It is intended that all specimens will be submitted to the Western Australian Herbarium for incorporation into the main collections. Refer to Appendix A for a full species list, including voucher number.

In November of 2004 photo monitoring points were established at each of the permanently established monitoring transects to determine a visual change in the communities over a period of time. Refer to Appendix B for photograph record.

RESULTS

Species richness of introduced and native plant species

One introduced taxa was recorded for the two transects established in the vegetation infested with *Phytophthora cinnamomi*, and three taxa from two families and three genera were recorded in the portion of the reserve not affected by the disease. The origins of the exotic species were Europe and South Africa. The family containing the greatest number of introduced taxa was Asteraceae (2) while the Poaceae family contained one introduced species. Only annual weed species were recorded from the transects. Refer to Appendix A for a list of species recorded in the infested and un-infested portions of the Talbot Road reserve.

A total of 35 native taxa from 17 families and 31 genera were recorded from the two transects established in the vegetation infested with *Phytophthora cinnamomi*, and 40 taxa from 17 families and 30 genera were recorded from the three transects placed in the portion of the reserve known to be free of the disease. One Priority taxa, *Isopogon drummondii* (P3), was recorded from the transects located in the portion of the reserve that has been identified as free of *Phytophthora cinnamomi*. Refer to Appendix A for a list of species recorded from the infested and un-infested portion of the Talbot Road reserve.

In the area infested with dieback, the families containing the greatest number of native taxa were Haemodoraceae (7), Cyperaceae (4) and Restionaceae (4), those typically resistant to *P.cinnamomi*. In the portion of the reserve not affected by dieback again Haemodoraceae (8 spp.) contained the greatest number of species with Myrtaceae (6) and Proteaceae (4) containing high number of native species present.

Figure 4 below illustrates the mean number of introduced and native species recorded per transect within the infested and un-infested portions of the reserve.

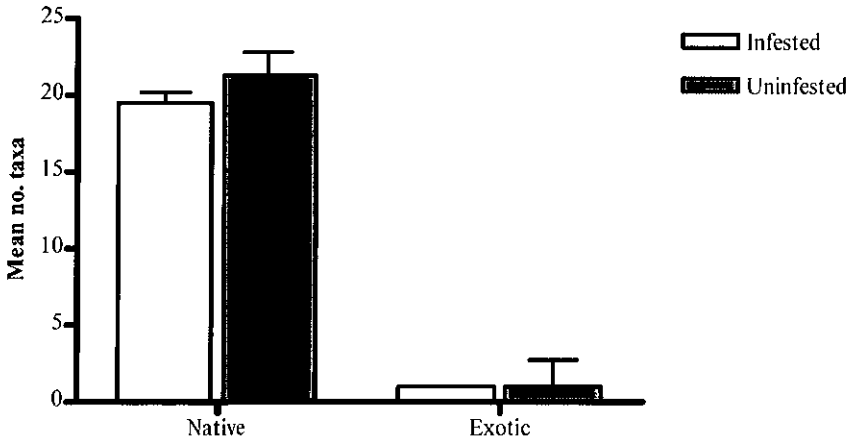

Figure 4. Mean number of native and exotic taxa recorded within *Phytophthora cinnamomi* infested and un-infested portions of community 20c (S.D. error bars).

The graph illustrates that the mean number of exotic species recorded per transect in the un-infested vegetation is the same as that recorded in the area affected by the disease.

The mean number of native species recorded per transect in the un-infested vegetation was slightly higher than in the area affected by the disease, with 22.2 and 19.5 species recorded respectively.

Figure 5 below, illustrates the mean number of native species recorded per transect that are considered susceptible, resistant or unknown to *Phytophthora cinnamomi* within the Talbot Road reserve.

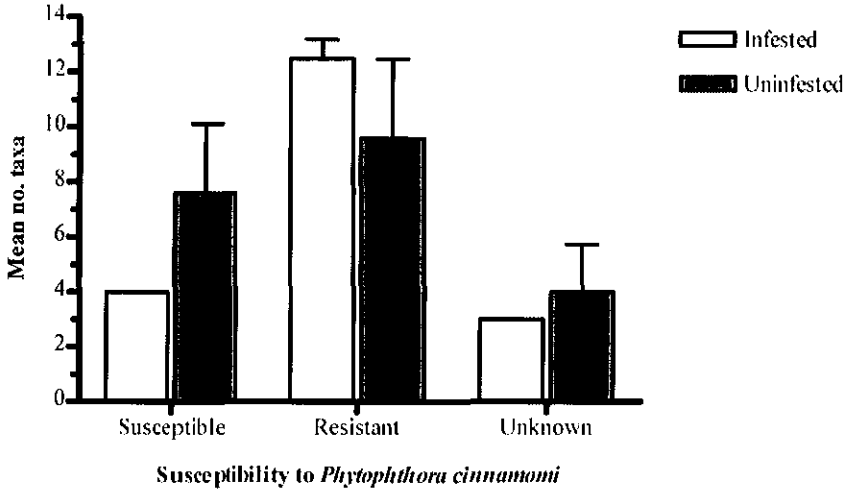

Figure 5. Mean number of native taxa susceptible and resistant to *Phytophthora cinnamomi* (S.D. error bars).

The graph illustrates similar numbers of species resistant to *P. cinnamomi* in both the infested and un-infested areas. However there is a contrast in the number of susceptible species recorded within the two areas, with approximately 50 percent more species recorded in the area identified as being free from the disease. These numbers exclude exotic species.

Figure 6 below, illustrates the mean number of introduced and native species present in the infested and un-infested areas of the reserve classified by their life form.

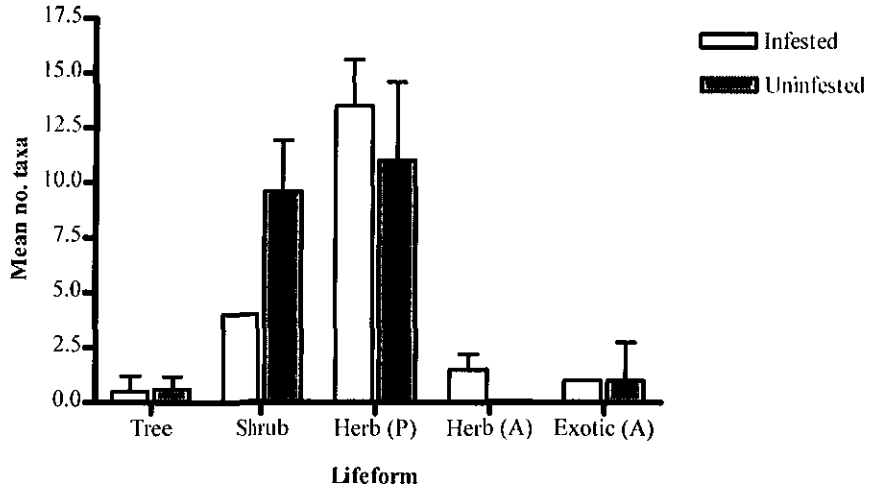

Figure 6. Mean number of taxa by lifeform in areas of Talbot Road reserve that are infested and uninfested by *Phytophthora cinnamomi*. (P) refers to perennial and (A) annual (S.D. error bars).

The graph illustrates a similar number of native herbs, with 13.5 and 11 native perennial herbs recorded in both the infested and un-infested areas respectively. There is a significant difference in the number of native shrubs present between the infested and un-infested areas, with more than double the number of shrubs recorded in the portion of the reserve not affected by dieback (9.6 species in contrast to 4 species).

Plates 1, 2, 3, 4 and 5 in Appendix B illustrate the photo monitoring points that were established in this community type in 2004.

Cover of introduced and native plant species

Figure 7 below, illustrates the mean percentage cover of introduced and native species present in the infested and un-infested areas of the reserve classified by their lifeform.

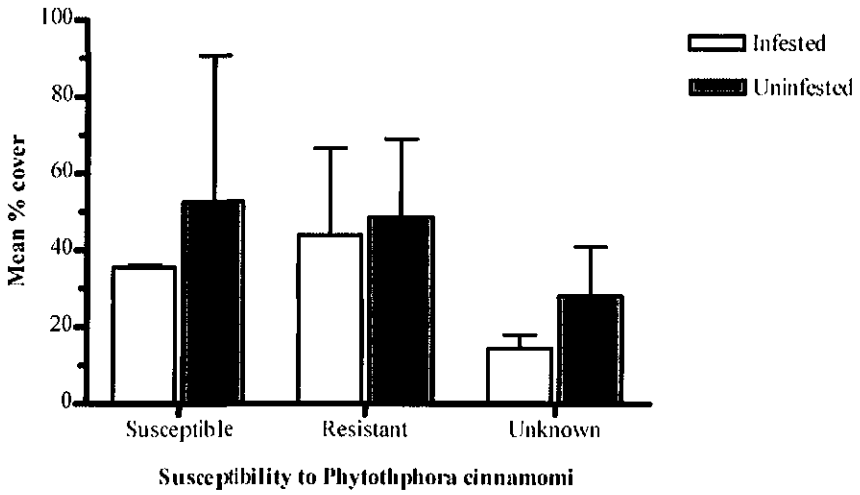

Figure 7. Mean percentage cover of susceptible, resistant and unknown native taxa within infested and un-infested portions of community type 20c at Talbot Road reserve (S.D. error bars).

The graph illustrates a similar mean percentage cover of resistant taxa in both the area infested with *P. cinnamomi* and without, with 44 and 48.7 percent cover per transect respectively.

The graph shows a significant contrast in the mean percentage cover of susceptible taxa, with the susceptible taxa in the area unaffected by dieback contributing 25 percent more cover per transect than area infested with the disease.

The cover of the unknown taxa in the un-infested area is 50 percent greater than in the transects located in the area infested with dieback.

Figure 8 below, illustrates the mean percentage cover of taxa present in the infested and the un-infested areas of the reserve by their lifeform.

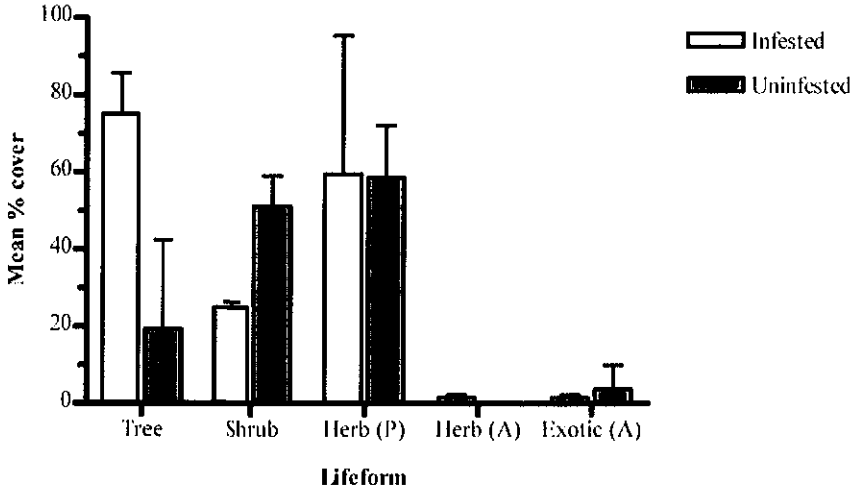

Figure 8. Mean percentage cover of taxa by lifeform in areas infested and unaffected by *Phytophthora cinnamomi* (S.D. error bars).

The graph illustrates a very similar mean percentage cover of native perennial herbs in both the area infested with *P. cinnamomi* and without, with 59.5 and 58.7 percent cover per transect respectively.

The graph shows a substantial difference in the mean percentage cover of native shrubs and native trees between the two areas, with double the cover of shrubs in the area not infested with the disease (51.3% in contrast to 25%), and almost three times the cover by trees (19.3% in contrast to 7.5% in the infested area).

The mean percentage cover of annual weeds was approximately 50 percent less in the infested area compared to the area not affected by the disease, with 1.5 and 3.7 percent cover respectively.

DISCUSSION

In 2003-04 a survey was undertaken for Talbot Road reserve in Stratton, to identify and map the presence of *Phytophthora cinnamomi* throughout the reserve. The survey detected the disease in the majority of the reserve however a small area in the central western portion was determined to be free of plant disease symptoms that indicate the presence of *P.cinnamomi.* A map showing the extent of the disease is presented in Figure 2 in the methods section of this report.

As illustrated in Figure 4 the portion of the reserve that is infested with *P.cinnamomi* has a slightly lower species richness than the portion not affected by the disease. This may be attributed to the death of a number of the susceptible plants once infected with the disease and as the pathogen spreads through the plant community, the species richness decreases as a result.

The significant difference in the mean number and cover of species that are susceptible to *Phytophthora cinnamomi* in the infested portion of the reserve in contrast to the number in the un-infested area is likely to be attributed to the fungus having resulted in the death of many susceptible species. In the un-infested area there

is a much higher proportion of susceptible species still surviving due to the absence of the disease and therefore healthier vegetation.

The portion of the reserve supporting community type 20c that is infested with *P.cinnamomi* has a significantly lower number and cover of native shrubs present in contrast to the area not affected by the disease. This may be because the species that comprise the shrub layer in the infested area are more susceptible to dieback and therefore are likely to have died out, leaving a high number of native herbs that are predominantly resistant to the disease. In contrast, in the vegetation not affected by dieback a high number of shrubs and significant cover still remain.

The data to date appears to indicate that the infestation of a portion of the Talbot Road reserve with *Phythopthora cinnamomi* has had an impact on the 'critically endangered' community type 20c. The disease appears to have altered the community's shrub layer by significantly reducing the mean number and cover of native shrubs present in the community.

The presentation of the results in this report represents a snapshot of the data collected from the monitoring transects established in the community to date, and as a result the findings are preliminary. With monitoring of the transects undertaken over a period of time the trends in the data will become more defined.

The following recommendations have been derived from the findings of the report:

- The sample size (i.e. the number of transects in the infested and un-infested portion of the reserve) should be increased so that statistical analysis can be performed on the data with powerful results.

- The monitoring of should continue long-term so that statistical analyses are able to be performed on the data and therefore ensure the results of such tests are powerful. With long-term monitoring the trends in the data will become more evident and conclusions relating to the extent and impact of *P.cinnamomi* upon this particular community type will be able to be made.

- Hygiene management measures should be set up at the reserve by the DEC's Perth Hills District and all staff visiting the reserve should be briefed on the importance of ensuring clean vehicles etc when visiting the reserve.

- A dieback hygiene plan should be developed for Talbot Road Bushland.

REFERENCES

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Status of Phytophthora cinnamomi (Pc) in Talbot Road Bushland, Stratton

Grid shown at 500 metre intervals
Graticule shown at 15 seconds intervals

1:12,000 (A4)

0 65 130 260 390 520
Meters

Department of Environment and Conservation

Projection: Universal Transverse Mercator
MGA Zone 50. Datum: GDA94

Interpretation undertaken by
Forest Management Branch
in 2004

Produced under the Direction of
Keiran McNamara
Director General, Department of
Environment and Conservation

Produced at 15:3pm, on March 17, 2008

Pc Status Infested; Uninfested (Protectable); Unprotectable; Uninterpretable (Protectable)

Appendix A: Occurrence of exotic and native taxa within infested and un-infested portion of swan coastal plain community type 20c

	Voucher number	INFESTED	UNINFESTED
ANTHERICACEAE			
Arnocrinum preissii	INF3.7, UNINF3.9	X	X
CYPERACEAE			
Cyathochaeta avenacea	UNINF3.4		X
Lepidosperma pubisquameum	INF3.20	X	
Mesomelaena graciliceps	UNINF3.15		X
Mesomelaena pseudostygia	INF2.6, INF3.11, UNINF1.2, UNINF3.3	X	X
Schoenus brevisetis	INF3.9	X	
Tricostularia neesii var. *neesii*	INF2.14	X	
DASYPOGONACEAE			
Dasypogon bromeliifolius	INF3.10, UNINF1.12, UNINF2.4, UNINF3.19	X	X
Lomandra caespitosa	INF2.16	X	
HAEMODORACEAE			
Anigozanthos manglesii	INF2.17, INF3.12	X	
Conostylis aculeata subsp. *aculeata*	INF2.8, UNINF3.16	X	X
Conostylis aculeata subsp. *cygnorum*	UNINF2.1		X
Conostylis aurea	INF3.19, UNINF3.1	X	X
Conostylis setigera subsp. *setigera*	UNINF1.4		X
Haemodorum laxum	INF2.19, UNINF2.8	X	X

Haemodorum paniculatum	INF3.15, UNINF1.5, UNINF3.6	X	X
Haemodorum simplex	UNINF2.19		X
Haemodorum spicatum	INF2.4	X	
Phlebocarya filifolia	INF3.16, UNINF1.10, UNINF2.3	X	X
IRIDACEAE			
Patersonia occidentalis	INF3.17, UNINF2.15, UNINF3.11	X	X
POACEAE			
Amphipogon turbinatus	INF3.4, UNINF1.9, UNINF2.21, UNINF3.10	X	X
Austrodanthonia occidentalis	INF2.15	X	
Austrostipa compressa	INF2.11	X	
**Aira cupaniana*	UNINF2.9		X
RESTIONACEAE			
Chordifex sinuosus	INF3.3, UNINF3.20	X	X
Desmocladus asper	UNINF3.18		X
Hypolaena exsulca	INF3.1	X	
Lepidobolus preissianus subsp. *preissianus*	INF2.10	X	
Lyginia imberbis	INF2.20, UNINF1.13, UNINF2.12, UNINF3.17	X	X
APIACEAE			
Trachymene pilosa	INF3.18	X	
ASTERACEAE			

**Hypochaeris glabra*	UNINF2.16		X
Podolepis gracilis	INF2.9	X	
**Ursinia anthemoides*	INF2.12, INF3.22, UNINF2.13	X	X
CASUARINACEAE			
Allocasuarina humilis	UNINF1.16, UNINF2.10		X
DILLENIACEAE			
Hibbertia acerosa	UNINF3.13		X
Hibbertia huegelii	UNINF2.22		X
DROSERACEAE			
Drosera pallida	INF2.13	X	
EPACRIDACEAE			
Conostephium pendulum	UNINF1.19, UNINF2.5		X
Lysinema ciliatum	INF2.3	X	
HALORAGACEAE			
Gonocarpus cordiger	UNINF3.22		X
Gonocarpus pithyoides	UNINF1.15		X
MIMOSACEAE			
Acacia auronitens	UNINF3.7		X

MOLLUGINACEAE			
Macarthuria australis	INF3.14	X	
MYRTACEAE			
Calytrix flavescens	UNINF2.7		X
Eremaea pauciflora	UNINF2.17		X
Eremaea pauciflora var. *lonchophylla*	UNINF1.3		X
Eremaea pauciflora var. *pauciflora*	UNINF3.14		X
Melaleuca trichophylla	UNINF1.18		X
Scholtzia? involucrata	UNINF1.8		X
Verticordia densiflora var. *densiflora*	INF2.2	X	
PAPILIONACEAE			
Bossiaea eriocarpa	UNINF1.20, UNINF2.11		X
Daviesia triflora	UNINF1.6, UNINF2.6, UNINF3.2		X
Gompholobium aristatum	INF2.18, INF3.8	X	
Gompholobium capitatum	UNINF1.7, UNINF2.2, UNINF3.12		X
PROTEACEAE			
Banksia attenuata	INF2.5	X	X
Conospermum stoechadis subsp. *sclerophyllum*	INF2.7, INF3.13	X	
Isopogon drummondii (P3)	UNINF1.11, UNINF2.14		X
Petrophile linearis	UNINF1.17, UNINF2.18, UNINF3.5		X
Stirlingia latifolia	INF3.6, UNINF1.21, UNINF2.20, UNINF3.8	X	X

STYLIDIACEAE			
Stylidium brunonianum	INF3.5	X	
Stylidium brunonianum subsp. *brunonianum*	UNINF1.14, UNINF3.21		X
Stylidium? *bulbiferum*	INF3.2	X	
VIOLACEAE			
Hybanthus calycinus	INF2.1, UNINF1.1	X	X

Appendix B: Photographic record of monitoring transects established at the Talbot Road reserve in 2004

Plate 1. Community type 20c infested with *Phytophthora cinnamomi*. Transect INF2.

Plate 2. Community type 20c infested with *Phytophthora cinnamomi*. Transect INF3.

Plate 3. Community type 20c not impacted by *Phytophthora cinnamomi*. Transcect UNINF1.

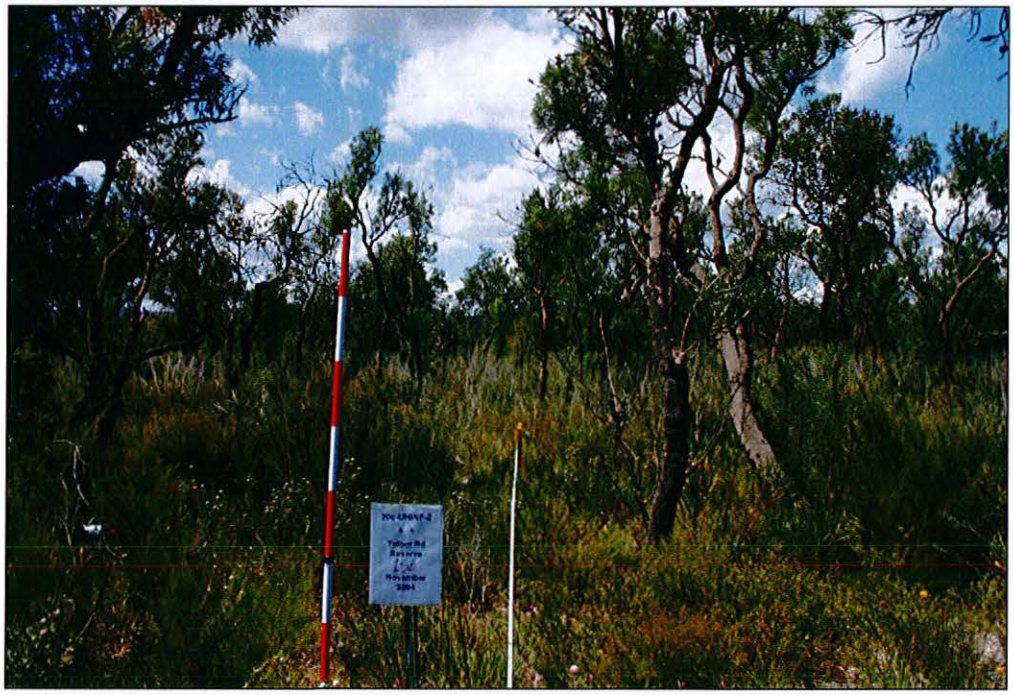

Plate 4. Community type 20c not impacted by *Phytophthora cinnamomi*. Transect UNINF2.

Plate 5. Community type 20c not impacted by *Phytophthora cinnamomi*. Transect UNINF3.