



Woookarung Regional Park *Phytophthora
cinnamomi* sensitivity mapping

Report prepared for Parks Victoria – Western Region

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1. Introduction

1.1 Project background

Biosis Pty Ltd was commissioned by Parks Victoria to undertake a flora assessment of Woowookarung Regional Park to detect areas of vegetation that are susceptible to *Phytophthora cinnamomi* (hereafter referred to as PC). The park has a large population of Austral Grass-trees *Xanthorrhoea australis* which has been identified through the park planning process as a highly valued feature by park users. Grass-trees are especially susceptible to infection by PC, the result of which is often reduced health and death. Infection by PC can result in plant sickness and death, referred to as 'dieback'. Example photographs of Austral Grass-tree condition states are provided in Appendix 1.

The park has a long history of disturbance, being initially used as a mining area, and more recently as a forestry plantation site, where areas are still recolonising with native species from recent clearing events. Due to these events, the trees are relatively young, and there is a mixture of weed and native understory species throughout the park. Within the park two Ecological Vegetation Communities were identified: Heathy Dry Forest (EVC 20) and Valley Grassy Forest (EVC 47). Valley Grassy Forest is considered vulnerable within the bioregion. Currently, the park is used by the public for recreational purposes including walking, cycling and 4WD tracks. These activities are mostly confined to the existing track network, including both formal and informal roads and tracks.

The persistence of *Xanthorrhoea* spp. within the park is highly valued, and therefore assessments of population health are being taken. This assessment will identify areas of the park that currently appear free from the disease, along with areas that show signs of potential infection, with a key indication being areas of Grass-tree dieback.

Phytophthora cinnamomi

Phytophthora cinnamomi, commonly known as Root-rot fungus or Cinnamon fungus, is a water mould that inhabits the soil. Being a water borne pathogen, the spread of infection is often greater in porous soils where water can move freely, such as sandy loams, and as a result it is commonly identified within the coastal and heathland vegetation types. When conditions are suitable for PC, it can cause dieback of range of native species, resulting in changes to communities and in extreme cases local extinction of entire species. The presence of PC throughout Victoria is well recognised, with many parks having identified the disease as present.

PC is listed as a key threatening process under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999*. The listing reflects the ability of the mould to cause widespread damage to flora, reduce fauna habitat and lead to local extinction of species.

Fire can help reduce the spread of PC as it kills the disease, but only to a soil depth of approximately 20 cm.

Austral Grass-tree and Small Grass-tree

Grass-trees *Xanthorrhoea* spp. are robust monocot species within the Xanthorrhoeaceae family, which also includes the Mat-rush *Lomandra* genus. Two species of Grass-tree *Xanthorrhoea* spp. are known to occur within the Ballarat area, including Woowookarung Regional Park:

- Austral Grass-tree *Xanthorrhoea australis* is a large, slow growing and long-lived (potentially up to 300 years) Grass-tree species that can form tall trunks after several years of growth. This species is widespread within Woowookarung RP.

- Small Grass-tree *Xanthorrhoea minor* subsp. *lutea* is a smaller, tufted species that does not generally form trunks. Known to occur in a small number of locations within Woookarung RP.

Grass-trees generally have shallow root systems and are therefore highly susceptible to soil disturbance. Flowering may occur erratically in response to stress, but is generally most prolific in the spring and particularly following a bushfire. Grass-trees are known to be highly susceptible to PC infection and are often used as early indicators of presence of the pathogen.

1.2 Scope of assessment

The objectives of this investigation are to:

- Assess all areas of Woookarung Regional Park and map native vegetation that shows signs of PC infection or deemed to be at risk of infection due to presence of susceptible species.
- Recommend any further assessments of the site that may be required (such as soil testing for PC in areas that appear strongly affected).

1.3 Location of the study area

Woookarung Regional Park is located approximately seven kilometres east of Ballarat (Figure 1). It encompasses 641 hectares native of vegetation, with some ex-plantation areas currently regenerating from recent clearing events. The geology of the park contains low and dissected ridges of Palaeozoic sedimentary rocks with stripped soils and quartz deposits, which is a result of the intense mining history of the park.

The study area is within the:

- Central Victorian Uplands Bioregion
- Barwon River Basin (Barwon River Catchment)
- Corangamite Catchment Management Authority (CMA)
- City of Ballarat.

2. Methods

2.1 Site investigation

2.1.1 Flora assessment

The flora assessment was undertaken between the 20th September and 6th of December 2017. The assessment focused on mapping the location of Grass-trees (both Austral Grass-tree and Small Grass-tree), with data gathered relating to percentage cover, health, age estimate (based on presence of trunk) and evidence of fire/burning for individual Grass-trees.

Prior to the commencement of fieldwork, the park was split into polygons, where topography and roads were used as boundaries to each polygon. Data about the presence and health status of Grass-trees was recorded from within each polygon. This data described the total cover, cover of healthy, cover of dead, cover of stumps and cover of slumped Grass-trees. Along with this, the age of present Grass-trees was recorded, based on the percentage of recruiting, tussock and trucked Grass-trees, and the spatial arrangement, being either uniform, clumped or scattered individuals.

2.2 Qualifications

Ecological surveys provide a sampling of flora at a given time and season. There are a number of reasons why not all species will be detected at a site during survey, such as low abundance, patchy distribution, species dormancy, and seasonal conditions. In many cases these factors do not present a significant limitation to assessing the overall biodiversity values of a site.

All forested areas were assessed on foot. Cleared ex-plantation areas were inspected by vehicle to confirm absence of Grass-trees from these areas.

The current assessment was conducted in spring, which is a suitable time for monitoring the health of the Grass-trees.

2.3 Mapping

Parks Victoria supplied a map that highlighted 18 priority areas to be surveyed for PC presence (Figure 1).

Mapping was conducted using hand-held (uncorrected) GPS units and aerial photo interpretation. The accuracy of this mapping is therefore subject to the accuracy of the GPS units (generally ± 7 metres) and dependent on the limitations of aerial photo rectification and registration.

Mapping has been produced using a Geographic Information System (GIS). Electronic GIS files which contain our flora spatial data are available to incorporate into design concept plans. However this mapping may not be sufficiently precise for detailed design purposes.

3. Results

The majority of the study area has been highly modified due to past land clearing and mining practices, and areas of the park are currently regenerating. The study area now supports a large population of Austral Grass-tree, some areas of which appear to have been impacted by the spread of PC.

Example photos of Austral Grass-tree, showing a range of condition states, are provided in Appendix 1.

3.1 Grass-tree assessment

The areas mapped as dieback within the park are areas that contain a noticeable amount of sick or dead Grass-trees. This was often determined due to the presence of three or more Grass-tree stumps and/or slumped individuals. This mapping is not detailing areas where PC is present, but more so highlighting areas that should be investigated for the presence of the disease due to a large number of sick or dead individuals. Soil testing will need to be completed to confirm the presence of the disease.

A summary of the cover of Austral Grass-tree across the park is provided in Table 1. Grass-trees were absent from 46% of the park. The remaining 54% of the part supported some cover of Grass-trees, with the majority of this area having less than 25% cover. Very high cover (>25%) of Grass-trees was recorded in 14% of the study area.

Table 1 Cover (%) of Grass-trees across the study area

Absent	< 10%	10-25%	25-50%	50-75%
46 %	23%	18%	12%	2%

Most areas of the study area supported a high percentage of healthy Grass-trees (39% of the total area, or 72% of the area with Grass-trees).

Areas of the park were undergoing planned burns of individual Grass-trees at the time of the assessment. This process removed the skirt of the Grass-trees, but left most of the crown foliage. It is unlikely that the burning had an impact on the heath assessment, or any other component of the Grass-tree assessment as the age and health status could still be determined.

The majority of areas that were mapped as dieback were on slopes. Declines in Grass-tree health in areas along vehicle and bike/walking trails could be attributed to disturbance to the shallow root system of the species. Regardless of whether PC is detected or not in these areas, consideration should be given to track management to reduce the impacts on nearby Grass-tree roots.

Areas absent of Grass-trees

No Grass-trees were observed in areas of the park that had recently been cleared for logging and were in the early stages of regeneration (Photo 14). The habitat conditions within these areas are not currently suitable for Grass-tree establishment. Along with the cleared areas, creek lines and damp areas rarely had any Grass-trees recorded, and there was no evidence of dieback through a high presence of stumps or dead individuals. It is likely that the habitat in these areas is not suitable for Grass-trees, as opposed to the populations being impacted by PC in the past. Grass-trees were also absent or in very low densities in some hillside areas, but similar to the wet areas, these areas do not contain evidence of stumps of dead Grass-trees, and it's likely the population is limited in these areas due to other environmental factors.

Small Grass-tree presence

Only three main populations of Small Grass-tree were identified within the park. Two patches were primarily dominated by Small Grass-tree and had a high percentage cover (50 – 75%), and a clear separation between Small Grass-tree and Austral Grass-tree patches was apparent. The other patch was mixed in with Austral Grass-tree, and had a lower cover (10 – 25%). The Small Grass-tree in the smaller patch contained some flowering individuals. Aside from these two main patches, there was the odd individual of Small Grass-tree spread across the site. No signs of dieback were recorded in any Small Grass-tree patches.

3.2 Further survey recommendations

A soil testing program will be required to confirm the presence and distribution of PC within Woowookarung RP. If confirmed, continual monitoring of the areas identified as being at risk of PC infection is recommended to reduce the impacts of the mould and maintain the Grass-tree population health.

Management of walking and cycling tracks to direct water run-off and reduce soil spread will assist in preventing the spread of PC if found to be present within areas of the park. Notice boards to inform the community about the risk of PC to native vegetation and how spread can be reduced could help manage the disease.

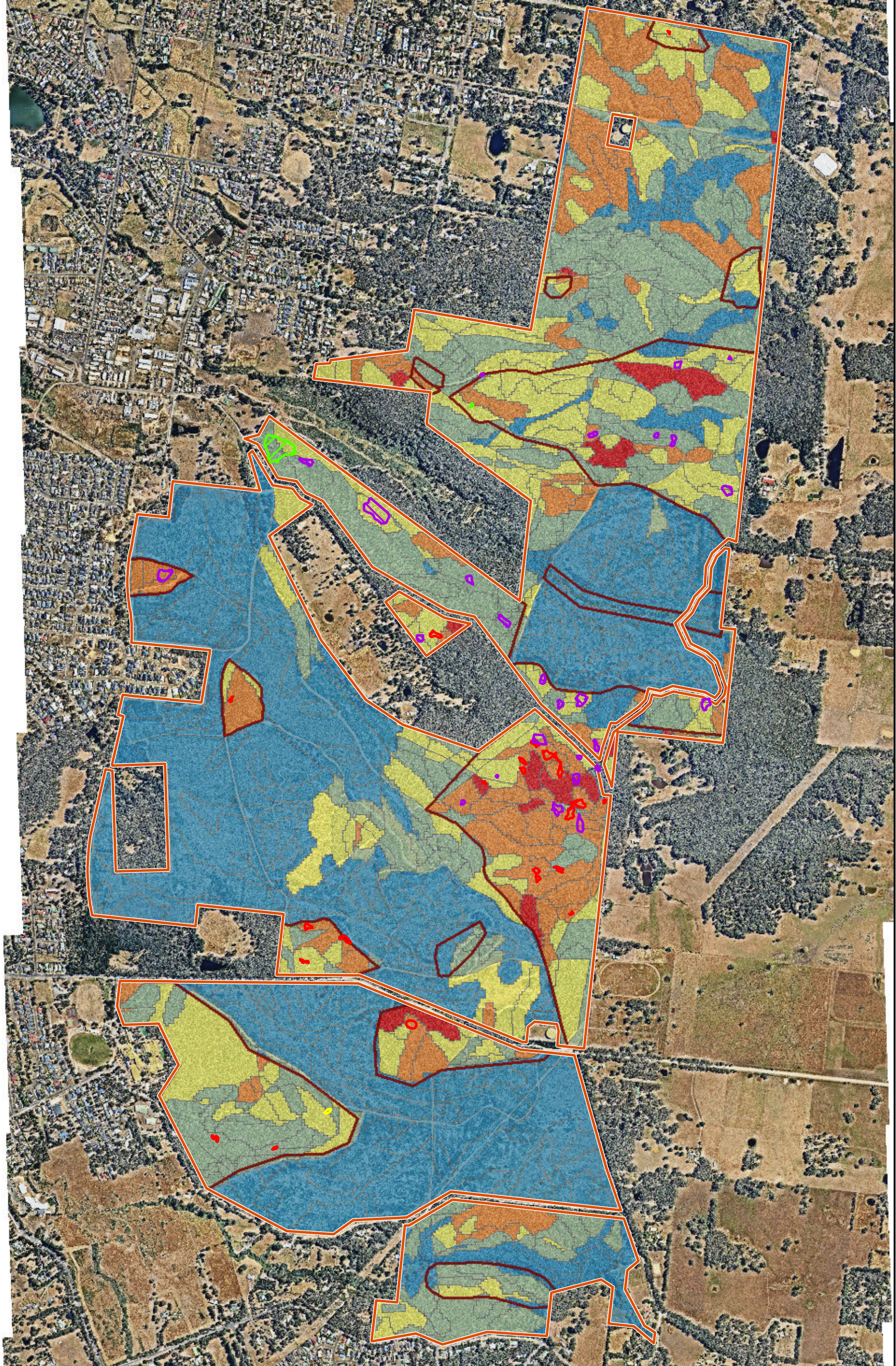
A suggested starting point for determining the presence of PC infection would be in areas that have been mapped as potential dieback, but are not in close proximity to any tracks or roads. This suggests that there is less likely to be human caused impacts (such as root trampling) on the population health, and therefore the cause of decline could be directly related to PC infection. Focus should then be on the larger areas of dieback, and in sections of high Grass-tree cover to avoid further population loss. Table 2 outlines the location of the mapped sections of dieback within the park, and could be used to aid in management of the park.

All the sections within the park that have a high cover of Grass-trees (50-75%) currently have very little signs of dieback, with no patches lying directly in these sections. Areas that are close to or bordering these high cover patches should be monitored closely and action taken where possible to prevent further dieback and reduce impacts to these large populations.

Table 2 Location and extent of Grass-tree dieback within Woowookarung Regional Park

Location	Impact extent and site condition
Eastern edge of park, within the northern section of a priority area bordering Davidsons Road	This area contains multiple sections marked as potential PC sites. Most of the sites are on a north facing slope, and appear to be spreading down the hill. Grass-tree cover within the affected areas is generally between 25 – 50%. If PC is found to be present, containing the spread within this area should be a priority due to being the largest affected area in the park.
Area south of Olympic Avenue	The patch of park that is located south of Olympic Avenue (the most southern section of the park), only had one small area of potential dieback. Controlling this area will help keep this section healthy. Grass-tree cover in the at risk area is between 25-50%, although areas surrounding this have lower cover, averaging less than 10% cover.

Location	Impact extent and site condition
Area between Recreation Road and Olympic Avenue.	<p>Four small patches of dieback were identified within the priority area on the western side of this section. All are located in areas of low Grass-tree cover (< 10%). One large patch of dead trunks was identified in the priority section along Recreation Road in an area of Grass-trees with 25 – 50% cover, but is close to a section of higher cover, and spread should be monitored to ensure this section is not also impacted.</p>
Triangular section between Katy Ryans Road, Recreation Road, and western edge of park.	<p>This section contains four small priority areas, three of which have areas of dieback mapped. There is also a small patch of dieback mapped in the non-priority section, in a remnant patch surrounded by cleared vegetation. The southern-most priority section has three small patches of dieback, within areas of Grass-tree cover between 10-50%, the two northern priority areas have a Grass-tree cover between 25-50%, with dieback mapped within these sections.</p>
Priority areas in northern section of park (north of Bakers and Davidson Road.	<p>Within this area, the two larger priority areas have a number of sections marked as dieback. The mapped areas are mainly in sections where the Grass-tree cover is between 1-25%. A number of dieback patches were identified in the non-priority areas across the northern section. Management should focus on the larger sections of dieback.</p>



Legend

- Study area
- Priority area

Notes

- Dead patch
- Dieback
- Dieback - old
- X. minor

Percentage cover

- None
- <10%
- 10-25%
- 25-50%
- 50-75%

Figure 1 Xanthorrhoea species, fieldwork results - percentage cover

References

Centre for Environmental Management University of Ballarat (2002). Preliminary review of the actual and potential distribution of *Phytophthora cinnamom* dieback in parks and reserves across Victoria

Appendices

Appendix 1 Grass-tree condition photographs



Photo 1 Example of the slumped category used in Grass-tree *Xanthorrhoea australis* survey. Photo taken within Woookarung Regional Park.



Photo 2 Example of the stump category of an Austral Grass-tree. Photo taken from within Woookarung Regional Park.



Photo 3 Example of a healthy Austral Grass-tree located within Woookarung Regional Park



Photo 4 Slumped Austral Grass-tree.



Photo 5 Dead Austral Grass-tree



Photo 6 Patch of Austral Grass-tree dieback



Photo 7 Succession of dieback down a slope in an area of water run-off



Photo 8 10 - 25% Austral Grass-tree cover



Photo 9 25 - 50% Cover of Austral Grass-trees



Photo 10 Austral Grass-tree recruitment



Photo 11 Austral Grass-tree within close proximity to a vehicle track showing a decline in health



Photo 12 Burnt Austral Grass-tree to promote population health



Photo 13 Small Grass-tree patch



Photo 14 Cleared area of Woookarung Regional Park. No Grass-trees were recorded in any cleared areas.