FOREST CHECK

DEPARTMENT OF Conservation AND LAND MANAGEMENT

# REPORT OF PROGRESS
# 2004 – 2005

## Science Division
## August 2005

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## EXECUTIVE SUMMARY

This document reports the results of FORESTCHECK monitoring in the eastern jarrah forest in Wellington District in 2004-05. Ten monitoring grids were installed in 2004, bringing the total number of FORESTCHECK grids to 37. Previously, grids were established in Donnelly, Wellington and Perth Hills Districts. At the time of writing a further 11 grids have been selected and are in the process of being installed in the Blackwood District and will be monitored in 2005-06. This report, and previous reports, can be viewed on and downloaded from CALM's Naturebase website at http://www.calm.wa.gov.au/science/science.html .

The integrated monitoring system used in the FORESTCHECK program has revealed the complex nature of the jarrah forest environment through the variation in species composition and community structure found in various forest types. Each year large numbers of species have been shown to be specific to particular locations and vegetation complexes within the jarrah forest range. The drier eastern jarrah forest monitored in 2004-05 included many species not found in previous years. Wildfires in late December 2004 and January 2005 resulted in a number of grids being burnt. The Perth Hills external control grid in Occidental block in particular was severely burnt, along with a complete set of treatment grids in Bell forest block in the eastern jarrah in Wellington District. The occurrence of these fires will provide the FORESTCHECK program an opportunity to monitor and compare post-fire recovery on the sites.

The FORESTCHECK project continues to collect valuable data and voucher collections for groups of organisms for which we have little knowledge. The invertebrate collection has expanded to include 1271 morphospecies. The list of macrofungi and cryptogams (lichens, mosses and liverworts) includes 482 and 235 species respectively. Many of these species are undescribed and have been collected and recorded for the first time.

During the year, all 37 FORESTCHECK grids were assessed to determine the number, size and age of cut stumps, which will permit the effects of past harvesting on forest structure to be quantified.

Some interesting points that have emerged from the 2004-05 results are:

- Shelterwood and gap release grids were well stocked except for the Stockyard shelterwood, which had poor regeneration
- The Wellington East soils appear to have higher concentrations of nutrients than soils in the Donnelly, Perth Hills and Wellington locations
- The network of snig tracks on the Stockyard shelterwood was extensive, and the possibility of re-using existing snig tracks to limit further ground disturbance should be investigated
- Litter and small wood and twig loads reflected the time since last burn
- Unique species of macrofungi were recorded on the burnt grids in Bell forest block
- Some species of macrofungi are common throughout the jarrah forest (recorded each year in the different FORESTCHECK locations) but many appear to have a restricted distribution
- Species richness of cryptogams was higher on the external control (unlogged) grids

- Fewer species of mosses and liverworts were recorded in the drier eastern jarrah forest compared to locations monitored in previous years

- The eastern jarrah appears to have a remarkably diverse invertebrate fauna (including 306 morphospecies not recorded previously)

- Vascular plant species richness and abundance appeared to be related to time since fire

- There were significantly more native mammals trapped in Godfrey forest block, which is fox baited, compared to Stockyard and Bell forest blocks which are unbaited

- The wet and cold autumn weather had an adverse effect on the success of small mammal and reptile trapping

- Although nocturnal birds were not surveyed, masked owls, southern boobook owls, tawny frogmouths and owlet nightjars were all recorded from opportunistic sightings.

Each year, the data collected are entered and stored in a central database. The results in this report represent preliminary observations from basic analyses; however, it is the intention to subject the data collected in the first 5 years to a rigorous, integrated analysis, report and external review. The results will be important in supporting ecologically sustainable forest management in WA.

I thank the FORESTCHECK team for their professionalism, enthusiasm and commitment to the project, and Verna Tunsell and Richard Robinson for compiling and editing this report.

Dr Neil Burrows
Director, Science Division

September 2005

# INTRODUCTION

## Scope

This report has been compiled from chapters prepared by scientists and technical staff involved in the FORESTCHECK monitoring program. It represents a summary of monitoring activities completed in eastern jarrah forest in the Wellington District during the 2004/2005 financial year.

FORESTCHECK is an integrated monitoring system that has been developed to provide information to forest managers in the southwest of Western Australia about changes and trends in key elements of forest biodiversity associated with a variety of forest management activities. Although the initial focus of FORESTCHECK will be on timber harvesting and silvicultural treatments in jarrah (*Eucalyptus marginata*) forest, the protocol lends itself to monitoring other forest ecosystems, fire (prescribed and wildfire), mining, the effects of forest disturbance for utility corridors (e.g. roads, power transmission lines), and the impacts of recreation uses. (Note, however, that the Forest Products Commission will only fund the part of FORESTCHECK that is specific to its activities).

FORESTCHECK was developed to meet a range of compliance conditions placed on the Forest Management Plan 1994-2003 through Ministerial Conditions and the Codd Report of 1999 and is included as an operational program in the current Forest Management Plan 2004-2013[1]. Integrated monitoring is a fundamental component of Ecologically Sustainable Forest Management (ESFM), and is necessary for reporting against the Montreal Process criteria and indicators for ESFM. In addition, monitoring forms the basis for adaptive management, which is recognized as an appropriate strategy for managing under conditions of uncertainty and change.

The Science Division of the Department of Conservation and Land Management has primary responsibility for the implementation of FORESTCHECK. The development of the program took place over 2 years and included input from scientists and managers within the Department of Conservation and Land Management, and from a number of external scientific agencies. The background to this process is described in the FORESTCHECK Concept Plan, and details of methods are provided in the FORESTCHECK Operations Plan. Annual Progress Reports, the Concept Plan and Operations Plan may be viewed on the Department's Naturebase website at http://www.calm.wa.gov.au/science/science.html.

## Sampling strategy

Between 1995 and 2004 timber harvesting in jarrah forests was undertaken according to Silvicultural Guideline 1/95, which recognizes 3 silvicultural objectives:

(1) Thinning: to promote growth on retained trees.
(2) Release of regeneration by gap creation, where existing advance growth is encouraged to develop unimpeded by the removal of competing overstorey.
(3) Regeneration establishment by shelterwood, where seedlings are encouraged to establish and develop into the lignotuberous ground coppice stage. This is achieved by reducing the competition from the overstorey, but retaining sufficient overstorey to provide a seed source and maintain other forest values until the ground coppice is developed and capable of responding to release.

[1] Conservation Commission of Western Australia (2004). Forest management plan 2004-2013. Conservation Commission of Western Australia. 144pp + maps.

Silvicultural guidelines were revised in conjunction with the preparation of the Forest Management Plan 2004-2013 and are now available as SFM Guideline No. 1(CALM 2004[2]).

Gap creation and shelterwood treatments are being given priority in the initial stages of FORESTCHECK as these are the most widespread operations and involve the greatest extent of disturbance to the forest. Thinning will also be monitored where the structure of the forest dictates that this treatment is appropriate on a significant scale.

FORESTCHECK sites are being established at a number of locations across the forest, stratified according to recognized ecological gradients of rainfall, evapo-transpiration and soil fertility. Forest ecosystem mapping (Mattiske and Havel 1998[3], 2000[4]) provides a systematic basis for stratification of sampling. Allocation of sites also takes account of scheduled future harvesting within the jarrah forest, with priority given to those ecosystems likely to be subject to harvesting on an extensive scale in the next decade.

Each FORESTCHECK site consists of up to 4 sampling grids. Grids will be established in forest subject to the following treatments:

(1) gap release,
(2) shelterwood,
(3) coupe buffer or internal reference forest i.e. temporary exclusion areas (TEAS) between adjacent gaps or shelterwood forest,
(4) external reference or control forest i.e. not recently harvested, or has had minimal harvesting, and will not be subject to harvesting in the foreseeable future.

The intention is that grids be closely matched in terms of site characteristics (climate, geomorphology, soils, topography, altitude, aspect), pre-harvest forest structure and vegetation attributes in order that differences between grids reflect the effects of harvesting, rather than inherent site differences. Not all treatment types will be found in the one locality and it is expected that external reference forest may have to be located some distance from their harvested counterparts. It may not always be possible to find gap release and shelterwood treatments together, because underlying relationships between rainfall, soil fertility and jarrah lignotuber development influence the broad pattern of silvicultural treatment across the jarrah forest, as have previous silvicultural activities.

**Methodology**

A range of ecosystem attributes are monitored at each site including:

1. Forest structure and regeneration stocking
2. Foliar and soil nutrients
3. Soil disturbance
4. Coarse woody debris and leaf litter
5. Macrofungi
6. Cryptogams
7. Vascular flora
8. Invertebrate fauna
9. Vertebrate fauna (birds, herpetofauna, and mammals)

[2] CALM 2004. Silvicultural practice in the jarrah forest. Dept. CALM, SFM guideline No. 1.
[3] Mattiske, E.M. and Havel, J.J. 1998. Regional Forest Agreement Vegetation Complexes, Collie, Western Australia [cartographic material – scale 1:250,000]. WA Department of Conservation and Land Management.
[4] Mattiske, E.M. and Havel, J.J 2000. Vegetation Mapping in the South West of Western Australia. CALM, Perth.

Sampling methodologies for each set of ecosystem attributes are described in the FORESTCHECK Operations Plan, together with examples of protocols for data collection and storage. Monitoring of biodiversity is based on a sampling grid (see Fig. 15 on p.18). The main grid is 100 m x 100 m, with 30 m x 30 m vegetation sample plots at each corner.

**Sampling in Wellington District (eastern jarrah) 2004-05.**

Ten FORESTCHECK monitoring grids were established and sampled in the eastern jarrah forest of the Wellington District during 2004/05. The location encompassing the sites will be referred to from here on as Wellington East and grids are identified by alphanumeric codes FC28 to FC37. Four grids (FC28-31) were established in Nalyerin and Godfrey forest blocks (Figs 1 & 2), 3 (FC32-34) in Stockyard forest block (Fig. 3) and 3 (FC35-37) in Bell forest block (Fig. 4). All grids were located in areas of forest immediately east of the 800 mm annual rainfall isohyets and meet the definition of eastern jarrah forest outlined in SFM Guideline No 1 (CALM 2004).

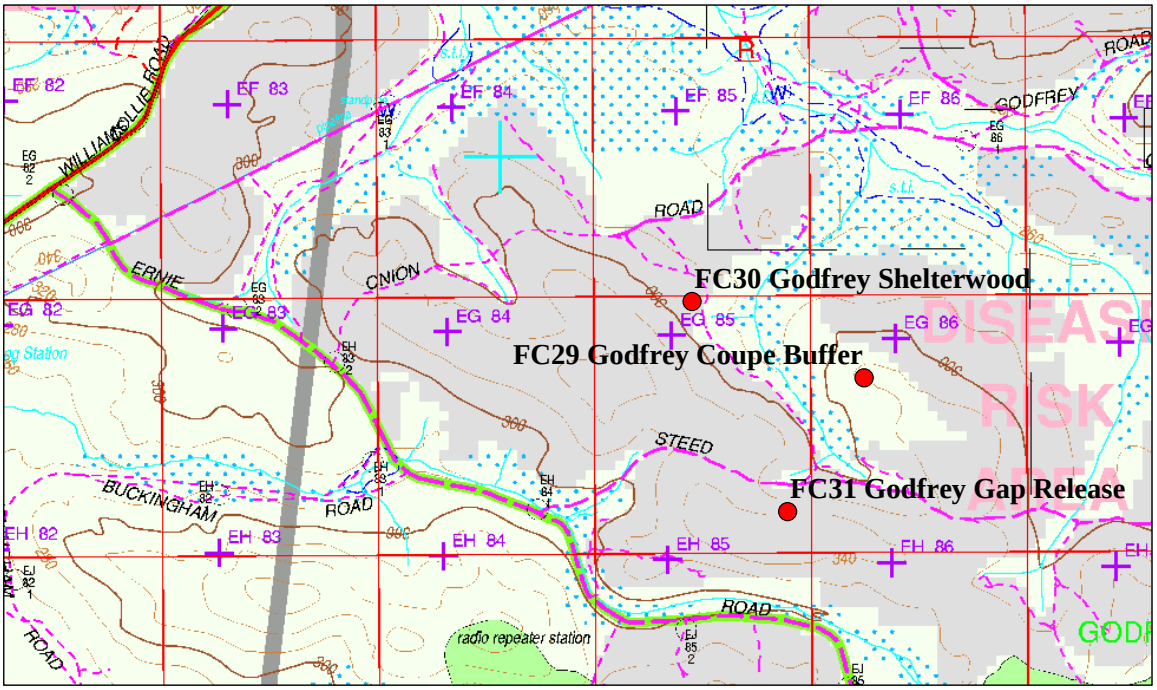


**Figure 1**. Location of FORESTCHECK sampling grids established in 2004 in Godfrey forest block.

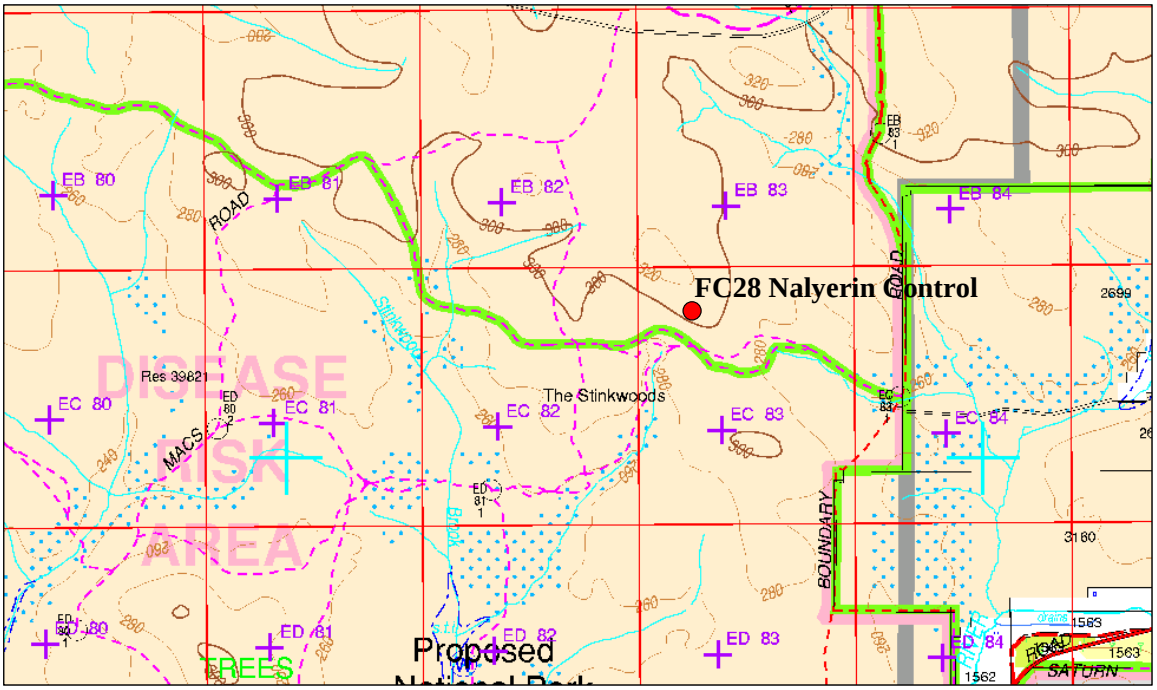


**Figure 2**. Location of FORESTCHECK sampling grid established in 2004 in Nalyerin forest block.

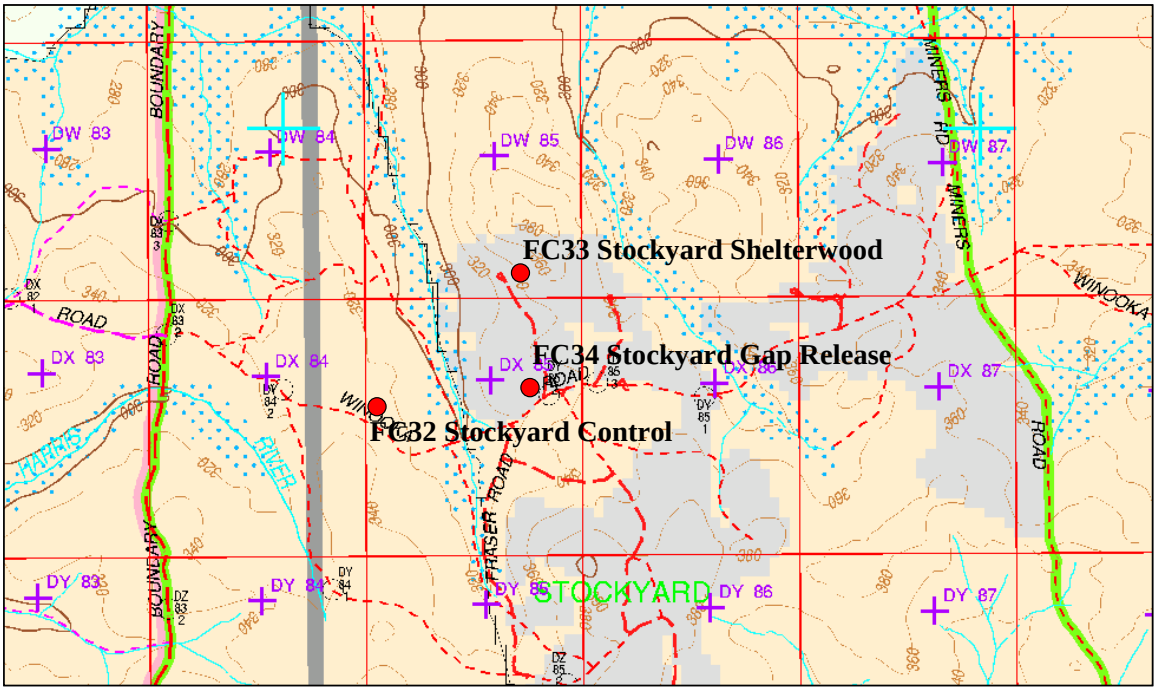


**Figure 3**. Location of FORESTCHECK sampling grids established in 2004 in Stockyard forest block.

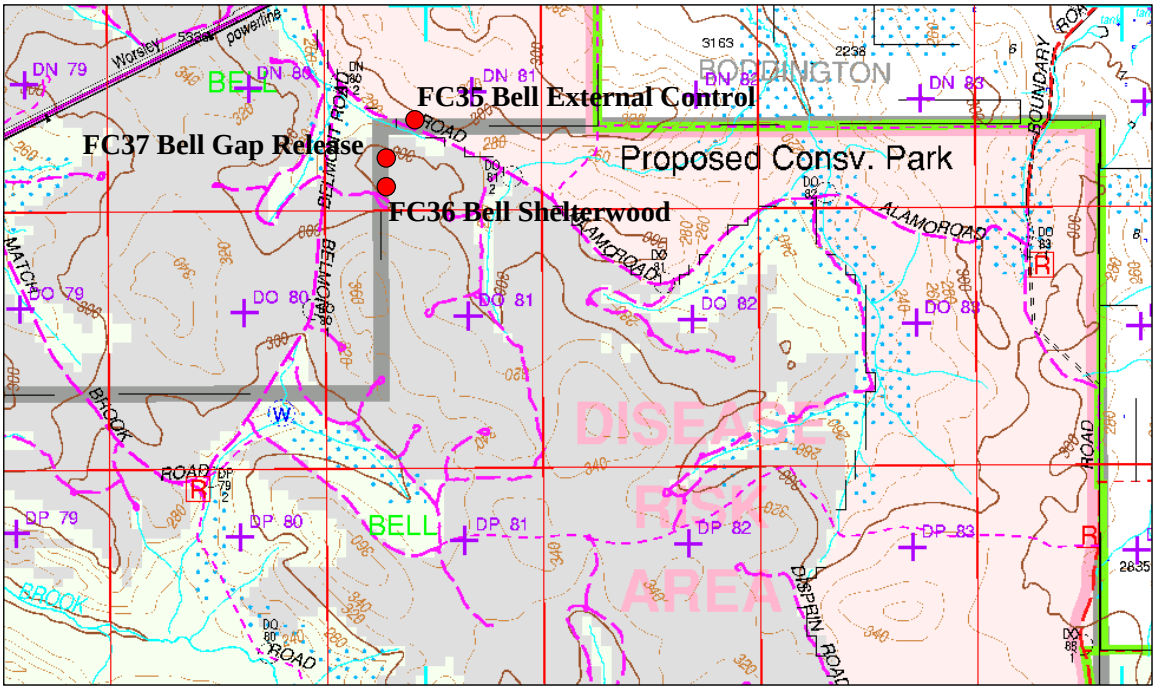


**Figure 4**. Location of FORESTCHECK sampling grids established in 2004 in Bell forest block.

All grids are located within the Dwellingup 4 vegetation complex of Mattiske and Havel (1998). These complexes are found in open forests or woodland jarrah (*E. marginata* ssp. *thalassica*) and marri (*Corymbia calophylla*), on semi-arid lateritic uplands (Table 1).

**Table 1** Locations and attributes for each FORESTCHECK grid in Wellington East.

| Grid ID | Block | Vegetation Complex | Latitude (S) | Longitude (E) | Elevation (m) | Aspect | Slope (degrees) |
|---|---|---|---|---|---|---|---|
| FC28 | Nalyerin | Dwell. 4 | 33° 12' 15" | 116° 23' 21" | 300 | SW | - |
| FC29 | Godfrey | Dwell. 4 | 33° 16' 24" | 116° 26' 16" | 320 | W | 2 |
| FC30 | Godfrey | Dwell. 4 | 33° 16' 02" | 116° 25' 25" | 300 | E | 1 |
| FC31 | Godfrey | Dwell. 4 | 33° 16' 52" | 116° 25' 51" | 340 | N | 3-4 |
| FC32 | Stockyard | Dwell. 4 | 33° 08' 21" | 116° 24' 55" | 320 | NE | - |
| FC33 | Stockyard | Dwell. 4 | 33° 07' 53" | 116° 25' 44" | 340 | W | 3 |
| FC34 | Stockyard | Dwell. 4 | 33° 08' 21" | 116° 25' 44" | 320 | S | 3 |
| FC35 | Bell | Dwell. 4 | 32° 59' 40" | 116° 21' 35" | 300 | SW | - |
| FC36 | Bell | Dwell. 4 | 32° 59' 53" | 116° 21' 18" | 300 | SW | - |
| FC37 | Bell | Dwell. 4 | 32° 59' 51" | 116° 21' 32" | 300 | NE | - |

The 3 external control grids are situated in unlogged forest (but there are a small number of stumps present in the Stockyard grid suggesting a couple of trees were selectively harvested in the past), and have a range of 6-17 years since the time of the last fire (Table 2). The Stockyard external control grid is situated in National Park, the Bell grid in Conservation Park and the Nalyerin grid in the Lane-Poole Reserve. The remaining grids are in forest that was harvested during the period of 1996-2000. All the treatment grids were thus established at sites in stands with comparable management histories.

**Table 2**. Management history for each FORESTCHECK grid in Wellington East.

| Treatment/ Plot | Block | Logged | | | Burnt | | |
|---|---|---|---|---|---|---|---|
| | | Most Recent | Years since | Previous cutting | Most Recent | Years since | Type of Burn |
| **Control** | | | | | | | |
| FC28 | Nalyerin | Unlogged | | | 1987-88 | 17 | Fuel reduction |
| FC32 | Stockyard | Uncut | | 1950s | 1998-99 | 6 | Fuel reduction |
| FC35* | Bell | Unlogged | | | 1997-98 | 7 | Fuel reduction |
| **TEAS** | | | | | | | |
| FC29 | Godfrey | Uncut | | 1940s | 2002-03 | 2 | Fuel reduction |
| **Shelterwood** | | | | | | | |
| FC30 | Godfrey | 2000 | 5 | 1930s, 1950s | 2002-03 | 2 | Establishment |
| FC33 | Stockyard | 1998 | 7 | 1950 | 1998-99 | 6 | Establishment |
| FC36* | Bell | 1996 | 9 | | 1997-98 | 7 | Establishment |
| **Gap Release** | | | | | | | |
| FC31 | Godfrey | 2000 | 5 | 1950s | 2002-03 | 2 | Regeneration release |
| FC34 | Stockyard | 1998 | 7 | 1950s | 1998-99 | 6 | Regeneration release |
| FC37* | Bell | 1996 | 9 | | 1997-98 | 7 | Regeneration release |

*NB. Bell grids were all burnt in a wildfire on 28 December 2004.

In December 2004, about 3 months following establishment, a fire initiated by a lightning strike in Bell forest block resulted in all 3 grids in Bell forest block being burnt (see Figs 12-14). External control and shelterwood treatments were burnt during mild evening conditions and fire intensities were sufficiently low to avoid crown defoliation and stem damage to saplings taller than about 6 m. The Bell gap release treatment was burnt at moderate intensity resulting in overstorey crown scorch and death of some saplings back to ground level. A portion of the monitoring had been completed prior to the fire, including vascular plant and cryptogam surveys, spring invertebrate survey and the spring animal trapping and spotlighting program, however, this meant that a significant proportion of the monitoring program was conducted following the fire. A post fire severity survey was also conducted on the burnt grids in January 2005.

On May 16 2005, a mini tornado hit the coast at Bunbury. The storm travelled inland and passed through the forest north of Collie. Storm damage was clearly evident in the Godfrey gap release grid where many fallen trees and broken branches had affected the stand structure and the amount of CWD on site (see Fig. 8b).

Reference photographs taken of each sampling grid are presented in Figs. 5-14. All photos were taken from peg W2.1 looking towards the centre peg (W2.3) (see Fig. 15), and will allow changes in vegetation structure and condition to be observed in each subsequent photograph. All photographs were taken during plot establishment in October 2004. The additional photos of grids in Bell forest block were taken in January 2005, 10 days following the fire, and the Godfrey gap release on July 7 2005, 6 weeks following the tornado/wind storm.

**Godfrey/Nalyerin grids:**

**Figure 5. FC28** Nalyerin forest block, External Control

**Figure 6. FC30** Godfrey forest block, Shelterwood

**Figure 7. FC31** Godfrey forest block, Gap Release.
Before (above) and after (below) the wind storm in May 2005.

**Figure 8. FC29** Godfrey forest block, Coupe Buffer

## Stockyard grids:

**Figure 9. FC32** Stockyard forest block, External Control;

**Figure 10. FC33** Stockyard forest block, Shelterwood.

**Figure 11. FC34** Stockyard forest block, Gap Release.

**Bell grids:**

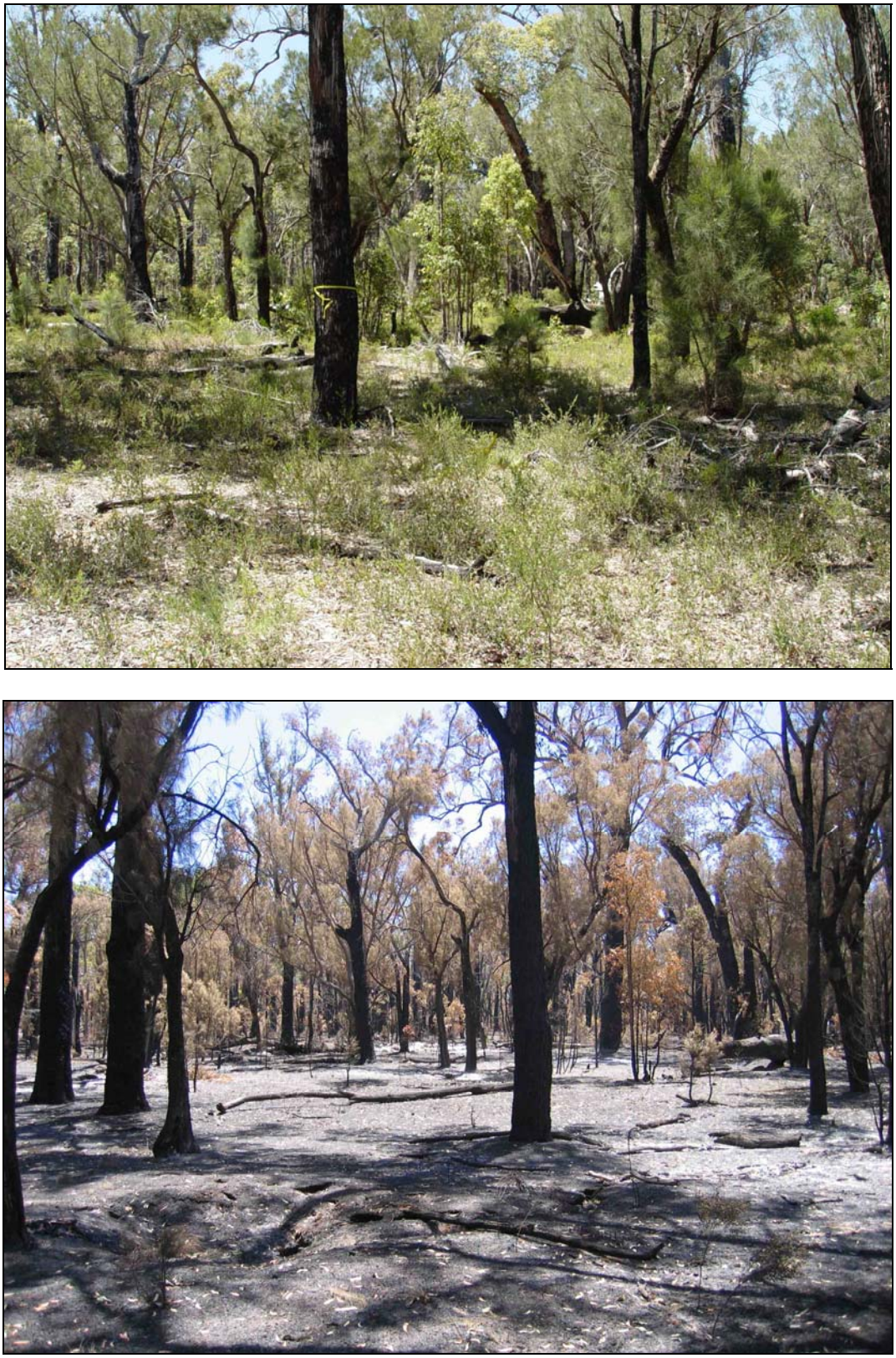

**Figure 12. FC35** Bell forest block, External Control.
Before (above) and 10 days after (below) being burnt.

**Figure 13. FC36** Bell forest block, Shelterwood.
Before (above) and 10 days after (below) being burnt.

**Figure 14. FC37** Bell forest block, Gap Release.
Before (above) and 10 days after (below) being burnt.

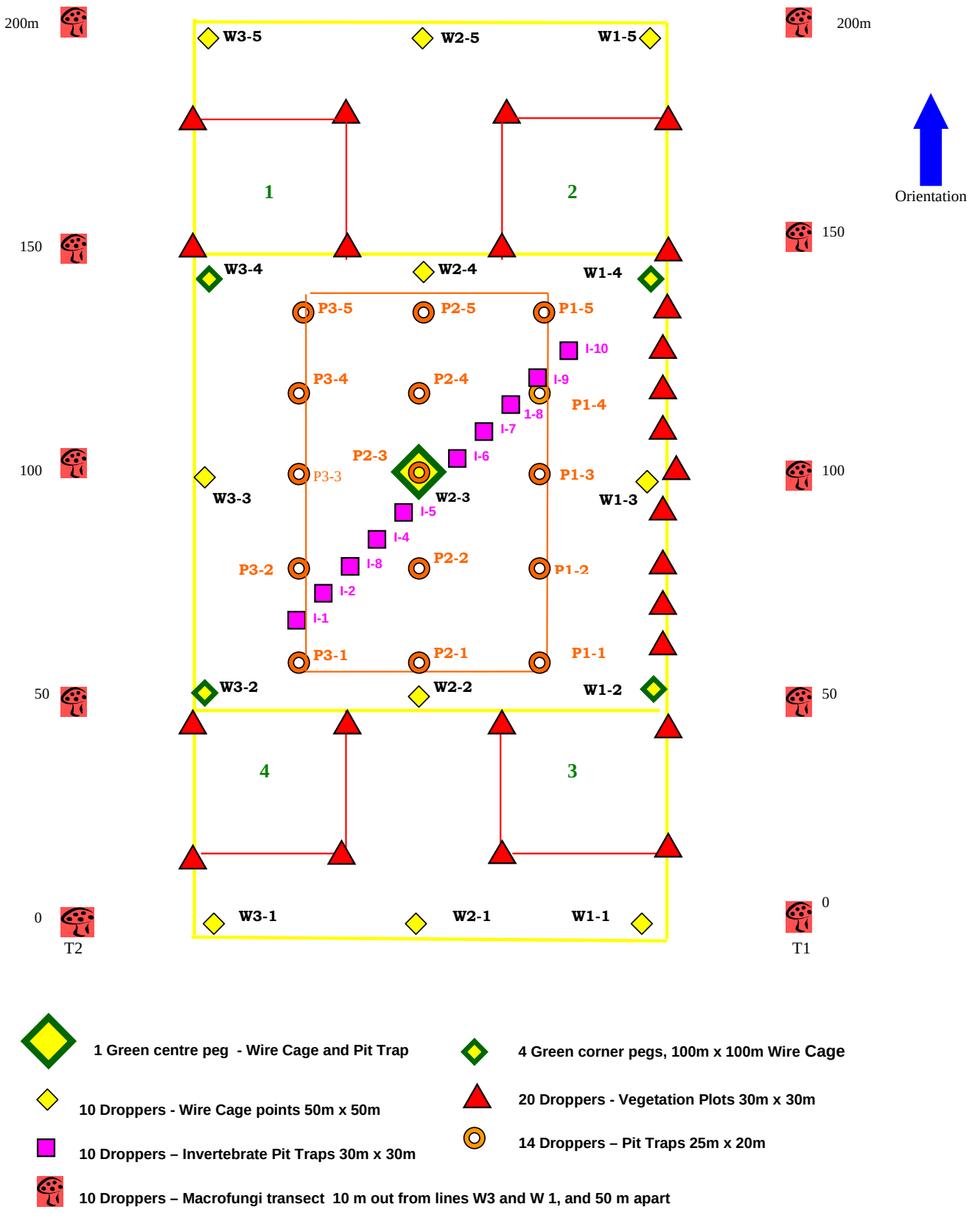


**Figure 15**. The layout of a FORESTCHECK sampling grid.

The budget and expenditure for the 2004-05 FORESTCHECK program is detailed in Table 4. Funding for the program is provided by the Forest Products Commission and CALM, of which the FPC contributed $200, 000.

**Table 4.** Budget for establishment and monitoring of FORESTCHECK sites in Wellington East in 2004/05

| Task/Activity | Officer-in-charge | Total Operating |
|---|---|---|
| **OPERATIONAL** | | |
| Grid establishment | McCaw | 10 000 |
| Forest structure and regeneration | McCaw | 6 000 |
| Soil and foliar nutrients | McCaw | 5 000 |
| Soils disturbance | Whitford | 10 000 |
| Macrofungi / Litter & CWD | Robinson | 7 000 |
| Vascular flora | Ward | 5 000 |
| Cryptogams | Cranfield | 5 000 |
| Invertebrates | Farr | 13 000 |
| Birds (diurnal) | Liddelow | 4 000 |
| Birds (nocturnal) | Liddelow | 5 000 |
| Fauna (grid trapping) | Liddelow | 4 000 |
| Spotlight Road surveys (vertebrate.) | Liddelow | 4 000 |
| **OTHER** | | |
| Administration and overheads | McCaw | 63 882 |
| Database management | McCaw | 46 796 |
| Directorate | | 11 321 |
| **SUB TOTAL** | | **200 000** |
| **SALARY** | | 173 437 |
| **TOTAL** | | **373 437** |

## FOREST STRUCTURE AND REGENERATION STOCKING

Lachlan McCaw, Bob Smith and John Neal

### Introduction

The adequacy of regeneration following harvesting and silvicultural treatment is one of the core indicators of Ecologically Sustainable Forest Management (ESFM). The current framework of regional level indicators provides for assessment of the area and per cent of harvested area of native forest effectively regenerated (Indicator 2.1.g). This is recognized as a Category A indicator that can be reported upon immediately.

Regeneration outcomes have for a number of years been assessed as a matter of routine on at least a portion of the area of forest subject to harvesting. For uneven-aged forest stands, there is a need to consider the existing structure of the stand and whether sufficient sapling and advance growth is present to re-establish the stand following harvesting. Under the current silvicultural guidelines for jarrah-marri forest the decision as to whether the stand should be cut to gap release or shelterwood is determined by the density of existing lignotuberous advance growth.

Forest managers also require information about the rate of growth and species composition of stands so that future stand conditions can be projected over time. These attributes can affect the potential of forest stands to produce wood and other products, and to achieve ecological outcomes.

Following discussion at the 2004 annual project meeting the sampling methodology for stand structure was extended to include assessment of cut stumps and trees that have been either pushed over or blown down. Collection of this data makes possible a quantification of the basal area removed in each previous cutting cycle, and the effect of stand improvement silvicultural practices on forest structure. All 37 sampling sites established to date as part of the project were assessed for stumps and pushed trees during 2005.

The objectives of this component of FORESTCHECK monitoring are therefore:

- To describe the stand structure, species composition and developmental stage of tree species present at each sampling grid,
- To quantify the basal area removed in past harvesting events, and
- To measure the contribution of mid-storey species to stand structure, density and basal area.

### Monitoring

All the grids were assessed in mid March 2005, but the burnt sites in Bell forest block were not assessed for regeneration stocking because seedlings and above ground parts of lignotuberous advance growth had been consumed by the fire.

Sampling techniques were the same as in previous years, apart from the additional assessment of cut stumps and pushed trees. The diameter, height and species of stumps >10 cm diameter on the cut face were recorded in the 800 $m^2$ transect used to assess stand structure. The age of cutting event that resulted in the stump was noted (1 = most recent harvest event, 2 = harvested prior to the most recent event and so on for earlier harvests). Trees that had been pushed or blown down were measured for diameter at 1.3 m above nominal ground level, and a judgement was made as to whether they had fallen as a result

of disturbance before during or after harvesting. Regeneration stocking was assessed using the triangular tessellation method at 50 points around the outer perimeter of each grid. Triangular tessellation sampling is the standard technique employed for regeneration surveys undertaken before and after timber harvesting operations. Stand structure was assessed by measurement of all trees taller than 2 m in a transect 200 m long by 4 m wide. In stands cut to gap release and shelterwood treatments, the height and species of regeneration was assessed at 4 locations on each grid to indicate the rate of regrowth. Canopy cover was measured as part of the vascular plant assessment.

## Results

### Stand structure and species composition

Eucalypt basal areas ranged from 13 to 57 $m^2$/ha in the 3 external control grids, and were comprised predominantly of jarrah (Figure 1, Table 1). Intermediate trees of *Allocasuarina fraseriana* contributed a further 10 $m^2$/ha at Stockyard (FC 32) and 17 $m^2$/ha at Nalyerin (FC28). The external control at Stockyard has been subject to timber harvesting in the past with almost 20 $m^2$/ha of basal area removed prior to the current cutting cycle, probably during the decade of the 1920-29. Previous harvesting had also removed 36 $m^2$/ha of basal area from the coupe buffer at Godfrey forest block (FC29), although the standing basal area of 31 $m^2$/ha at this site was still substantial.

Shelterwood stands had retained basal area of jarrah and marri ranging from 20 to 26 $m^2$/ha. At Godfrey (FC30) and Bell (FC36) the most recent harvesting operation had removed 9-11 $m^2$/ha of jarrah basal area, while at Stockyard (FC33) the reduction in basal area within the sample transects resulted from push down of *A. fraseriana* and *Banksia grandis* (Table 2). Marri basal area had only been reduced at Bell, where a large mature tree had fallen over after having been burnt through at the base of the stem. Cut stumps from earlier harvesting operations were not recorded in any of the shelterwood stands, but several mature jarrah trees at Godfrey had fallen over as a result of fire damage.

Gap release treatments had relatively high basal areas (18-32 $m^2$/ha) comprised mostly of jarrah. At Godfrey (FC31) this was due to retention of a cohort of trees 35-50 cm dbh and occasional large habitat trees. At Stockyard (FC34) the high basal area resulted from dense sapling regeneration released by silvicultural treatment and from retention of trees of pole-size (15-45 dbh) and occasional mature trees. Sapling regeneration also contributed to the basal area at Bell (FC37) but to a lesser extent than at Stockyard. Basal areas of *A. fraseriana* in gap release treatments were low (<1 $m^2$/ha) and there had been only limited pushing down of standing trees to achieve this result (Table 2).

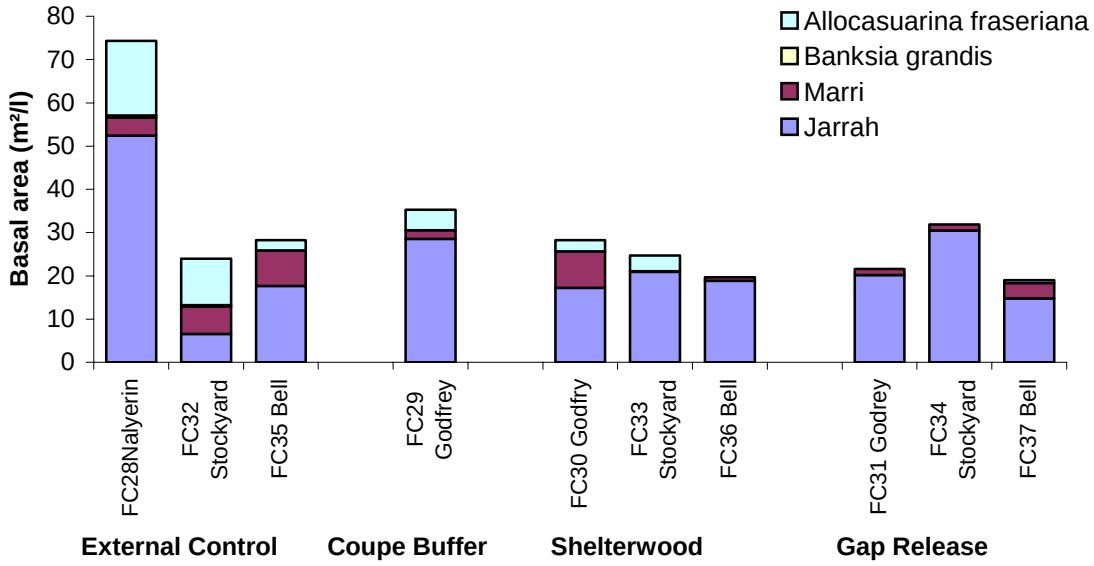


**Figure 1.** Basal area of jarrah, marri and intermediate trees.

Marri was present as a secondary species although its contribution to basal area varied considerably between stands. Marri made the largest relative contribution to basal area in the external control at Stockyard, although this may have been because the basal area of jarrah had been reduced by earlier timber harvesting. Marri contribution to basal area ranged from 7-31 % in the other external control grids that had no evidence of previous harvesting. Relative proportions of jarrah and marri were generally consistent between basal area, stems per ha, and the regeneration cohort of saplings and advance growth (Table 1). The current silvicultural guideline requires that on predominantly jarrah sites the species mix of the eucalypt regeneration should contain at least 20 % jarrah. This requirement was achieved in silviculturally treated stands at Godfrey and Stockyard, but could not be assessed at Bell because of the effects of recent fire.

**Table 1.** Analysis of eucalypt species composition determined according to basal area and stem density of live standing trees >2 m tall, and the species mix determined in regeneration surveys of FORESTCHECK grids in Wellington East. Regeneration stocking could not be assessed at Bell forest block because of the grids were burnt by an unplanned fire in December 2004.

| Treatment Grid | Basal area ($m^2$/ha) | | | Stems/ha | | | Regeneration Species Composition | |
|---|---|---|---|---|---|---|---|---|
| | **jarrah** | **marri** | **total** | **jarrah** | **marri** | **total** | **jarrah** | **marri** |
| **External Control** | | | | | | | | |
| FC28 | 52.45 | 4.11 | 56.56 | 238 | 63 | 301 | - | - |
| | *93%* | *7%* | | *79%* | *21%* | | *70%* | *30%* |
| FC32 | 6.56 | 6.34 | 12.90 | 300 | 300 | 600 | - | - |
| | *51%* | *49%* | | *80%* | *20%* | | *37%* | *63%* |
| FC35 | 17.70 | 8.10 | 25.80 | 163 | 50 | 213 | - | - |
| | *69%* | *31%* | | *77%* | *23%* | | *n/d* | *n/d* |
| **Coupe Buffer** | | | | | | | | |
| FC29 | 28.51 | 2.02 | 30.53 | 600 | 163 | 763 | - | - |
| | *93%* | *7%* | | *79%* | *21%* | | *33%* | *66%* |
| **Shelterwood** | | | | | | | | |
| FC30 | 17.21 | 8.45 | 25.66 | 1513 | 338 | 1851 | - | - |
| | *67%* | *33%* | | *82%* | *18%* | | *65%* | *35%* |
| FC33 | 20.91 | 0 | 20.91 | 313 | 0 | 100 | - | - |
| | *100%* | *0%* | | *100%* | *0%* | | *73%* | *27%* |
| FC36 | 18.86 | 0.80 | 19.66 | 350 | 150 | 500 | - | - |
| | *96%* | *4%* | | *70%* | *30%* | | *n/d* | *n/d* |
| **Gap Release** | | | | | | | | |
| FC31 | 20.21 | 1.35 | 21.56 | 125 | 63 | 188 | - | - |
| | *97%* | *3%* | | *66%* | *33%* | | *53%* | *47%* |
| FC34 | 30.48 | 1.41 | 31.89 | 1650 | 350 | 200 | - | - |
| | *97%* | *3%* | | *83%* | *17%* | | *97%* | *2%* |
| FC37 | 14.80 | 3.54 | 18.34 | 513 | 213 | 726 | - | - |
| | *81%* | *19%* | | *70%* | *30%* | | *n/d* | *n/d* |

**Table 2.** Basal area of cut stumps and trees pushed down in FORESTCHECK grids in Wellington East. Figures in italics show how the percentage reduction in basal area is distributed between 2 transects on left and right hand sides of the sampling grid. Other trees and shrubs were predominantly *A. fraseriana* and *B. grandis*.

| Treatment Grid | Basal area reduction from most recent harvesting ($m^2$/ha) | | | Basal area reduction from earlier harvesting or disturbance ($m^2$/ha) | | |
|---|---|---|---|---|---|---|
| | **jarrah** | **marri** | **other** | **jarrah** | **marri** | **other** |
| **External Control** | | | | | | |
| FC28 | - | - | - | - | - | 2.45<br>*100/0* |
| FC32 | - | - | - | 19.8<br>*40/60* | - | - |
| FC35 | - | - | - | - | - | 0.10<br>*100/0* |
| **Coupe Buffer** | | | | | | |
| FC29 | - | - | - | 35.54<br>*78/22* | - | - |
| **Shelterwood** | | | | | | |
| FC30 | 8.98<br>*100/0* | - | - | 16.69<br>*0/100* | - | - |
| FC33 | - | - | 10.37 | - | - | - |
| FC36 | 10.73<br>*58/42* | 28.37<br>*0/100* | - | - | - | - |
| **Gap Release** | | | | | | |
| FC31 | 10.40<br>*71/29* | - | 2.15<br>*0/100* | - | - | - |
| FC34 | 21.62<br>*100/0* | 1.49<br>*0/100* | - | - | - | - |
| FC37 | 7.36<br>*77/33* | - | - | 4.81<br>*100/0* | - | - |

### Regeneration stocking

Grids in uncut forest contained relatively few saplings but moderate stocking levels of ground coppice and advance growth (Table 3). The general absence of saplings can be attributed to the lack of recent disturbance and associated temporary reduction in competition from the overstorey canopy.

Satisfactory stocking in stands cut to shelterwood is defined as having 65 % of sample points with 500 or more stems/ha of saplings or stool coppice from stumps <30 cm diameter, or 1000 or more stems/ha of saplings, stool coppice and jarrah ground coppice or marri advance growth, and can also include lignotuberous seedlings at 5000 or more stems/ha. The Godfrey shelterwood (FC30) was marginally stocked (52 % of sample points) with saplings, advance growth and some seedlings established as a result of silvicultural treatment (Table 3). The level of retained basal area on the Godfrey shelterwood was higher than recommended in the current specification and resulted in 44 % of sample points being influenced by overwood. The Stockyard shelterwood (FC33) was poorly stocked with eucalypt regeneration, probably reflecting a low stocking of

lignotuberous advance growth at the time of harvest. Few seedlings had established as a result of silvicultural treatment.

The Godfrey gap release (FC31) was 40 % stocked, mostly with ground coppice, and did not meet the regeneration standard of 65 %. Only 2 years have elapsed since post-harvest burning and so the proportion stocked with saplings can be expected to increase as ground coppice develops. Much of the current ground coppice showed evidence of dynamic growth. The Stockyard gap release (FC34) was 78 % stocked and contained a stratum of dynamic well-formed saplings (Tables 1 and 3).

**Table 3.** Regeneration stocking and species composition for FORESTCHECK grids in Wellington East assessed during March 2005. Regeneration stocking was not assessed on 3 grids at Bell forest block burnt by unplanned fire in December 2004. Values for per cent stocking are based on 50 sample points per grid. Retained over-wood was not assessed in uncut stands or coupe buffers.

| Treatment<br>Grid | Height range of eucalypt regeneration (m) | Percent affected by overwood | Percent stocked with saplings | Percent stocked with saplings & ground coppice | Per cent stocked including seedlings | Per cent not stocked to standard |
|---|---|---|---|---|---|---|
| **External Control** | | | | | | |
| FC28 | Uncut | N/a | 2 | 46 | N/a | 6 |
| FC32 | Uncut | N/a | 16 | 36 | N/a | 6 |
| FC35 | Uncut | N/a | N/d | N/d | N/a | N/d |
| **Coupe Buffer** | | | | | | |
| FC29 | Uncut | N/a | 6 | 38 | N/a | 2 |
| **Shelterwood** | | | | | | |
| FC30 | 3-4 | 44 | 22 | 22 | 8 | 4 |
| FC33 | 2-4 | 28 | - | 14 | 2 | 56 |
| FC36 | N/d | N/a | N/d | N/d | N/a | N/d |
| **Gap Release** | | | | | | |
| FC31 | 1-2 | 30 | 4 | 36 | N/a | 30 |
| FC34 | 4-5 | 14 | 34 | 44 | N/a | 14 |
| FC37 | N/d | N/a | N/d | N/d | N/a | N/d |

Regeneration originating from stool coppice on stems >30 cm diameter and from stump coppice is not considered to contribute to the effective stocking at a point. This is because it is prone to wind-throw and is readily damaged by fire if the parent stump burns. However on most sites there are a considerable number of additional stems originating from stump coppice that contribute to the initial re-establishment of crown cover and basal area.

The origin of all jarrah and marri stems >2 m tall measured in the 4 x 200 m transect on each grid is shown in Figure 2. Saplings on the external control and coupe buffer grids were mostly of lignotuberous origin. This reflects the fact that the Bell and Nalyerin sites had no evidence of previous harvesting, and that the harvesting in the Stockyard control and Godfrey coupe buffer

had removed only large trees thus creating a relatively small number of cut stumps. Trees of lignotuberous origin and stool coppice from small stumps contributed to adequate stocking at the Godfrey shelterwood, Stockyard gap release and Bell gap release. Stump coppice made only a small contribution to stocking at any of the grids.

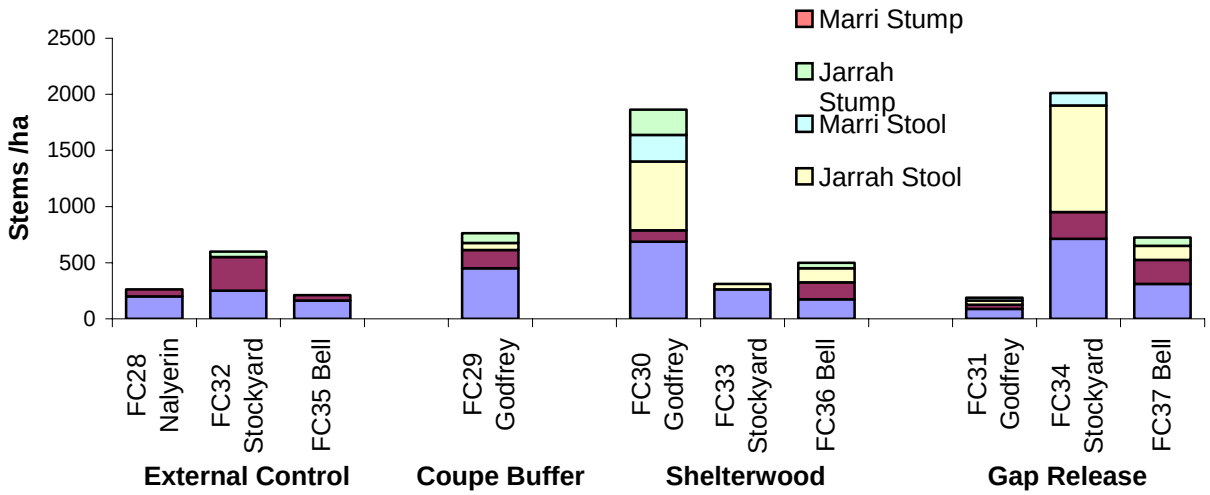


**Figure 2**. Origin of all jarrah and marri stems >2 m tall measured in the 4 x 200 m transect on ten grids in Wellington East.

### Canopy cover

Overstorey canopy cover in external control and coupe buffer grids ranged from 47-62 % (Figure 3). Shelterwood grids had canopy cover ranging from 32 % in the most recently treated stand at Godfrey through to 50 % at Bell, even though Bell had experienced the largest reduction in basal area as a result of silvicultural treatment and had the lowest retained basal area (Table 2). Gap release grids had canopy cover ranging from 24 to 40 %, with a trend for cover to increase with increasing time since silvicultural treatment. This is expected because of the recruitment of saplings, and increased foliage density on retained trees.

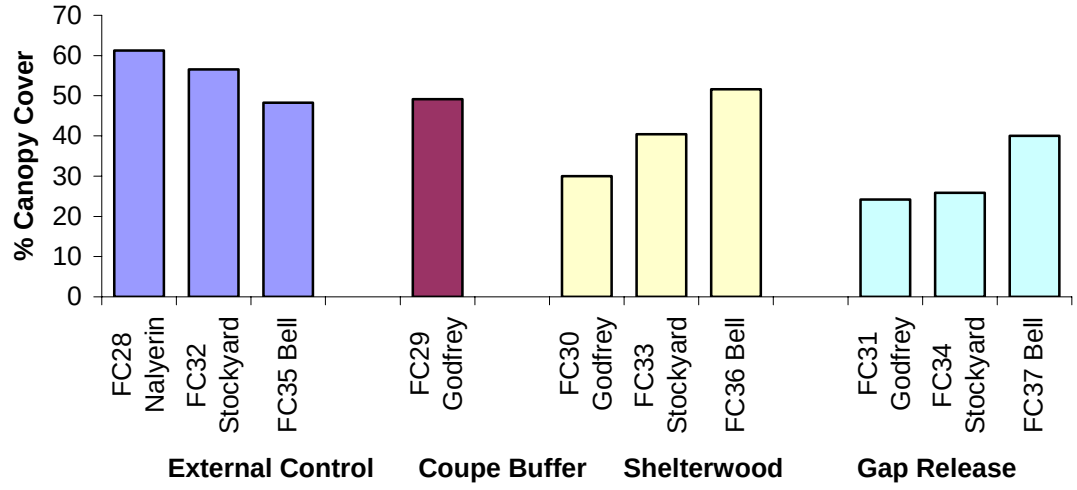


**Figure 3.** Canopy cover estimated using point intercept sampling.

**Assessment of burnt grids**

A standard procedure has been developed for assessment of grids burnt by prescribed fires wildfires. The 15 main pegs that define the layout of each grid are used as sample points, and at each peg an assessment is made to determine:

1. the proportion of area within 5m radius of the peg that has burnt,
2. the height of crown scorch to the overstorey canopy,
3. average height of the scrub layer
4. depth of any residual litter layer.

Post-fire assessment was undertaken at the 3 Bell forest block grids, and at the Occidental forest block external control grid (FC27) that was burnt at very high intensity during the large Perth Hills bushfire in mid-January 2005 (Table 4).

**Table 4**. Number of sample points (from a total of 15) allocated to various categories indicative of fire intensity.

| Grid | Category | | | | Total |
|---|---|---|---|---|---|
| | Defoliated | Full crown scorch | Partial crown scorch | Unburnt | |
| **Occidental** | | | | | |
| FC27 | 15 | - | - | - | 15 |
| **Bell** | | | | | |
| FC35 | - | 6 | 9 | - | 15 |
| FC36 | - | 3 | 8 | 4 | 15 |
| FC37 | - | 3 | 12 | - | 15 |

**Discussion**

Eastern jarrah forest (CALM 2004) is a broad description for forest that occurs generally east of the 900 mm rainfall isohyet. Eastern forest is characterized for the most part by more widely spaced trees and a low herbaceous understorey. Lignotuberous advance growth is patchier and less vigorous than in higher rainfall forest closer to the Darling Scarp, and thickets of *A fraseriana* and *B.grandis* are less extensive. All of the sampling grids for 2004-05 were located in vegetation complex Dwellingup 4 (Mattiske and Havel 1998) which is regarded as transitional between western and eastern forest. Stand growth and individual tree growth are typically slower in these drier eastern forests than in western forests (Abbott and Loneragan 1983).

External control and coupe buffer grids included in this year's program had either not previously been harvested for timber, or had not been harvested for at least 50 –70 years. The Nalyerin external control grid was notable for its high stand basal area (56 $m^2$/ha), comprised predominantly of jarrah. Considering the current basal area of standing jarrah and of cut stumps we conclude that the stand density of the Godfrey coupe buffer grid would have been similarly large. Abbott and Loneragan reported stand basal area increments of 0.6 $m^2$/ha/decade for eastern forest, and extrapolating from this figure the expected recovery of basal area following earlier partial cutting would be 3-4 $m^2$/ha. Superior soil fertility and long absence of major disturbance to the overstorey are factors that could account for the large basal area of these stands. Mature trees had dbh up to 1 m, with most codominant trees having dbh of 70-90 cm. There were fewer very large trees in the eastern forest than recorded in the 2002 set of Wellington District sites that adjoined the 900 mm annual rainfall isohyet.

Shelterwood treatments had been applied conservatively, with retained basal areas on the 3 grids substantially exceeding the minimum level of 6 $m^2$/ha recommended (CALM 2004). Jarrah poles (15-45 cm dbh) and small mature trees (45-70 cm dbh) made up the majority of retained basal area in shelterwoods. None of the shelterwood treatments had involved extensive push down of *A. fraseriana*, and retained basal areas of *A. fraseriana* were small. The regeneration result in the Stockyard shelterwood was poor, with little seedling establishment and few saplings exhibiting dynamic growth.

Gap cutting at Stockyard had released a dense cohort of saplings with a high proportion of these originating from lignotubers, and this treatment could be judged as very successful. The Godfrey gap was not as well stocked but still has a substantial overwood of established trees.

The Bell forest block sites will be assessed for regeneration stocking in autumn 2006 by which time lignotuberous advance growth burnt back by the December 2004 fire will have had an opportunity to re-sprout.

**Recommended change to sampling procedure**

The only change to field sampling procedure that should be considered at this stage relates to how established trees of pole size (15-45 cm dbh) are recorded during regeneration stocking assessment in areas cut to gap release. Currently the sampling protocol specifies that saplings may be included in regeneration assessment, and that sampling points with a tree of >50 cm dbh within 4 m should be recorded as stocked. However, pole sized trees are not directly accounted for in this protocol even though they may often be the preferred form of regeneration and should be retained where possible. From a silvicultural perspective the logical approach would be to consider a point as stocked if it included a pole sized tree of acceptable form within 4 m radius of the sample point. Cull trees having poor form or high levels of stem defect would not be counted as acceptable stocking.

**Data management**

Regeneration stocking data were summarized and entered into the FORESTCHECK database. Data were analysed to determine the following key information:

- whether the grid meets current stocking standards,
- species composition of overstorey trees and the regeneration cohort,
- proportion of the grid affected by retained overwood (gap and shelterwood grids only),
- average density of saplings and ground coppice at points that meet the stocking standard.

**References**

Abbott, I. and Loneragan, O. (1983). Growth rate of jarrah (*Eucalyptus marginata*) in relation to site quality in cut-over forest, Western Australia. *Australian Forestry* **46**: 91-102.

Department of Conservation and Land Management (2004). Silvicultural Practice in the Jarrah Forest. Department of Conservation and Land Management, Sustainable Forest Management Series, SFM Guideline No. 1.

Mattiske, E. M. and Havel, J.J. (1998). Vegetation mapping in the South West of Western Australia. Department of Conservation and Land Management.

## FOLIAR AND SOIL NUTRIENTS

Lachlan McCaw, John Neal, Bob Smith

### Introduction

Concentrations of nitrogen (N), phosphorus (P) and potassium (K) in the foliage of advance growth, saplings and overstorey trees, and in surface soils are measured at each FORESTCHECK monitoring grid to provide information about the nutritional status of the forest ecosystem. Data will be used to investigate correlations between macronutrient concentrations and measures of plant and animal abundance, and ecosystem health.

### Monitoring

Samples of foliage and soil were collected from 7 of the Wellington East grids in mid March 2005. The 3 Bell forest block grids that were burnt during an unplanned fire in December 2004 were not sampled but will be in autumn 2006. The methodology for collection and analysis of samples is described in the Operations Plan. Samples were analysed at the WA Chemistry Centre.

### Foliar nutrients

Foliage from mature marri trees tended to have slightly higher concentrations of N, P and K than measured in advance growth or saplings. Growth stage appeared to have little or no effect on concentrations of N, P or K in jarrah foliage (Table 1). Mature marri foliage had higher concentrations of N, P and K than mature jarrah foliage, with this difference being almost threefold in the case of K. These patterns of foliar nutrient concentration are generally consistent with those observed in the previous 3 years of sampling.

**Table 1**. Concentrations of N, P and K in the foliage of jarrah and marri advance growth, saplings and mature trees for 7 grids in Wellington East. Data are shown as minimum-**mean**-maximum.

| Species | Foliage source | % Nitrogen (total) | % Phosphorus | % Potassium |
|---|---|---|---|---|
| Jarrah | Advance growth | 0.63-**0.69**-0.76 | 0.020-**0.023**-0.027 | 0.24-**0.38**-0.56 |
| | Sapling | 0.59-**0.74**-0.95 | 0.020-**0.026**-0.034 | 0.30-**0.34**-0.37 |
| | Mature | 0.69-**0.77**-0.82 | 0.023-**0.027**-0.032 | 0.31-**0.37**-0.41 |
| Marri | Advance growth | 0.71-**0.83**-0.96 | 0.024-**0.031**-0.035 | 0.56-**0.78**-0.88 |
| | Sapling | 0.73-**0.82**-0.94 | 0.025-**0.031**-0.037 | 0.55-**0.81**-0.97 |
| | Mature | 0.73-**0.90**-0.99 | 0.030-**0.037**-0.043 | 0.74-**0.90**-1.14 |

### Soil nutrients

Soil N concentrations for the Godfrey and Nalyerin grids were consistently twice as high as those measured in the 3 Stockyard grids (Table 2). Extractable P concentrations were also consistently greater for the Godfrey and Nalyerin grids, although total P concentrations were more comparable, except for the external control at Stockyard forest block (FC32).

Extractable K concentrations varied by a factor of about 2.5 with the lowest levels measured in the Stockyard grids. The Stockyard external control also had a notably low concentration of total K.

**Table 2.** Mean concentrations of N, extractable and total P, and extractable and total K determined from 5 surface soil samples. The overall mean (s.e.m.) for 7 grids in Wellington East is indicated.

| Grid | N<br>Per cent | P_extract<br>ppm | P_total<br>ppm | K_extract<br>ppm | K_total<br>ppm |
|---|---|---|---|---|---|
| FC28 | 0.28 | 3.25 | 166 | 114.7 | 123 |
| FC29 | 0.18 | 2.75 | 123 | 65.6 | 102 |
| FC30 | 0.23 | 3.80 | 133 | 128.4 | 94 |
| FC31 | 0.25 | 3.50 | 146 | 132.0 | 146 |
| FC32 | 0.11 | <2 | 55 | 45.0 | 42 |
| FC33 | 0.13 | <2 | 112 | 49.4 | 148 |
| FC34 | 0.14 | <2 | 123 | 70.2 | 130 |
| **MEAN<br>(s.e.m)** | **0.18<br>(0.02)** | **2.76<br>(0.29)** | **122.3<br>(13.35)** | **86.47<br>(14.16)** | **112.14<br>(14.00)** |

**Discussion**

There was a clear distinction between the low nutrient concentrations in the soils at Stockyard forest block and the higher levels measured at Nalyerin and Godfrey. The Stockyard Control (FC32) stood out as having the lowest concentrations of all macronutrients. The poor nutrient status of this site was reflected in a low basal area of jarrah and marri. Soil and foliar nutrients will be sampled in the Bell forest block grids in autumn 2006 and this will allow a more complete comparison of nutritional status of eastern jarrah forest sites.

Comparing the overall mean concentrations of soil nutrients measured this year in Wellington East and previous years in Donnelly, Perth Hills and Wellington (Table 3), shows that the eastern jarrah forest sites in Wellington East have:

- higher mean N concentrations,
- higher mean concentrations of total P and comparable concentrations of available P, and
- higher mean concentrations of extractable K and similar concentrations of total K than the other sites.

Foliar nutrient concentrations measured in Wellington East were generally comparable with those measured in Donnelly and Wellington in previous years.

**Table 3.** Mean (s.e.m) soil nutrient concentrations for FORESTCHECK grids in Donnelly, Wellington, Perth Hills and Wellington East locations.

| District | N Per cent | P_extract ppm | P_total ppm | K_extract ppm | K_total ppm |
|---|---|---|---|---|---|
| Donnelly | 0.12 (0.01) | 2.0 (0.4) | 65.4 (13.4) | 43.8 (5.6) | 94.8 (13.5) |
| Wellington | 0.14 (0.01) | 2.3 (0.6) | 85.2 (16.3) | 54.7 (5.6) | 119.0 (11.0) |
| Perth Hills | 0.13 (0.03) | 1.4 (0.4) | 32.3 (16.7) | 53.6 (17.1) | 135.7 (49.4) |
| Wellington East | 0.18 (0.02) | 2.8 (0.3) | 122.3 (13.4) | 86.7 (14.1) | 112.1 (14.0) |

**Recommended changes to operating procedure**

The WA Chemistry Centre analysed soil and foliar samples this year at similar cost to previous years.

## SOIL DISTURBANCE

Kim Whitford

### Introduction

This report covers the 2004-05 soil disturbance assessments of the Wellington East FORESTCHECK sites. Only a subset of the sites are sampled as soil disturbance cannot be reliably assessed on all sites. Bulk density is measured on only one harvested site each year. This year the Stockyard shelterwood site (FC33) was measured. The soil bulk density on this site was compared with the bulk density on an adjacent undisturbed site to determine the soil compaction caused by timber harvesting. As snig tracks are the source and location of most soil disturbance produced by logging, mapping of snig track layout and snig track order was attempted on all of the harvested sites.

The objectives of this work were to:

- Record the extent of soil disturbance on FORESTCHECK monitoring sites where machine disturbance (snig tracks) could be readily identified.
- Monitor the intensity of changes to soil physical properties induced by logging, on selected sites.
- Provide base data that could be used to monitor any change in these soil physical properties over time.
- Contribute data that can be used to relate the intensity of disturbance to the operational categories, where intensity of disturbance is measured as the fine earth bulk density of the soil.

### Monitoring

Soil bulk density samples were collected in June 2005. Data from the Stockyard shelterwood (FC33) were compared with data from an adjacent unlogged site. These sites were selected for measurement of bulk density because: (a) the surface soils were relatively free of large boulders or sheet caprock, (b) the 2 sites were the same Mattiske-Havel vegetation complex and consequently could be expected to have similar soils, and c) the snig tracks could be successfully mapped on the Stockyard shelterwood site, thus providing information on the operational categories of the bulk density sample points. The sampling of bulk density was stratified on the basis of operational categories. Operational categories are classifications of the type of harvesting activities that have occurred at the sample point, e.g. harvested area, unharvested area, log landing, old log landing, old snig track, snig track order.

On the Stockyard shelterwood site, and the remaining 3 sites where bulk density was not measured, mapping of snig tracks provided an assessment of both the amount and the location of the disturbance. Incorrect or low quality mapping gives a poor indication of soil disturbance. Satisfactory mapping of the snig track layout occurred on the Stockyard shelterwood and gap release (FC34), and the Godfrey shelterwood (FC30) and gap release sites (FC31) (see Table 1). The snig tracks could not be mapped on the harvested Bell forest block sites (FC36 and FC37). This is attributed to the amount of surface rock at these sites which prevented depression of the soil under the wheel load of the machinery, the burning of the sites which removed some of the plant evidence of vehicle tracks, and possibly the relatively light harvest that occurred at these sites. The relative quality of the snig track mapping was high on the Stockyard shelterwood site, where primary, secondary, and tertiary snig tracks could be readily identified. In addition some old snig tracks from the previous 2 harvesting events could be identified. The quality of the snig track mapping on the remaining sites (FC30, FC31, and FC34) was reasonable, with primary and

secondary snig tracks identified. The tertiary snig tracks were not well mapped on any of these 3 sites. Surface rock and dispersed harvesting prevented detailed mapping of the tertiary snig tracks on the Stockyard gap release site, though some old snig tracks were identified and mapped on this site. The relatively light harvest on the Godfrey shelterwood resulted in limited mapping of the tertiary snig tracks. Disturbance from what appears to be post harvest pushdown, or possibly the machine harvesting on the Godfrey gap release site obscured some of the tertiary snig tracks on that site and limited the mapping of these snig tracks.

**Preliminary results**

The sites and treatments assessed and measured are listed in Table 1. Table 2 gives the means and standard errors for total bulk density (TBD) and fine earth bulk density (FEBD), and gravel content for the various operational categories on the Stockyard shelterwood and an adjacent undisturbed unlogged area with similar soil.

**Table 1.** The type of assessment and the number of samples collected at each site.

| Site | | Site label | Snig track map | Operational category sample points | Bulk density sample points | Quality of snig track mapping |
|---|---|---|---|---|---|---|
| Godfrey | Coupe Buffer | FC29 | No | | | Not mapped |
| Godfrey | Shelterwood | FC30 | Yes | | | Satisfactory |
| Godfrey | Gap Release | FC31 | Yes | | | Satisfactory |
| Stockyard | External Control | FC32 | No | | | Not mapped |
| Stockyard | Shelterwood | FC33 | Yes | 175 | 175 | High |
| Stockyard | Gap Release | FC34 | Yes | | | Satisfactory |
| Bell | External Control | FC35 | No | | | No snig tracks |
| Bell | Shelterwood | FC36 | No | | | Not mapped |
| Bell | Gap Release | FC37 | No | | | Not mapped |
| **TOTAL** | | | | **175** | **175** | |

Table 3 shows the area of the snig tracks and landings for 4 sites from this years monitoring and 6 sites from previous years monitoring. The snig track maps (Figs. 1, 2, 3 and 4) show the location and extent of snig tracks and landings on the Stockyard and Godfrey shelterwood and gap release sites.

Table 4 provides a summary of the comparisons of soil bulk density that can be made between the control or undisturbed sites and the recently harvested sites over the 4 years of FORESTCHECK monitoring. Six such comparisons can be made. For each of the recently harvested sites 2 values of the mean bulk density are given; one mean for samples collected on the systematically sampled grid points, and another mean for the samples collected from the "harvested area" operational category. The change in bulk density as a result of the harvesting is best estimated by comparison of the mean bulk densities from the unharvested control site and the systematic grid point samples from the recently harvested sites.

**Table 2.** Number of samples (n), bulk density (g/cm$^3$ and SE) and gravel content (% and SE) for operational categories at the Stockyard shelterwood FORESTCHECK site and an adjacent area of unlogged forest. Operational categories: harvested area (HA), unharvested area (UA), major snig track into landing (ST0), primary snig track (ST1), secondary snig tracks (ST2), tertiary snig track (ST3), old snig track from previous logging (OST), old primary snig track from previous logging (OST1), old tertiary snig track from previous logging (OST3), log landing (LL), old log landing (OLL), access track (Track).

| FORESTCHECK site | Operational category | n | Total bulk density (g/cm$^3$) | SE | Fine earth bulk density (g/cm$^3$) | SE | Gravel content (%) | SE |
|---|---|---|---|---|---|---|---|---|
| Stockyard shelterwood | | | | | | | | |
| FC33 | HA | 76 | 1.395 | 0.029 | 0.672 | 0.015 | 64.8 | 1.0 |
| | LL | 22 | 1.604 | 0.034 | 0.955 | 0.033 | 60.6 | 0.9 |
| | OST | 14 | 1.608 | 0.081 | 0.832 | 0.054 | 66.2 | 1.9 |
| | ST1 | 20 | 1.709 | 0.052 | 0.929 | 0.039 | 64.8 | 0.8 |
| | ST2 | 21 | 1.555 | 0.066 | 0.804 | 0.038 | 64.4 | 1.7 |
| | ST3 | 22 | 1.526 | 0.060 | 0.775 | 0.036 | 63.9 | 2.3 |
| Stockyard adjacent unlogged | UA | 40 | 1.396 | 0.032 | 0.664 | 0.018 | 65.6 | 1.6 |

**Discussion**

Bulk density was measured on the Stockyard shelterwood (logged 3 times, most recently in 1998). These bulk density measurements were compared with measurements from an adjacent area that had never been harvested. The soils on the 2 sites were very similar. The mean gravel content of the Stockyard shelterwood site was 64% and the mean gravel content of the adjacent unlogged site was 66%.

The bulk density values on the Stockyard shelterwood site followed a logical and consistent trend with the compaction increasing as the amount of traffic increased across the operational categories. The bulk density of the log landing was 44% higher than the bulk density of the undisturbed site. The bulk density of the primary snig tracks was 40% higher, the bulk density of the secondary snig tracks was 21% higher, and the bulk density of the tertiary snig tracks was 17% higher than the bulk density of the undisturbed site.

The bulk density of the general harvested area that was not covered by snig track was 0.67 ± 0.015 g/cm$^3$ while the bulk density of the undisturbed soil on the adjacent unlogged area was 0.66 ± 0.018 g/cm$^3$. The bulk density of the general harvested area on the Stockyard shelterwood site was not significantly different from the bulk density of the adjacent undisturbed unlogged area.

The mean bulk density for the Stockyard shelterwood site determined from a systematic grid sampling across the site was 0.71 ± 0.018 g/cm$^3$. This is only slightly higher than the mean bulk density of the adjacent unlogged site, which was 0.66 ± 0.018 g/cm$^3$. This 8% increase in the fine earth bulk density of the surface soil (0-10cm) (Table 4) is relatively small but still a significant increase in bulk density, attributable to the 3 harvesting events that occurred on the Stockyard shelterwood site.

**Table 3.** The estimated area of the fallers block surrounding each FORESTCHECK site, the area of snig tracks and landings identified on each fallers block, and the areal proportion of the fallers block that has been disturbed by snig tracks and landings. Snig track classes are: primary (ST1), secondary (ST2), tertiary (ST3), and old snig track from a previous logging (OST). Snig track area calculations are based on measurements of snig track lengths and assumed widths of 4.67 m for ST1, 4.46 m for ST2, and 4.13 m for ST3.

| Site | Site code | ST1 ($m^2$) | ST2 ($m^2$) | ST3 ($m^2$) | OST ($m^2$) | Total snig track area ($m^2$) | Landing Area ($m^2$) | Fallers block Area ($m^2$) | Landing area (% of fallers block) | Snig track area (% of fallers block) | % of fallers block disturbed |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Edward gap main landing and fallers block | FC11 | 1,365 | 1,346 | 5,326 | 0 | 8,037 | 1,970 | 55,220 | 3.6 | 14.6 | 18.1 |
| Edwards gap second landing | FC11 | n/a | n/a | n/a | n/a | n/a | 2,240 | n/a | | | |
| Edwards gap third landing | FC11 | n/a | n/a | n/a | n/a | n/a | 600 | n/a | | | |
| Ross gap | FC12 | 1,804 | 2,331 | 5,256 | 0 | 9,391 | 4,350 | 105,300 | 4.1 | 8.9 | 13.0 |
| Ross shelterwood eastern fallers block | FC13 | 1,112 | 1,560 | 8,262 | 0 | 10,934 | 2,248 | 77,130 | 2.9 | 14.2 | 17.1 |
| Surface shelterwood | FC15 | 2,351 | 1,761 | 6,908 | 0 | 11,020 | 1,590 | 65,760 | 2.4 | 16.8 | 19.2 |
| Chalk shelterwood western fallers block | FC18 | 322 | 825 | 5,995 | 2,159 | 9,301 | 2,120 | 43,820 | 4.8 | 21.2 | 26.1 |
| Chalk shelterwood eastern fallers block | FC18 | 444 | 1,511 | 3,596 | 2,739 | 8,290 | 680 | 46,700 | 1.5 | 17.8 | 19.2 |
| Chalk combined, both fallers blocks | FC18 | 766 | 2,336 | 9,591 | 4,899 | 17,592 | 2,805 | 90,520 | 3.1 | 19.4 | 22.5 |
| Chalk shelterwood west, excluding OST | FC18 | 322 | 825 | 5,995 | excluded | 7,142 | 2,120 | 43,820 | 4.8 | 16.3 | 21.1 |
| Chalk shelterwood east, excluding OST | FC18 | 444 | 1,511 | 3,596 | excluded | 5,551 | 680 | 46,700 | 1.5 | 11.9 | 13.3 |
| Chalk combined, excluding OST | FC18 | 766 | 2,336 | 9,591 | excluded | 12,693 | 2,805 | 90,520 | 3.1 | 14.0 | 17.1 |
| Lesley gap | FC25 | | | | | 9,666 | 418 | 120,179 | 0.4 | 8.4 | |
| Godfrey Shelterwood Landing 1 (East) | FC30 | 1,453 | 1,141 | 1,817 | 963 | 5,374 | 2,677 | 74,043 | 3.6 | 7.3 | 10.9 |
| Godfrey Shelterwood Landing 2 (West) | FC30 | | | | | | 2,970 | | | | |
| Godfrey Gap Release Landing 1 (East) | FC31 | 790 | 2,679 | 1,590 | 1,664 | 6,722 | 2,366 | 101,400 | 2.3 | 6.6 | 9.0 |
| Godfrey Gap Release Landing 2 (West) | FC31 | 220 | 2,536 | 1,420 | 173 | 4,349 | 2,044 | 77,406 | 2.6 | 5.6 | 8.3 |
| Stockyard Shelterwood | FC33 | 2,491 | 3,664 | 10,434 | 9,233 | 25,822 | 1,802 | 200,990 | 0.9 | 12.8 | 13.7 |
| Stockyard Gap Release Landing 1 (South) | FC34 | 1,467 | 1,110 | 1,197 | 1,444 | 5,219 | 1,358 | 80,959 | 1.7 | 6.4 | 8.1 |
| Stockyard Gap Release Landing 2 (North) | FC34 | 3,094 | 1,810 | 801 | | 5,704 | 2,568 | 181,224 | 1.4 | 3.1 | 4.6 |
| **Mean** | **All** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **2.6** | **12.1** | **15.1** |

**Table 4.** A summary of the mean change in surface soil (0-10cm) bulk density attributed to timber harvesting operations across all FORESTCHECK sites.

| Site | Site Code | Operational Category | Number of times harvested | Year of last harvest | Years since harvest | Mattiske-Havel vegetation complex | Fine earth bulk density (g $cm^{-3}$ ) | % Change (grid vs. not harvested) | n[1] | Gravel content (%) | Assessment year |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Kingston gap | FC2 | Grid points | 3 | 1995/96 | 7 | Corbalup 2 | 0.82 ± 0.03 | | 77 | 33 | 2001 |
| Kingston gap | FC2 | Harvested | 3 | 1995/96 | 7 | Corbalup 2 | 0.80 ± 0.02 | | 68 | 32 | 2001 |
| Kingston TEAS | FC4 | Not harvested | 2 | 1970s | 22-32 | Corbalup 2 | 0.92 ± 0.02 | -11 | 39 | 10 | 2001 |
| Thornton gap | FC6 | Grid points | 2 | 1991 | 11 | Corbalup 1 | 1.00 ± 0.02 | | 77 | 17 | 2001 |
| Thornton gap | FC6 | Harvested | 2 | 1991 | 11 | Corbalup 1 | 0.98 ± 0.02 | | 75 | 17 | 2001 |
| Thornton TEAS | FC7 | Not harvested | 1 | 1940s | 52-62 | Corbalup 1 | 0.76 ± 0.04 | 32 | 40 | 47 | 2001 |
| Carter gap | FC8 | Harvested | 2 | 1999 | 3 | Collis 1 | 0.80 ± 0.01 | | 137 | 35 | 2001 |
| Carter TEAS | FC9 | Not harvested | 1 | 1940s | 52-62 | Collis 1 | 0.78 ± 0.02 | 3 | 40 | 55 | 2001 |
| Chalk shelterwood | FC18 | Grid points | 3 | 1992 | 11 | Dwellingup 1 | 0.81 ± 0.02 | | 81 | 65 | 2002 |
| Chalk shelterwood | FC18 | Harvested | 3 | 1992 | 11 | Dwellingup 1 | 0.80 ± 0.02 | | 67 | 65 | 2002 |
| Tumlo control | FC19 | Not harvested | 0 | unlogged | n/a | Dwellingup 1 | 0.60 ± 0.02 | 35 | 40 | 70 | 2002 |
| Cameron shelterwood | FC23 | Grid points | 3 | 1989 | 15 | Dwellingup 1 | 0.92 ± 0.01 | | 74 | 53 | 2003 |
| Cameron shelterwood | FC23 | Harvested | 3 | 1989 | 15 | Dwellingup 1 | 0.92 ± 0.01 | | 73 | 52 | 2003 |
| Kennedy control | FC24 | Not harvested | 2 | 1930-34 | 74-70 | Dwellingup 1 | 0.83 ± 0.02 | 11 | 40 | 67 | 2003 |
| Stockyard shelterwood | FC33 | Grid points | 3 | 1998 | 7 | Dwellingup 4 | 0.71 ± 0.02 | | 75 | 65 | 2005 |
| Stockyard shelterwood | FC33 | Harvested | 3 | 1998 | 7 | Dwellingup 4 | 0.67 ± 0.02 | | 76 | 65 | 2005 |
| Stockyard unlogged | | Not harvested | 0 | unlogged | n/a | Dwellingup 4 | 0.66 ± 0.02 | 7 | 40 | 66 | 2005 |
| Mean | | | | | | | | 13 | | | |

[1] Number of bulk density samples taken.

**Table 5.** Comparison of soil bulk densities ($g/cm^3$) for the surface soil (0-10cm) following tractor logging as reported in Australia and overseas (Rab, 1992).

| | Total bulk density ($g/cm^3$) | | | | Percentage change from undisturbed | | |
|---|---|---|---|---|---|---|---|
| **Source** | **Undisturbed areas** | **Harvested areas** | **Snig tracks** | **Log landings** | **Harvested areas** | **Snig tracks** | **Log landings** |
| Dickerson (1976) | 1.29 | 1.42 | 1.55 | | 10.1 | 18.3 | |
| Froehlich (1979) | 0.97 | | 1.14 | | | | |
| Jakobsen (1983) | 0.9 | | 1.07 | | | | |
| Gent *et al.* (1984) | 1.14 | 1.36 | 1.52 | | 19.3 | 27.9 | |
| Incerti *et al.* (1987) | 0.96 | 0.99 | 1.22 | 1.33 | 3.1 | 26.3 | 30.3 |
| Rab *et al*. (1992) | 0.94 | 1.02 | 1.12 | 1.19 | 8.5 | 17.6 | 22.3 |
| Anderson *et al*. (1992) | 0.71 | 0.86 | 1.1 | 1.22 | 21.1 | 45.3 | 46.4 |

Table 4 summarizes the mean change in surface soil bulk density attributed to timber harvesting operations across all of the FORESTCHECK sites where bulk density has been measured. The change in bulk density as a result of timber harvesting is estimated by comparing the mean bulk densities from the grid point samples for the recently harvested sites, with the unharvested control sites. The comparisons in Table 4 are made between sites with the same Mattiske-Havel vegetation complex. Generally soils are similar within a Mattiske-Havel vegetation complex, although this is not always the case with one such exception occurring with the Kingston gap release and the immediately adjacent Kingston coupe buffer (TEAS) sites. The soil on these 2 sites was very different – the Kingston coupe buffer being a sand, and the Kingston gap release a gravely loam. Comparison of bulk density between these 2 sites is not valid because the soils are clearly different.

Excluding the Kingston gap release site, the mean increase in soil bulk density attributable to timber harvesting across these 5 sites was 18%. This is a substantial increase in the mean bulk density of the surface soils, and can be identified as a likely impact of timber harvesting. Similar data from a greater number of sites and further comparisons with unlogged sites is needed to clarify the validity of this observed increase in bulk density.

Table 5 lists actual and per cent increase in total bulk density observed at other harvested forest sites in Australia and overseas. The values indicate that the increase in soil bulk density observed in the jarrah forest (~18%) is within the upper range observed in other forest types (3% to 20%).

Of the 5 comparisons shown in Table 4, only 2, the Chalk shelterwood / Tumlo external control, and the Stockyard shelterwood/adjacent unlogged area, enable a comparison of a unlogged site with a harvested site. These 2 comparisons show surprisingly different responses. Both harvested sites have been logged 3 times, have similar soils with similar gravel contents, yet the Chalk shelterwood site shows a much greater increase in soil bulk

density (35%) attributable to the timber harvesting, than the Stockyard shelterwood site (8%). Factors that influence the impact of timber harvesting on soil bulk density include the soil moisture at the time of harvesting, the intensity of the timber harvest, and soil particle size distribution (Rab *et al*. 2005). Differences in these 3 factors between the 2 harvesting operations, particularly differences in soil moisture, most likely explain the differing impact of these operations on the soil bulk density.

Of the 4 FORESTCHECK monitoring sites that were examined this year, the Stockyard gap release (FC34) and the Godfrey gap release (FC31) have been harvested twice, and the Stockyard shelterwood (FC33) and part of the Godfrey shelterwood (FC30) has been harvested 3 times. The most recent harvest on the Godfrey gap release was a machine harvest in 2000. This type of harvesting operation, which has only recently been introduced into the jarrah forest and is now the predominant mode of timber harvesting, greatly influences the timber extraction pattern and the type, and intensity of soil disturbance that occurs on the harvested area. Machine harvesting generally decreases the amount of tertiary snig tracks on a site reducing the amount of soil compaction attributable to tertiary snig tracks. However, machine harvesting also greatly increase the amount of soil mixing that occurs across the harvested area.

As with the 2003-04 FORESTCHECK sites, the boundaries of the faller's blocks about the 2004-05 FORESTCHECK sites in the northern jarrah forest were not as well delineated as the 2001-02 FORESTCHECK sites in the southern jarrah forest. Consequently the faller's block areas presented in Table 3 are estimates. These areas were estimated from the extent and distribution of the snig tracks and harvesting on these sites. This reduces the accuracy of the last 2 columns in Table 3, i.e. the estimates of the area of the landing as a proportion of the faller's block area, and the estimates of the proportion of the faller's block disturbed by snig tracks and landings.

The network of snig tracks on the Stockyard shelterwood site was extensive (Fig. 3). There was some re-use of old snig tracks on this site, but not as much as could have been achieved. There were crossing tracks, and old snig tracks that were not re-used in the most recent harvest. This site is a particularly good example of how re-use of old snig tracks could reduce the amount of the harvested area compacted. Similarly there could have been greater re-use of old snig tracks on the Stockyard gap release site (Fig. 4). The pattern of timber extraction was generally rational on the Godfrey gap release (Fig. 2) and Godfrey shelterwood sites (Fig. 1); however, there was some duplication of snig tracks on these sites.

Across all of the FORESTCHECK sites, landing size has varied from 0.4% to 4.8% of the total area of the faller's block. The mean landing size was 2.6% of the total area of the faller's block.

The landing size varies according to the type and size of the harvesting operation, and the volume of timber and the range of timber products harvested from the site. Considering the mean landing size as a proportion of the harvested area, the landing on the Stockyard shelterwood was relatively small, occupying only 0.9% of the harvested area. Landing 1 on the Godfrey shelterwood was a particularly large landing, occupying 3.6% of the harvested area. The landings on the remaining sites were of average or less than average size for operations in the jarrah forest.

**Conclusions**

- Timber harvesting on the Stockyard shelterwood significantly increased the fine earth bulk density of the surface soil (0-10cm) by 7%.
- Considering that 3 harvesting operations have occurred on this site, this is a relatively small increase in soil bulk density and substantial less than that observed at a similar site (Chalk shelterwood) that was also harvested 3 times, resulting in a 35% increase in soil bulk density.
- The bulk density of the general harvested area away from the snig tracks on the Stockyard shelterwood site was not significantly different from the bulk density of the adjacent area that had never been harvested.
- Considering all of the FORESTCHECK sites so far monitored for soil bulk density, harvesting produces a mean increase in bulk density of the surface soil of 18%.
- Similar differences over a larger number of sites are needed to confidently identify the size of any increase in bulk density caused by harvesting, and the range and variation of this increase.
- Understanding the impact of timber harvesting on the soil bulk density of other FORESTCHECK sites would be greatly enhanced when further measurements of soil bulk density are taken on sites with matching soil types that have never been harvested.
- The network of snig tracks on the Stockyard shelterwood site was extensive. Greater re-use of old snig tracks on this and other sites would reduce the amount of soil compaction caused by timber harvesting.
- Across all of the FORESTCHECK sites, landing size has varied from 0.4% to 4.8% of the total area of the faller's block and the mean landing size was 2.6% of the total area of the faller's block.
- The landing on the Stockyard shelterwood site was relatively small, occupying only 0.9% of the harvested area. Landing 1 on the Godfrey shelterwood was a particularly large landing occupying 3.6% of the harvested area. The landings on the remaining sites were on average or less than average size for operations in the jarrah forest.

**Future tasks**

The planned work for this year's monitoring is complete. The snig track widths used to calculate the area of the snig tracks were mean values determined from earlier work at other sites in the jarrah forest (Whitford 2001). The addition of measurements of snig track widths on the individual FORESTCHECK sites would increase the value of the snig track areas presented here. It could be helpful in the final analysis of this data to have particle size analysis, soil descriptions and possibly soil mapping for all of the FORESTCHECK sites, but particularly for the 10 sites listed in Table 4 where soil bulk density has been measured. As many of the control sites have been harvested at least once, and have thus experienced soil disturbance which is slow to ameliorate, an attempt will be made in the next year's sampling to collect bulk density measurements from some additional sites which have never been harvested. These sites would be used as reference sites for the existing harvested FORESTCHECK sites. This additional sampling would be of areas adjacent to or near existing FORESTCHECK sites.

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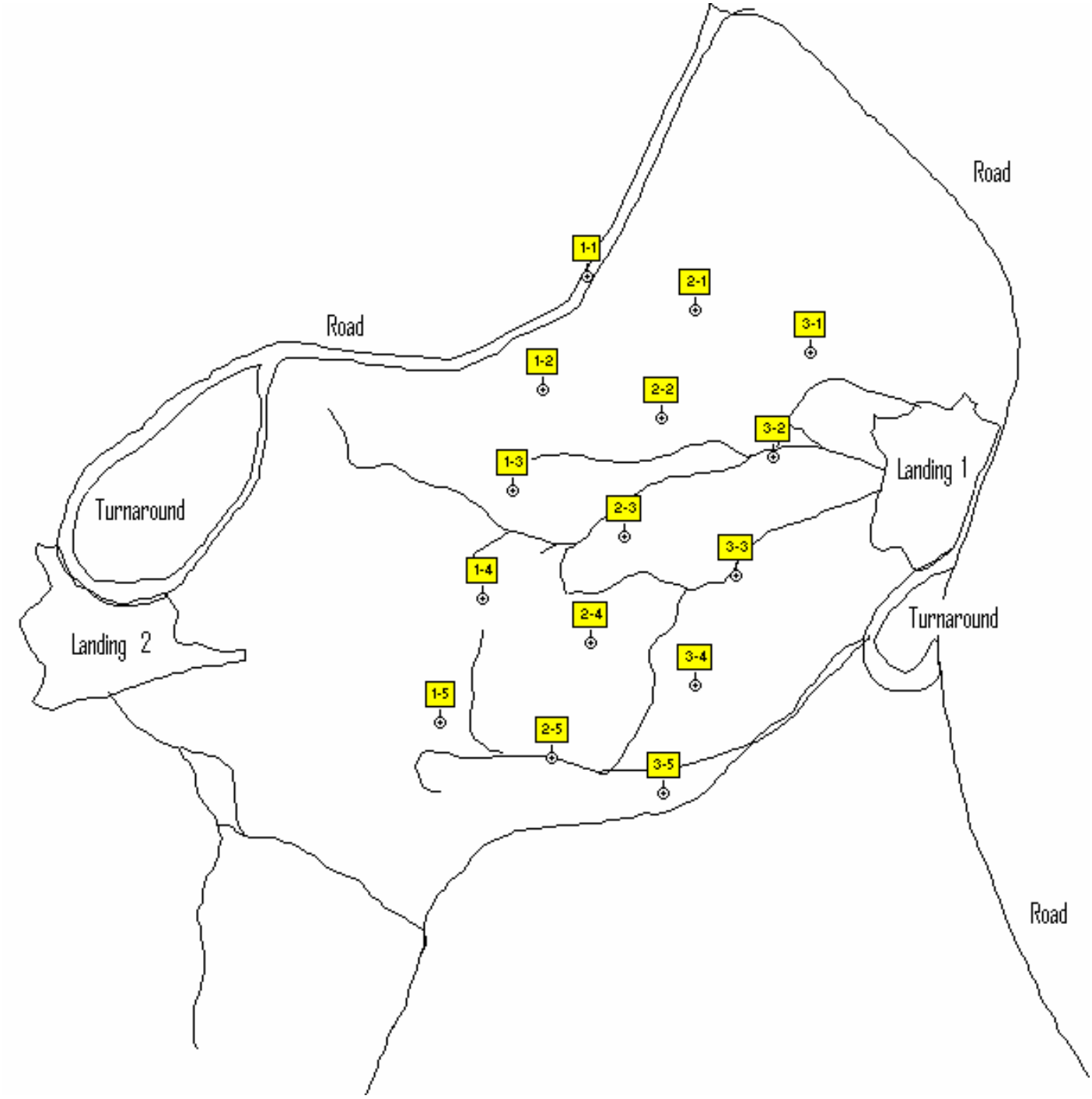


**Figure 1.** FORESTCHECK site FC30, Godfrey forest block shelterwood showing the layout of the snig tracks, the landings and the FORESTCHECK sampling grid. Scale is given by the grid point spacing of 50 metres.

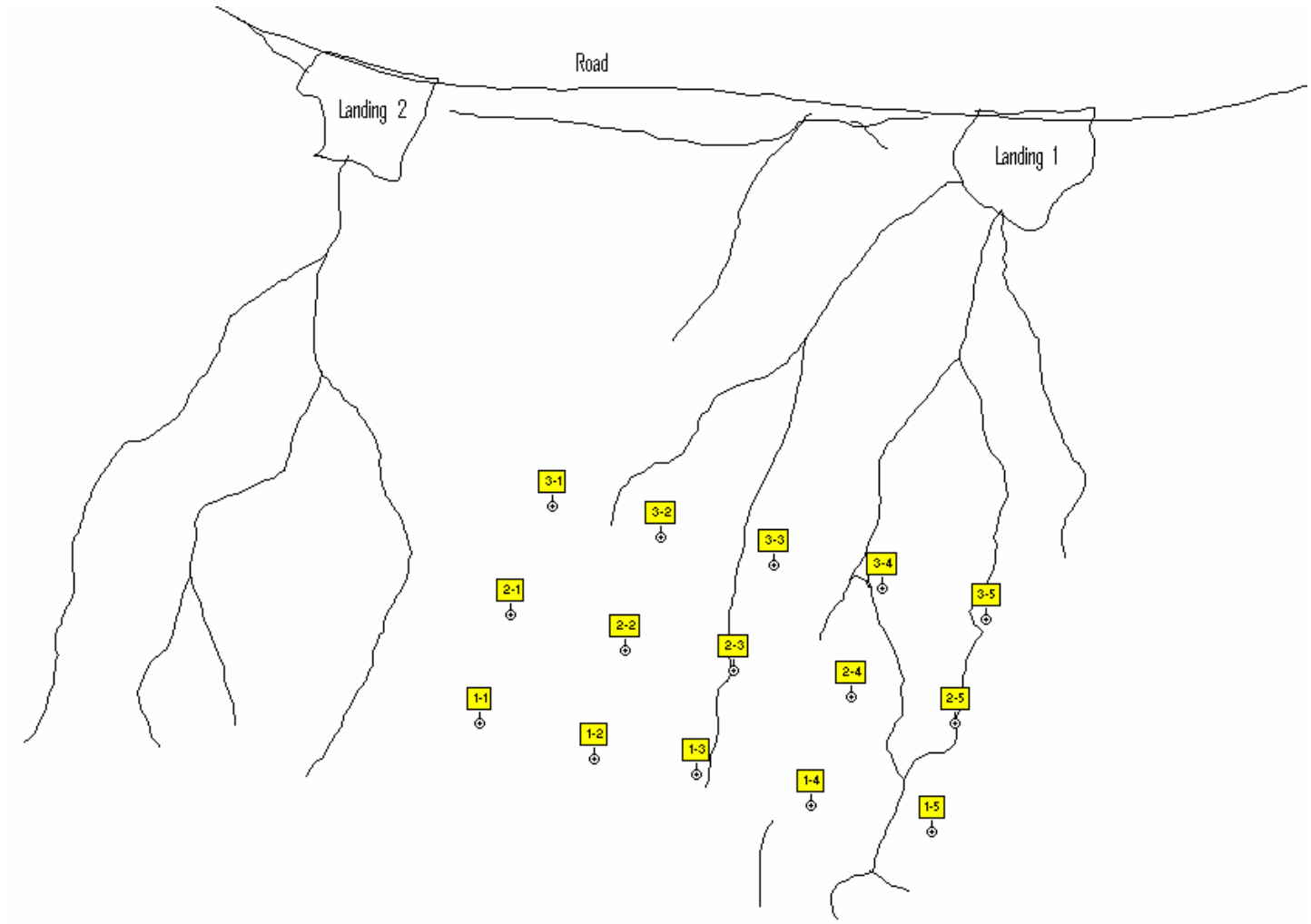


**Figure 2.** FORESTCHECK site FC31, Godfrey forest block gap release, showing the layout of the snig tracks, landings and the FORESTCHECK sampling grid. Scale is given by the grid point spacing of 50 metres.

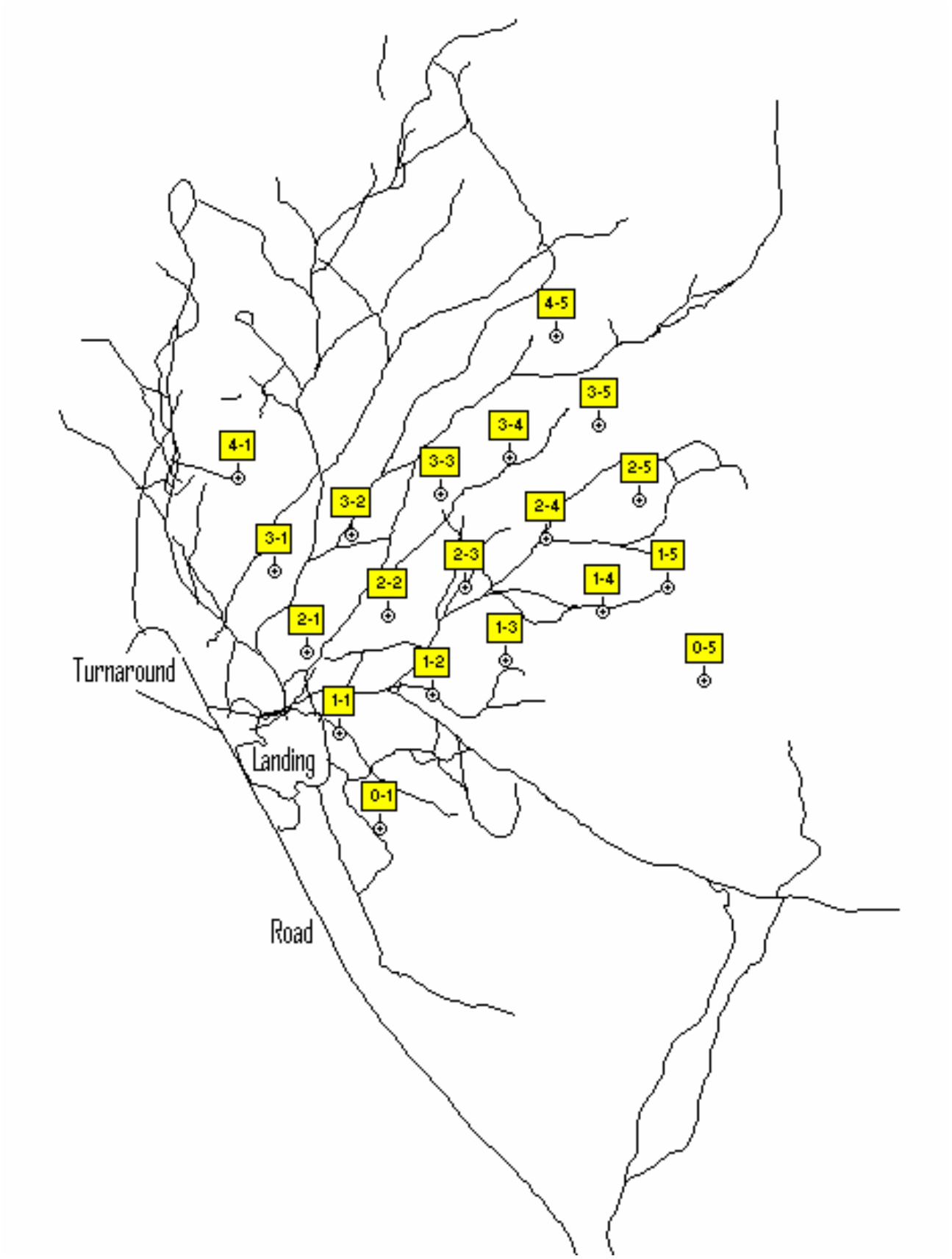


**Figure 3.** FORESTCHECK site FC33, Stockyard forest block shelterwood, showing the layout of the snig tracks, the landing and the FORESTCHECK sampling grid. Scale is given by the grid point spacing of 50 metres.

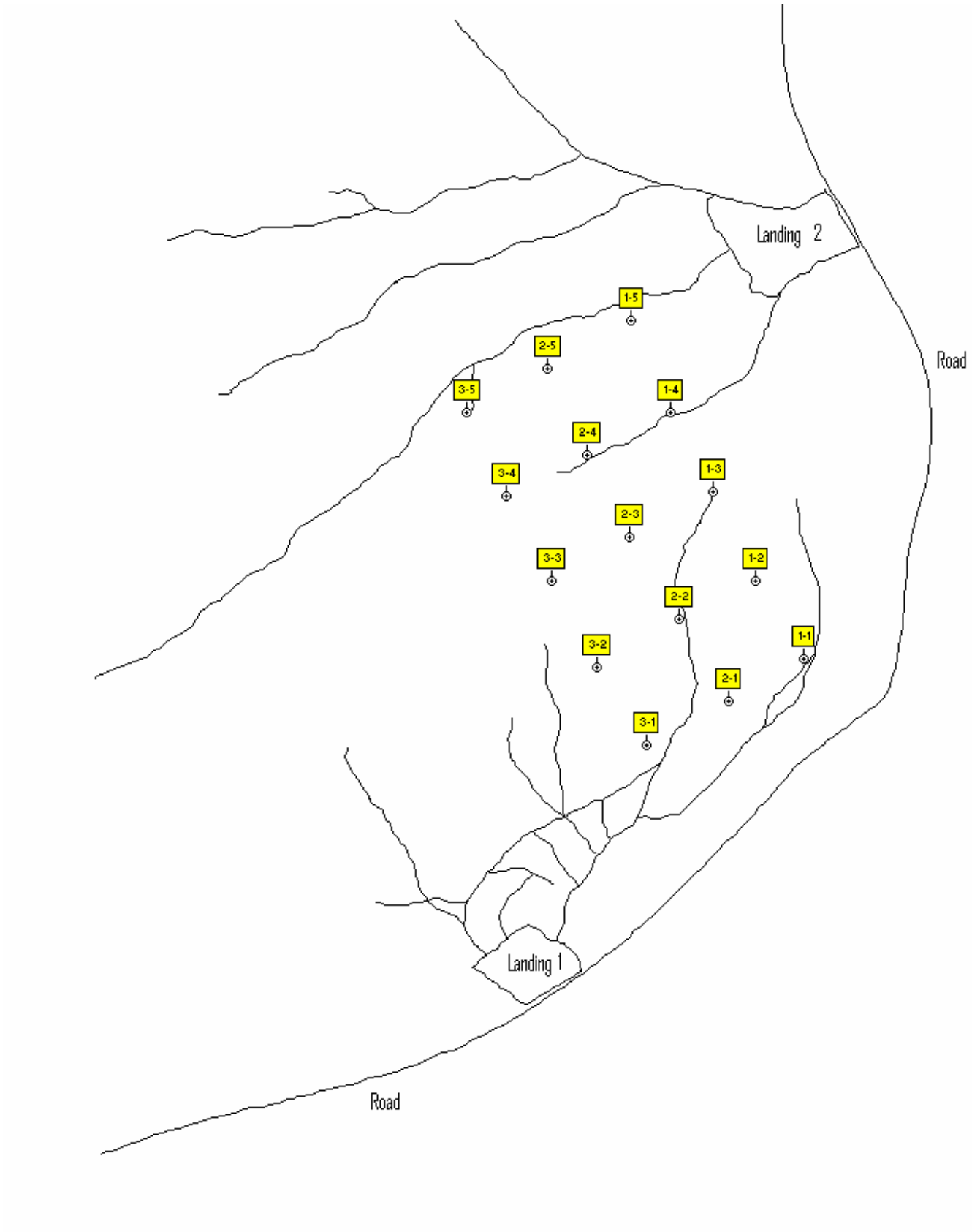


**Figure 4.** FORESTCHECK site FC34, Stockyard forest block gap release, showing the layout of the snig tracks, the landings and the FORESTCHECK sampling grid. Scale is given by the grid point spacing of 50 metres.

# COARSE WOODY DEBRIS, SMALL WOOD AND TWIGS, AND LITTER

Bob Smith and Richard Robinson

## Introduction

The quantity of wood and leaf debris on the forest floor contributes to the habitat of fungi, small reptiles, mammals and invertebrates. It is therefore of some importance to ascertain the amount of debris in each area before and after disturbance such as logging and burning. The amount of litter also affects the soil moisture, which in conjunction with micro-organisms affects the soil texture.

This component of FORESTCHECK is intended to:

- Measure and record the amount of litter, small wood and twigs (SWT) and coarse woody debris (CWD) on the ground in the various managed Jarrah forest treatments (i.e.: Gap Release and Shelterwood) and in uncut forest.
- Analyse trends within and between the treatments over time.
- Make the data available for analysis of distribution patterns of other organisms such as invertebrates, small mammals, fungi and cryptogams.

A wildfire burnt through the set of sites in Bell forest block prior to measurement. The litter and SWT were completely destroyed in the fire and as a result were not measured at these sites in 2005. The CWD was measured, however, as the larger logs were still present even though a proportion of them were charred and reduced in size.

## Monitoring and Laboratory Work

Sampling in 2004-05 was carried out from 8-10 March 2005, in conjunction with the soil and leaf nutrient sampling and stand structure measurement. The litter and small wood and twigs (SWT) samples were oven dried, weighed in grams and then converted to tonnes per hectare (t $ha^{-1}$). The volume of coarse woody debris (CWD) was determined using the line intersect method (van Wagner, 1968) and calculated to cubic metres per hectare ($cm^3$ $ha^{-1}$).

## Results and Discussion

### Litter Weights

Litter weights reflected the time since the last burn (Fig. 1). The heaviest litter weights were found on the external control sites. The Nalyerin site (FC28), with 17-year-old fuels combined with a dense canopy, resulted in the heaviest litter load. Within the silvicultural treatments, the Stockyard shelterwood (FC33) and gap release (FC34) treatments had both been unburnt for 6 years and carried heavier litter loads than the Godfrey forest block treatments (FC30, FC31) that had been unburnt for only 2 years. The Bell forest block sites (FC35, FC36, FC37) were all burnt in a summer wildfire and had no litter to be measured.

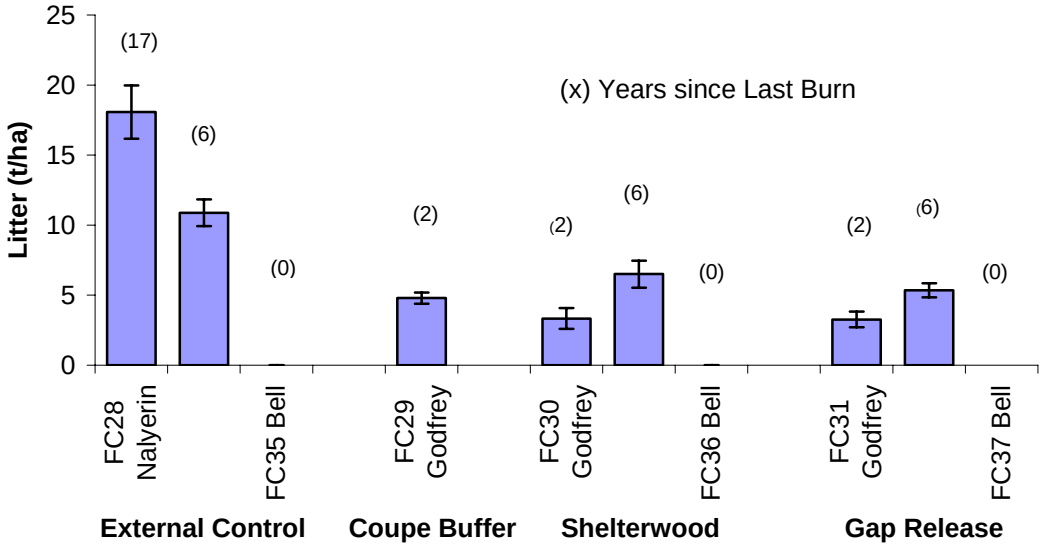


**Figure 1.** Mean litter loads (t $ha^{-1}$ ± se) calculated at each FORESTCHECK site at Wellington East in March 2005. Note that the Bell forest block grids were burnt by wildfire in December 2004.

### Small Wood and Twigs

The amount of small wood and twigs carried on all sites was very light (Fig. 2), with the heaviest load being less than 0.7 t $ha^{-1}$ on the Stockyard shelterwood site (FC33). Again, the entire SWT component on the Bell forest block sites was consumed in the fire and not measured.

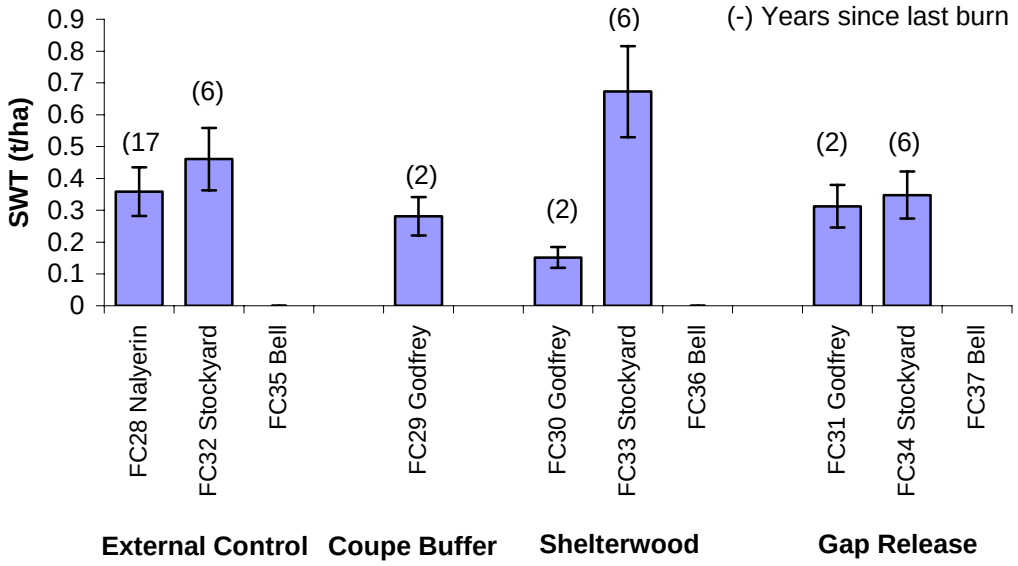


**Figure 2.** The average weights (t $ha^{-1}$ ± se) of small wood and twigs measured at each FORESTCHECK site at Wellington East in March 2005. Note that the Bell forest block grids were burnt by wildfire in December 2004.

### Coarse Woody Debris

The largest volume of CWD was found on the Stockyard shelterwood (FC33) and gap (FC34) treatments (Fig. 3). The fire undoubtedly affected the amount of CWD in Bell forest block and a large percentage of the larger logs were obviously reduced in size but not totally consumed. However, both the Bell external control (FC35) and shelterwood (FC36) treatments contained similar or larger volumes of CWD compared to the other grids in those treatments.

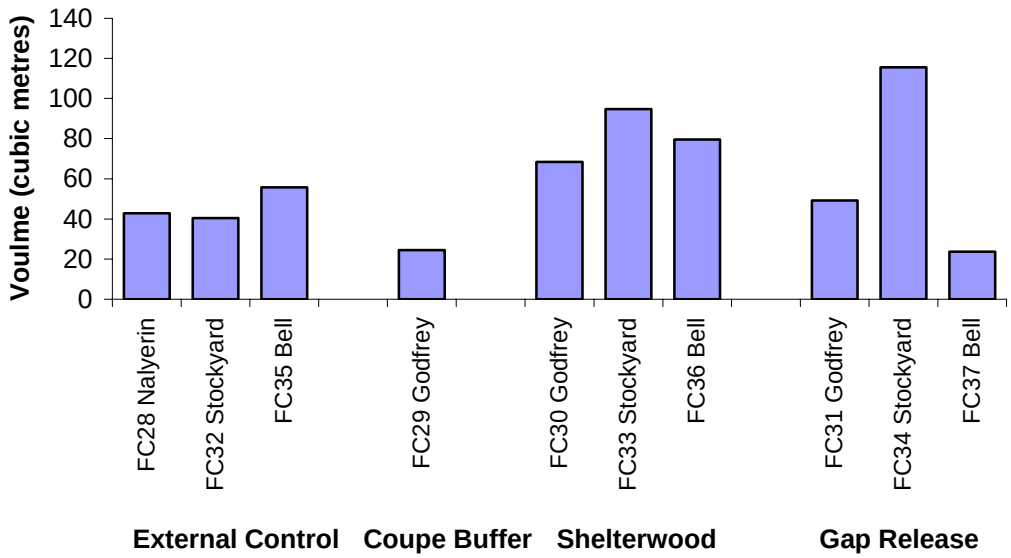


**Figure 3.** The volume ($m^3$ $ha^{-1}$) of coarse woody debris measured at each FORESTCHECK site in Wellington East in March 2005. Note that the Bell forest block grids were burnt by wildfire in December 2004.

## Conclusions

- Litter and SWT loads reflect the time since last burn
- Recent logging activity may increase the volume of CWD

## Data Management

The data were entered into Microsoft Excel worksheets.

## Issues

Full assessment was hampered by the fire in Bell forest block. This should not affect future assessments, however, as prescribed burns will be part of the normal silvicultural management within treatments in the future, and natural wildfire may occur at any time.

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# MACROFUNGI

Richard Robinson, Katrina Syme and Bob Smith

## Introduction

Fungi are considered one of the most important group of forest organisms in terms of both biodiversity and function. Soil, litter and wood inhabiting fungi play major roles in decomposition and nutrient cycling. Mycorrhizal fungi enhance nutrient uptake of plants and may enhance plant resistance to some pathogens. In addition, underground truffle-like fungi are an important food source for small mammals, especially following disturbance such as fire.

Research on fungi in Western Australia's southern forests is in its infancy. Knowledge on fungal diversity and the ecological roles that fungi play is of vital importance to forest managers making decisions on sustainable forest management.

The objective of this component of the FORESTCHECK program is to:

- Monitor and record the species of macrofungi in the various treatments of managed jarrah forest (gap, shelterwood) and in uncut forest.
- Analyse trends in species composition, richness and abundance and substrate utilization over time.
- Generate detailed descriptions of unknown or unnamed species.

## Monitoring and Laboratory work

Transects to monitor macrofungi were installed at the Wellington East sites during grid establishment in September-October 2004. The sites were monitored in June and again in July 2005. Donnelly FORESTCHECK sites (initially established and monitored in 2002) were also monitored in June 2005.

This report deals primarily with the results of monitoring undertaken on the Wellington East sites, however, a brief report on results obtained at the Donnelly sites in 2005 is also included.

## 1. WELLINGTON EAST

### Monitoring

Monitoring dates were selected on the basis of rainfall and soil dryness index (SDI). Statistics were supplied by the CALM Collie Work Centre, and viewed in conjunction with the Bureau of Meteorology online data from the Wandering automatic weather station. Consistent rainfall in early June resulted in the sites being monitored from 22-24 June and again from 4-7 July. Despite consistent rain throughout this period, it was noticeable that the litter dried out considerably between rain events. This is also reflected in the SDI statistic, which increased to about 145 following each rainfall event in late June and throughout July (Fig. 1).

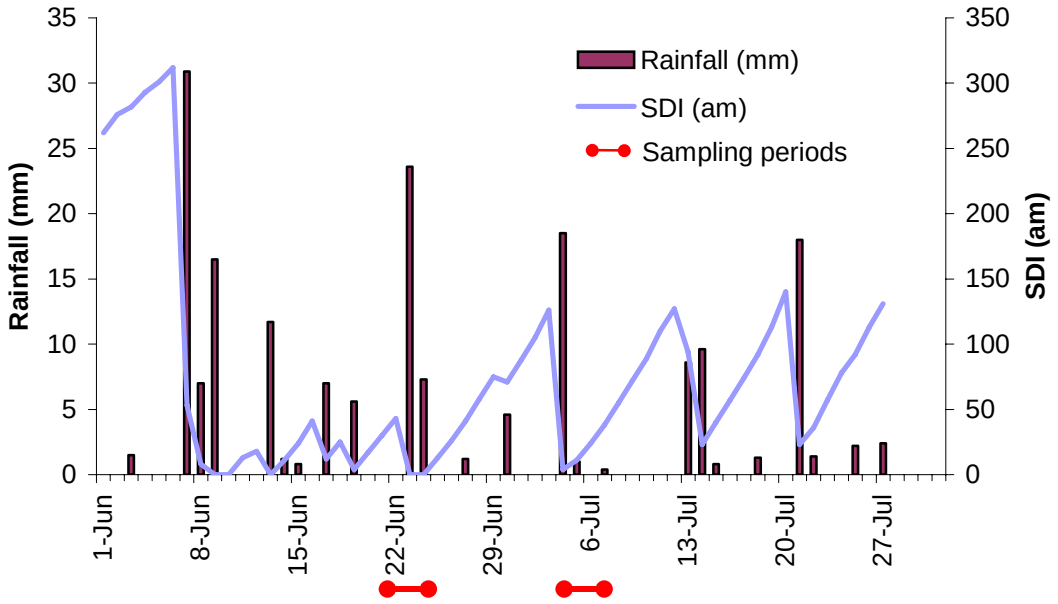



**Figure 1**. Daily rainfall and soil dryness index (SDI) calculated for Wellington District during the period 1 June to 30 July 2004. The FORESTCHECK sampling period is indicated in red.

## Voucher Specimens

Voucher specimens were processed and where possible identified. An overall species list and one for each individual site has been compiled. In total, 138 voucher collections were made representing 103 species. Processing of each voucher was completed on the day of collection or the next day. This included photographing in the field, and preparing morphological descriptions of fresh collections. A total of 68 species had not been encountered previously and detailed descriptions were compiled in order to validate their identity. All collections were air dried at 35º C. Microscopic descriptions were carried out to verify the identity of a number of species and to confirm a number of unnamed species. All vouchers have been entered onto the PERTH database and are housed at the Tony Annels Herbarium at the Manjimup Research Centre.

## Results and Discussion

Generally, more species were recorded on each grid in the July monitoring period than in June (Fig. 2). A total of 148 species were recorded in June and 185 in July. The abundance of fruitbodies was consistent and reflected the number of species, 5 204 in June and 6 849 in July. The weather and soil conditions were very similar during each period (Fig. 1).

In all, 240 species of fungi were recorded on the Wellington East sites (Appendix 1). Of these, 28% (68 species) were recorded for the first time in FORESTCHECK. A total of 12 053 fruitbodies were recorded (Appendix 1). This is the most number of species of macrofungi recorded in one year for FORESTCHECK to date, but the abundance of fruitbodies was not as high as that recorded in Wellington and Donnelly in 2003 (18 389 and 14 356 respectively).

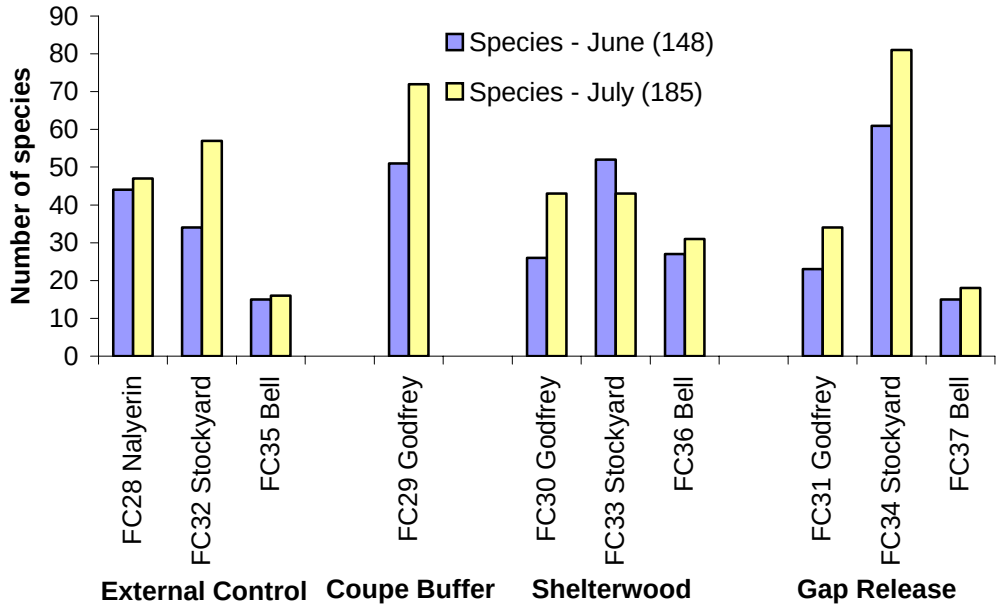



**Figure 2**. The number of species recorded in June and July at the Wellington East FORESTCHECK sites.

The highest numbers of species were recorded in the Godfrey coupe buffer (FC29) and the Stockyard gap release (FC34). The Bell forest block sites (FC35, FC36 and FC37) all had low numbers of species (Fig. 3). This was due to all 3 sites having been burnt by wildfire on December 28, 2004. On visiting the sites 10 days after the fire, the sclerotial polypore *Laccocephalum tumulosus*, was noted at each site but only recorded and collected from the Bell gap release (FC37) grid. During the regular autumn monitoring, species of typical post-fire macrofungi were recorded on all the burnt grids including Ascomycetes such as *Peziza tennacella*, *Peziza praetervisa*, *Anthrocobia* spp. and *Pulvinula archerii*. In addition a small number of Basidiomycetes such as *Cortinarius* sp., *Hebeloma* sp. and *Phaeocollybia* sp. fruiting on the burnt soil amongst scorched leaf litter and a species of *Dacromyces* fruiting on burnt wood were also recorded.

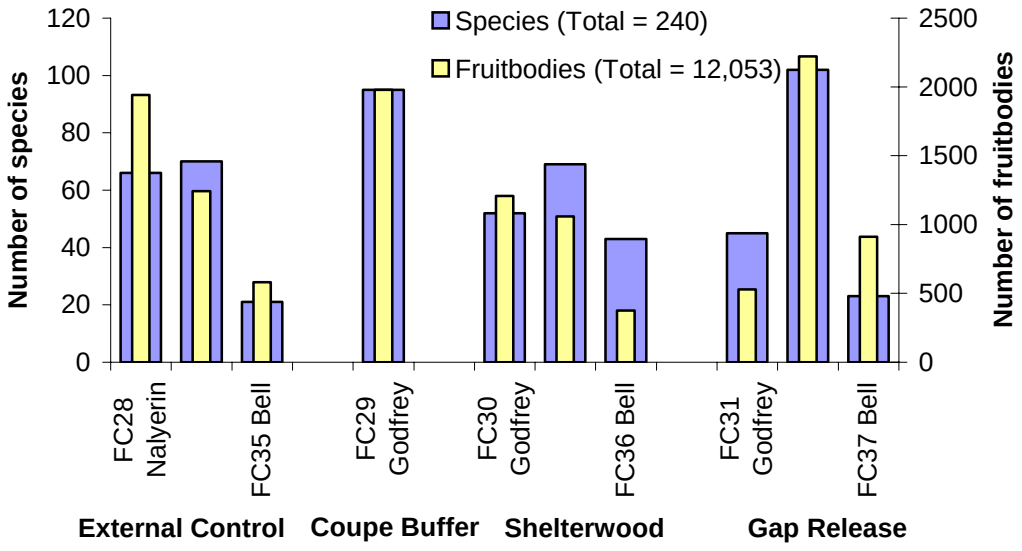



**Figure 3**. The total number of species and abundance recorded at the Wellington East FORESTCHECK sites in 2005.

Generally, in each treatment the majority of species were recorded fruiting on the soil (Fig. 4), and these species produced the majority of fruitbodies (Fig. 5), except in the Stockyard gap release (FC34) where the most fruitbodies were recorded on wood. The Nalyerin external control had the highest number of fruitbodies associated with the litter layer, about twice as many as recorded in the Stockyard external control. This corresponds well with the fire history of the grids, Nalyerin having been unburnt for 11-15 years longer than the other grids and consequently having the heaviest load of litter recorded (see chapter on CWD and Litter).

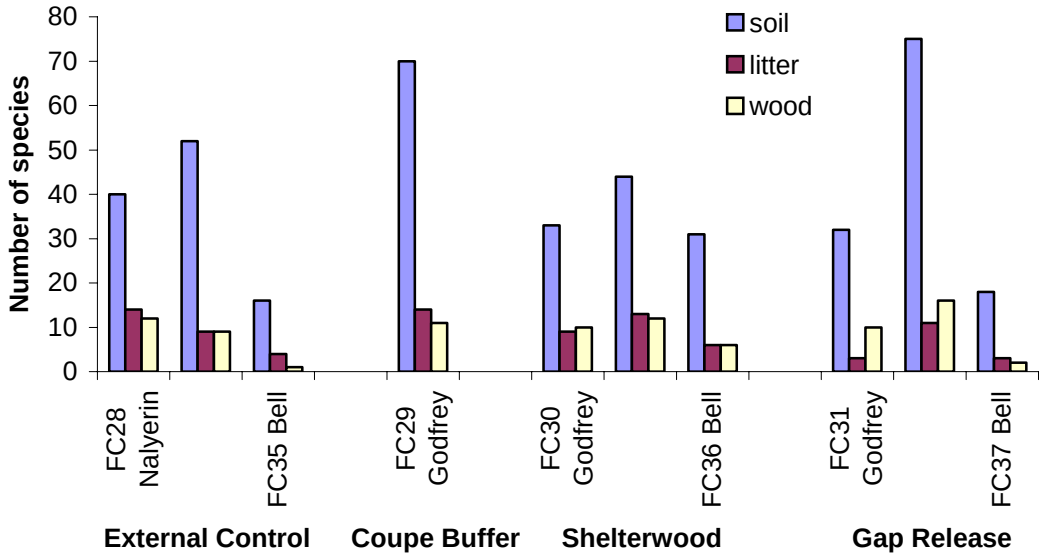



**Figure 4**. The number of species recorded fruiting on soil, litter and wood on the Wellington East FORESTCHECK sites in 2005.

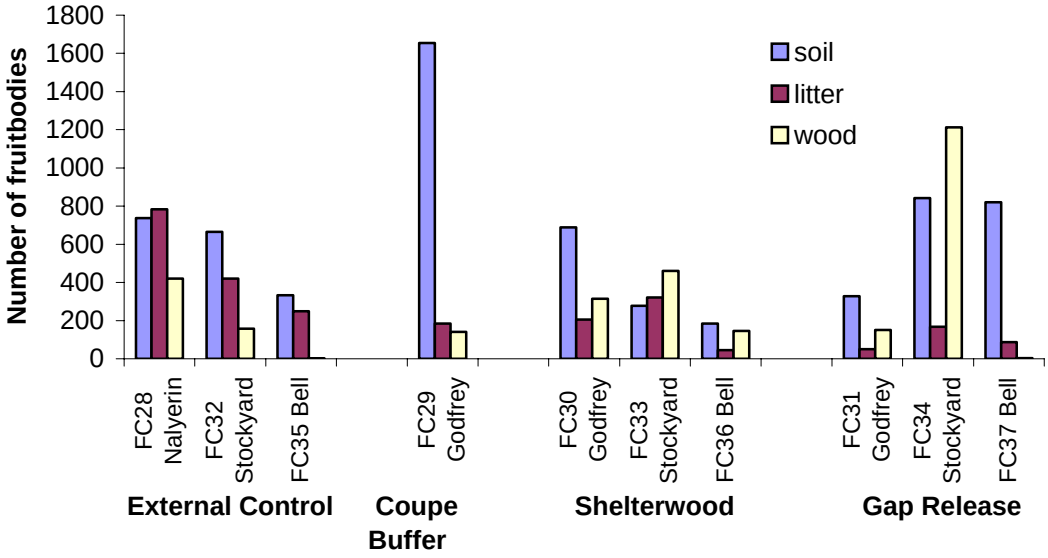



**Figure 5**. The number of fruitbodies recorded on litter, soil and wood in each grid on the Wellington East FORESTCHECK sites in 2005.

In general, there appears to be no obvious effect of logging on the species richness of macrofungi. However, the low number of species recorded on all the Bell forest block treatments can be attributed to the grids having been burnt. The burnt grids also had a distinct set of species associated with them. This illustrates the importance of monitoring immediately following a disturbance such as wildfire in order to record fluctuations in species composition associated with such disturbance.

## 2. DONNELLY

### Monitoring

The Donnelly sites were established in 2002. They have been monitored annually and in 2005 this was carried out from 13-20 June. Monitoring coincided with a drop in the SDI following consistent rain in early June.

### Voucher Specimens

87 voucher collections were made, representing 68 species.

### Results and Discussion

A total of 230 species and 15,324 fruitbodies were recorded across all the sites. 43 species were recorded for the first time on the Donnelly sites. There appeared to be no major differences in species richness on grids, either between or within treatments (Fig 6). However, the abundance of fruitbodies was unusually high on the Kingston gap release treatment (FC2). The low number of species and fruitbodies recorded on the Yornup external control (FC5) is likely due to that grid having been burnt 18 months previously.

Although this is the most number of species recorded for any single year at Donnelly, the abundance of fruitbodies was not as high as that recorded in 2003. Variation in species richness within the external controls appears to be very variable from year to year, but is consistently high in the gap release treatment (Fig. 7).

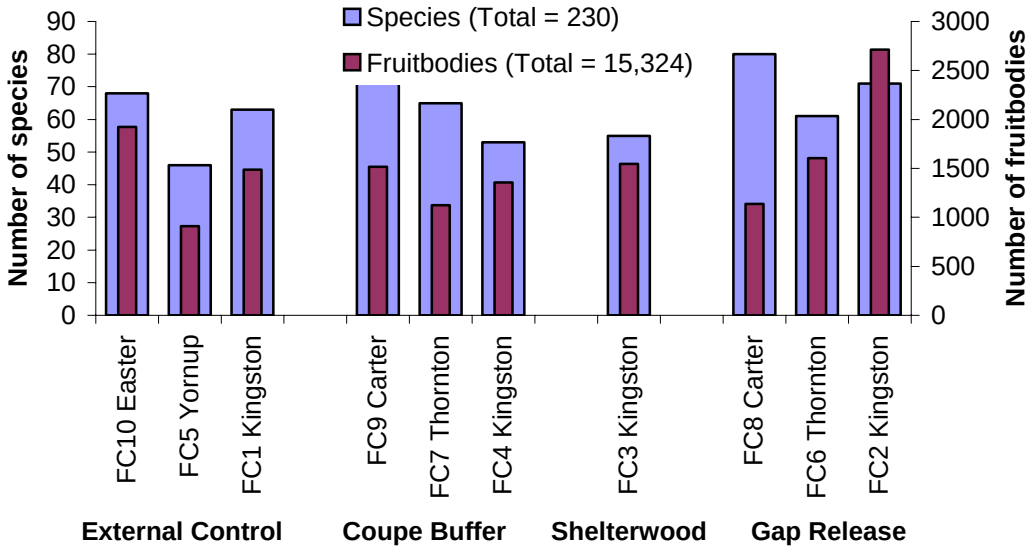



**Figure 6**. The total number of species and abundance recorded at the Donnelly FORESTCHECK sites in 2005.

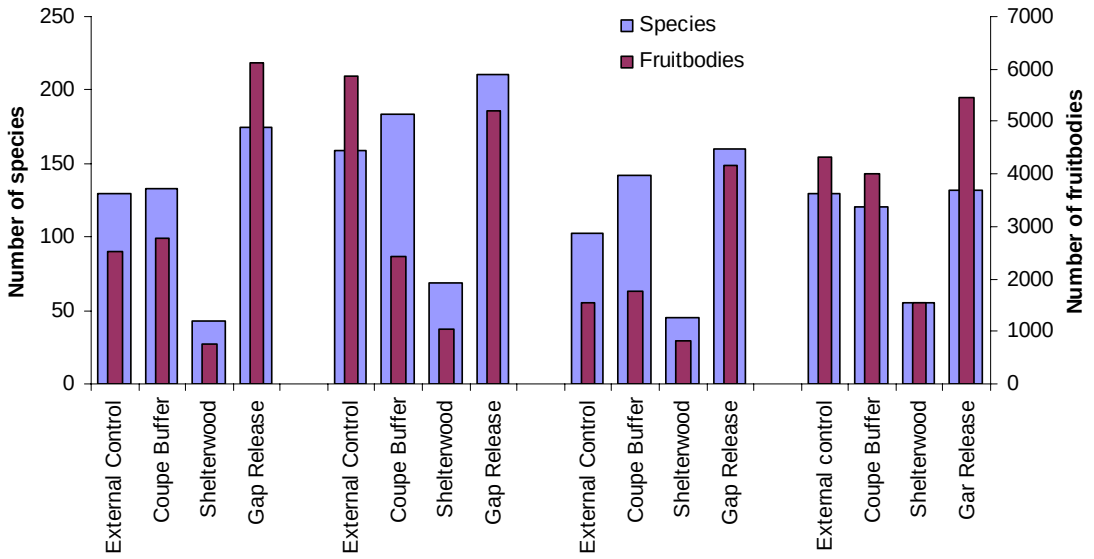



**Figure 7**. The total number of species and abundance recorded in each treatment in the Donnelly FORESTCHECK sites from 2002-05 (Note that there was only one shelterwood site at Donnelly).

The species list for Donnelly continued to increase, with 43 additions in 2005. This illustrates the value of long-term monitoring in documenting macrofungal diversity on sites and across the landscape.

## Conclusions

- A total of 482 species of macrofungi have so far been recorded in FORESTCHECK.
- 352 species were recorded in 2005, 240 at Wellington East and 230 at Donnelly. Of these 118 species were recorded at both locations, 122 were restricted to Wellington East, and 112 were restricted to Donnelly.
- Overall, many species appear to have restricted distribution, but many others are common throughout the various jarrah forest environments.
- Distinct species of macrofungi fruit following recent fire.
- The majority of macrofungi recorded in Wellington East fruit on the soil.
- Gap release treatments in Wellington East varied markedly in macrofungal species richness and abundance.

## Data Management

All data have been entered onto a Microsoft Excel worksheet. Species diversity and abundance at each site and a frequency rating of 1 (rare) to 8 (very common) for each species at each site has been determined. The data includes a complete list of species recorded across all the sites, their life modes (mycorrhizal, saprotrophic, parasitic) and the substrate on which they were fruiting. Analysis is ongoing.

**Appendix 1.** Master list of macrofungi recorded in FORESTCHECK 2002-05, and the species and abundance recorded in each treatment at Wellington East and the species and abundance recorded at Donnelly in 20005

| Sp # | Species | Life Mode[1] | Sub-strate[2] | Treatments[3] | | | | Well. East | Donn-elly |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E.C. | C.B. | SW. | G.R. | Total | Total |
| 349 | Agaric "brown, brown decurrent gills" | S? | S | | | | 8 | 8 | |
| 475 | Agaric "creamy brown scaly cap, white bifurcate gills" | S? | S | | | | | | |
| 46 | Agaric "creamy white" | S | S | | | | | | |
| 82 | Agaric "Lepiota-like, cream-grey" | S | S | | | | | | |
| 156 | Agaric "light brown - red scales on stem" | S | S | | | | | | |
| 18 | Agaric "light brown-olive" | S | S | | | | | | |
| 473 | Agaric "orange" | S? | S | | | | | | 3 |
| 97 | Agaric "pure white" | ? | S | | | | | | |
| 174 | Agaric "red/yellow/red" | S | ?? | | | | | | |
| 329 | Agaric "viscid buff, long stem" | M? | S | | | | | | |
| 170 | Agaric "yellow brown-moist" | S | S/L | | | | | | |
| 240 | *Agaricus* sp. "small with red brown fibrils" | S | S | | | 1 | | 1 | 3 |
| 38 | *Agaricus* sp. "small" | S | S | 1 | | | | 1 | |
| 71 | *Agaricus* sp. "small, flat- red stain" | S | S | | | | | | 3 |
| 33 | *Agaricus* sp. "yellow stainer" | S | S | | | | | | |
| 39 | *Agaricus* sp."large cap, purplish scales" | S | S | | 2 | 3 | | 5 | 1 |
| 120 | *Aleuria rhenana* | S | S | | 2 | 23 | 43 | 68 | 83 |
| 126 | *Aleurina ferruginea* | S | S/Moss | 2 | 2 | | 5 | 9 | 15 |
| 206 | *Amanita ananiceps* | M | S | | | 3 | 2 | 5 | |
| 186 | *Amanita brunneibulbosa* "grey-brown" | M | S | | 1 | | | 1 | |
| 283 | *Amanita eucalypti* | M | S | | | 2 | | 2 | |
| 269 | *Amanita ochrophylloides* | M | S | | | | | | |
| 114 | *Amanita* sp. "apricot-pink margin" | M | S | | | | | | |
| 518 | *Amanita* sp. "beige with saccate base" | M | S | | | | 1 | 1 | |
| 520 | *Amanita* sp. "creamy yellow, sticky cap" | M | S | | | | 1 | 1 | |
| 493 | *Amanita* sp. "grey brown robust" | M | S | | | | 2 | 2 | |
| 497 | *Amanita* sp. "grey brown with orange yellow veil" | M | S | | | 1 | | 1 | |
| 496 | *Amanita* sp. "grey veil" | M | S | | | 7 | | 7 | |
| 360 | *Amanita* sp. "large grey-white, robust" | M | S | | | | | | |
| 526 | *Amanita* sp. "small creamy white, membranous ring" | M | S | | | 1 | | 1 | |
| 320 | *Amanita* sp. "small robust, yellow-buff, bulbous base | M | S | | 1 | | | 1 | |
| 368 | *Amanita* sp. "white with mealy stem" | M | S | | | | | | |
| 371 | *Amanita* sp. "white with saccate volva" | M | S | | | 4 | | 4 | |
| 45 | *Amanita* sp. "white, deeply rooted" | M | S | | 1 | | 1 | 2 | |
| 525 | *Amanita* sp. "white, grey scales, silvery stem" | M | S | | | 1 | | 1 | |
| 28 | *Amanita* sp. "white, stout" | M | S | | | | | | |
| 519 | *Amanita* sp. "yellow brown, long stem, constricted bulb" | M | S | | | 1 | 1 | 2 | |
| 218 | *Amanita* sp."powdery - long tapering base" | M | S | | 1 | 10 | 6 | 17 | |
| 196 | *Amanita umbrinella* | M | S | | | | | | |
| 6 | *Amanita xanthocephala* | M | S | 2 | 13 | 12 | 15 | 42 | 32 |

| Sp # | Species | Life Mode | Sub-strate | Treatments | | | | Well. East | Donn-elly |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E.C. | C.B. | SW. | G.R. | Total | Total |
| 35 | *Amanita xanthocephala* forma *macalpiniana* | M | S | | | | 2 | 2 | |
| 531 | Amanita spp. (Unidentified) | M | S | | 1 | 3 | 1 | 5 | |
| 509 | *Anthracophyllum archeri* | S | T | | | | | | 10 |
| 338 | *Anthrocobia muelleri* | S | S | 62 | | | 300 | 362 | |
| 338b | *Anthrocobia muelleri "*small yellow" | S | S | | | | 130 | 130 | |
| 180 | *Armillaria luteobubalina* | P/S | W | | | | | | 43 |
| 188 | *Austroboletus laccunosa* | S | S | | | 2 | | 2 | 3 |
| 200 | *Austroboletus occidentale* | S | S | | | | | | 1 |
| 291 | *Austropaxillus* sp."orange-brown" | M | S | 11 | 13 | 24 | 4 | 52 | |
| 436 | *Beauvaria bassiana* | P | Insect | 1 | | | | 1 | |
| 93 | *Boletellus ananiceps* | S | S | 4 | | 2 | | 6 | 3 |
| 103 | *Boletellus obscurecoccineus* | S | S | 1 | 2 | | | 3 | 2 |
| 225 | *Boletus* sp. "creamy pale yellow | M | S | | | | | | |
| 29 | *Boletus* sp. "dull maroon" | M | S | | | | 2 | 2 | 1 |
| 345 | *Boletus* sp. "light yellow" | M | S | | | | | | |
| 350 | Boletus sp. "pink maroon cap, yellow/red stem" | M | S | | | | | | |
| 49 | *Boletus* sp. *"*red pores and stem" | M | S | | | | | | |
| 253 | *Boletus* sp. "red-brown/golden yellow - intense blue stain" | M | S | | | | 1 | 1 | |
| 95 | *Boletus* sp. "small yellow/cream pores" | M | S | | | | | | |
| 358 | *Boletus* sp. "viscid brown cap, yellow marshmallow pores" | M | S | | | | | | |
| 99 | *Boletus* sp. "yellow-red, stains blue" | M | S | | | | | | 1 |
| 216 | *Boletus* sp."brown/yellow pores which stain blue" | M | S | | | | | | |
| 210 | *Boletus* sp."maroon/orange pores" | M | S | | | | | | |
| 195 | *Boletus* sp."mustard brown-brown stain" | M | S | | | | | | |
| 193 | *Boletus* sp."purple brown" | M | S | | | | | | |
| 284 | *Boletus* sp."under Allocasuarina" | M | S | | | | | | |
| 208 | *Boletus* sp."yellow-brown, cracked/white pores" | M | S | | | | | | |
| 304 | *Byssomerulius corium*. | S | W/T | 2 | | 15 | | 17 | 36 |
| 9 | *Calocera* sp. "yellow" | S | W | | 11 | 345 | 429 | 785 | 2587 |
| 465 | *Calostoma fuscum* | S | S | | | | | | 3 |
| 463 | *Cantharellus cibarius* var. *australiensis* | M | S | | | | | | 12 |
| 470 | *Ceratiomyxa fruiticulosa* | Bacteria | W | | | | | | 6 |
| 265 | *Cheilymenia* sp. "eyelash on roo poo" | C | Dung | | | | | | |
| 243 | *Cheilymenia* sp. "orange disks on marri nuts" | S | Fruits | | | | | | 57 |
| 364 | *Chlorociboria aeruginascens* | S | W | | | | | | |
| 377 | Clavaria "small lemon yellow" | S | S | 1 | | 2 | 1 | 4 | 39 |
| 316 | *Clavaria* (*Clavulinopsis*) aff. *aurantiaca* "orange" | M? | S | | | | | | 10 |
| 319 | *Clavaria* (*Clavulinopsis*) sp. "grey-brown with black tips" | M? | S | | | 1 | 3 | 4 | 16 |
| 534 | *Clavulina amethystina* | S | S | | | | 1 | 1 | |
| 81 | *Clavulina* cf. *cinerea* "grey-brown" | S | S | 1 | | | 4 | 5 | 138 |
| 344 | *Clavulina* sp. "cream, fluffy tips" | M? | S | | | | | | 20 |
| 140 | *Clavulina* sp. "pink-buff coral" | S | S | | | 2 | | 2 | |
| 458 | *Clavulina* sp. "pinkish brown, red-brown tips" | S | S | 8 | 2 | | 6 | 19 | 147 |

| Sp # | Species | Life Mode | Sub-strate | Treatments | | | | Well. East | Donn-elly |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E.C. | C.B. | SW. | G.R. | Total | Total |
| 362 | *Clavulinopsis* "grey brown, black tips" | M? | S | | | | | | 54 |
| 472 | *Clavulinopsis* sp. "coral pink" | S | S | | | | | | 10 |
| 261 | *Clavulinopsis* sp. "cream" | S | S | | | | | | |
| 262 | *Clavulinopsis* sp. "tiny white candles" | S | S | | | | | | |
| 197 | *Clitocybe semi oculta* | S | W | | | | | | 4 |
| 197b | *Clitocybe semi-occulta* "large" | | | | | | | | |
| 14 | *Clitocybe* sp. | S | S | | | | | | |
| 23 | *Clitocybe* sp. | S | S | | | | | | |
| 370 | *Clitocybe* sp. "creamy beige" | S | S/L | | | | | | |
| 324 | *Clitocybe* sp. "grey robust" | S | S | | | | | | |
| 301 | *Clitocybe* sp."dark grey with dimple" | S | S | | 1 | | 1 | 2 | |
| 181 | *Collybia* aff. *butracea* | S | S | | | | | | 1 |
| 143 | *Collybia* sp. "buff funnel" | S | S | | | | | | 10 |
| 249 | *Collybia* sp. "grey" | S | S | | | | 3 | 13 | 2 |
| 233 | *Collybia* sp. "grey/dimple" | S | S | | | | 1 | 1 | |
| 489 | *Collybia* sp. "large brown, tan gills" | S | S | | | | 2 | 2 | |
| 151 | *Collybia* sp. "large" | S | S | | | | 1 | 1 | |
| 513 | *Collybia/Clitocybe* "dark grey-brown convex" | S | S | | 1 | 4 | | 5 | |
| 15 | *Coltricia oblectans* | S | S | 48 | 67 | 45 | 60 | 220 | 303 |
| 532 | *Coltriciella dependens* | S | W | | | | 3 | 3 | |
| 32 | *Coprinus* sp. | S | S/L | | | | | | |
| 128 | *Coprinus* sp. "basal hairs" | S | S | | | | | | 112 |
| 224 | *Coprinus* sp. "micacus" | S | S | | | | | | |
| 460 | *Cordyceps* sp. "brown club" | P | Insect | | | | | | 11 |
| 467 | *Cordyceps* sp. "orange-brown club" | P | Insect | | | | | | 2 |
| 282 | *Corinarius* sp."honey-brown dome /long stem" | M | S | | | | | | |
| 303 | *Cortinaius* sp."stubby domes" | M | S | | | | | | |
| 511 | *Cortinarius* sp. "multi red" | M | S | | 12 | | | 12 | |
| 146 | *Cortinarius* (*Myxacium*) sp. "orange-brown" | M | S | | 8 | 3 | 1 | 12 | 3 |
| 125 | *Cortinarius (Phlegmacium)* sp. "purple-grey" | M | S | | | | | | |
| 158 | *Cortinarius* aff. *micro archerii* | M | S | | 6 | | | 6 | 1 |
| 314 | *Cortinarius archerii* | M | S | | | | | | |
| 207 | *Cortinarius australiensis* | M | S | | | | 1 | 1 | |
| 173c | *Cortinarius basirubescens* " brown large" | M | S | | 1 | | | 1 | |
| 173 | *Cortinarius basirubescens* (red cap) | M | S | | | | | | |
| 173b | *Cortinarius basirubescens*(brown cap) | M | S | | | | 5 | 5 | |
| 115 | *Cortinarius fibrillosus* | M | S | | | | | | 1 |
| 7 | *Cortinarius radicatus* | M | S | | 2 | | | 2 | |
| 293 | *Cortinarius rotundisporus* | M | S | 1 | | | | 1 | |
| 357 | *Cortinarius sinapicolor* | M | S | | | 1 | | 1 | 2 |
| 234 | *Cortinarius* sp. | M | S | | | | | | |
| 485 | *Cortinarius* sp. | M | S | | 4 | | | 4 | |
| 421 | *Cortinarius* sp. "brown cap, lilac white stem" | M | S | 8 | 1 | 4 | 3 | 16 | |
| 355 | *Cortinarius* sp. "brown with lavender margin and stem" | M | S | | | | | | |
| 73 | *Cortinarius* sp. "brown with purplish tints" | M | S | | | | | | |

| Sp # | Species | Life Mode | Sub-strate | Treatments | | | | Well. East | Donn-elly |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E.C. | C.B. | SW. | G.R. | Total | Total |
| 466 | *Cortinarius* sp. "brown with white margin" | M | S | | | | | | 2 |
| 68 | *Cortinarius* sp. "brown" ?(34) | M | S | 1 | | | | 1 | |
| 346 | *Cortinarius* sp. "brown, grey-lavender gills" | M | S | | | | | | |
| 232 | *Cortinarius* sp. "cf sinapicolor" | M | S | | 1 | | | 1 | |
| 500 | *Cortinarius* sp. "chestnut large" | M | S | 101 | | | | 101 | |
| 382 | *Cortinarius* sp. "chestnut with yellow margin and yellow flesh" | M | S | | | | | | |
| 154 | *Cortinarius* sp. "chestnut" | M | S | 30 | 15 | 6 | 10 | 61 | 9 |
| 453 | *Cortinarius* sp. "decurrent gills, deep stem with double ring" | M | S | | | 12 | | 12 | 6 |
| 334 | *Cortinarius* sp. "fawn brown" | M | S | | | | | | |
| 252 | *Cortinarius* sp. "glutinous cap/rooting stem" | M | S | | | | | | |
| 348 | *Cortinarius* sp. "golden tan, long stem" | M | S | | | | | | |
| 374 | *Cortinarius* sp. "golden-tan" | M | S | 2 | | | | 2 | 1 |
| 257 | *Cortinarius* sp. "honey-brown" | M | S | | | | | | |
| 369 | *Cortinarius* sp. "large red-brown" | M | S | | | | | | |
| 379 | *Cortinarius* sp. "lilac-brown with yellow gills" | M | S | | | | | | |
| 404 | *Cortinarius* sp. "orange cap, white floccose stem" | M | S | | | | 1 | 1 | |
| 251 | *Cortinarius* sp. "orange-brown 2" | M | S | | | | | | |
| 98 | *Cortinarius* sp. "pointy cap" | S | S | 18 | 19 | 4 | 5 | 46 | 34 |
| 515 | *Cortinarius* sp. "red brown cap, slender lavender stem" | M | S | | 5 | | | 5 | |
| 121 | *Cortinarius* sp. "slender brown" | M | S | | | | | | |
| 131 | *Cortinarius* sp. "slender lilac" | M | S | | | | | | |
| 432 | *Cortinarius* sp. "tan cap with chocolate gills" | M | S | 4 | | | | 4 | |
| 171b | *Cortinarius* sp. "vinaceus lilac" | M | S | 5 | | | | 5 | 18 |
| 96/259 | *Cortinarius* sp. "viscid - pink" | M | S | | | | | | 3 |
| 375 | *Cortinarius* sp. "yellow with brown fibrils and orange ring" | M | S | | | | | | |
| 237 | *Cortinarius* sp. "yellow with orange brown fibrils" | M | S | 5 | | | | 5 | 6 |
| 492 | *Cortinarius* sp. "yellow with yellow stem" | M | S | 4 | | 1 | 2 | 7 | |
| 354 | *Cortinarius* sp. "yellow-brown cap, lavender gills and stem" | M | S | 3 | 1 | | | 4 | |
| 231 | *Cortinarius* sp. "yellow-brown/tan margin" | M | S | | 2 | | | 2 | |
| 124 | *Cortinarius sp.* "yellow-olive" | M | S | | | | | | |
| 255 | *Cortinarius* sp. "yellow-orange" | M | S | | | | | | |
| 279 | *Cortinarius* sp."brown fibrillose" | M | S | | | | | | |
| 244 | *Cortinarius* sp."brown umbonate" | M | | | | | | | |
| 299 | *Cortinarius* sp."chocolate brown with mustard gills" | M | S | 1 | 12 | | | 13 | |
| 201 | *Cortinarius* sp."cream with orange gills" | M | S | | | | | | |
| 212 | *Cortinarius* sp."orange brown" | M | S | | | | | | |
| 230 | *Cortinarius* sp."orange viscid" | M | S | | | | | | |
| 223 | *Cortinarius sp."orange"* | M | S | | | | | | |
| 205 | *Cortinarius* sp."orange/yellow flesh/yellow gills" | M | S | | 2 | | | 2 | |

| Sp # | Species | Life Mode | Sub-strate | Treatments | | | | Well. East | Donn-elly |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E.C. | C.B. | SW. | G.R. | Total | Total |
| 267 | *Cortinarius* sp."snowy chestnut" | M | S | 11 | 2 | | | 13 | 2 |
| 270 | *Cortinarius* sp."viscid, yellow-red-brown, white stem" | M | S | | 1 | | | 1 | 1 |
| 273 | *Cortinarius* sp."white with deep rooting stem" | M | S | | | | | | |
| 199 | *Cortinarius* sp."yellow orange" | M | S | | | | | | |
| 184 | *Cortinarius* spp. (unidentified) | M | S | | 9 | 5 | 9 | 23 | 11 |
| 171 | *Cortinarius vinaceolamellatus* | M | S | | | | | | |
| 290 | *Cortinarius violaceous* | M | S | | | | | | |
| 469 | *Crepidotus* sp. "chestnut with fringed margin" | S | W | | | | | | 9 |
| 118 | *Crepidotus* sp. "large creamy-tan" | S | W | 4 | | | | 4 | 37 |
| 323 | *Crepidotus* sp. "rusty brown suede" | S | W | | | | | | |
| 61 | *Crepidotus sp.* "small brown" | S | W/Bark | | | | | | 19 |
| 83 | *Crepidotus* sp. "small creamy tan" | S | Bark/W | | | | | | 5 |
| 21 | *Crepidotus* sp. "small white" | S | W | 75 | | | | 75 | 25 |
| 241 | *Crepidotus variabilis* | S | T/W | 215 | | | | 215 | 1799 |
| 148 | *Crucibulum laeve* | S | T/L | 47 | 12 | 222 | 51 | 332 | 12 |
| 296 | *Cyathus* sp."on roo poo" | S/C | Dung | | 10 | 58 | | 80 | |
| 307 | *Cyathus*sp. | S | L | 28 | 2 | | | 30 | 90 |
| 138 | *Daldina concentrica* | S | W | | | | | | 5 |
| 110 | *Dermocybe* aff. *sanguinea* | M | S | | | | | | |
| 147 | *Dermocybe austroveneta* | M | S | | | | | | 2 |
| 340 | *Dermocybe clelandii* "mini" | M | S | 17 | 25 | | | 42 | |
| 57b | *Dermocybe clelandii* "olive brown" | | | | | | | | |
| 57/34 | *Dermocybe clelandii* (white mycelium) | M | S | 5 | 7 | 1 | 2 | 15 | 3 |
| 172b | *Dermocybe clelandii* (yellow mycelium - glutinous cap) | M | S | | | | | | |
| 172 | *Dermocybe clelandii* (yellow mycelium) | M | S | | | | 1 | 1 | 1 |
| 328 | *Dermocybe* sp. "small olive" | M | S | | | | | | |
| 486 | *Dermocybe* sp. "yellow stipe, yellow mycelium" | M | S | | | | | | |
| 168 | *Dermocybe* sp. (*D. clelandii* ?) "brown with mustard yellow gills" | M | S | 16 | | | | 16 | |
| 40 | *Dermocybe* sp."chestnut" | M | S | | | | | | |
| 310 | *Dermocybe splendida* | M | S | | | | | | 1 |
| 294 | Discomycete "small yellow on *Banksia grandis* leaf" | S | L | | | | | | 135 |
| 508 | *Discomycete "tiny cream disks on leaves"* | S | L | | | | | | 20 |
| 462 | Discomycete "tiny white on marri nut" | S | Fruits | | | | | | 1 |
| 123 | Discomycete "yellow stalked" | S | S | 88 | 11 | 12 | 22 | 133 | 873 |
| 31 | *Entoloma* (*Leptonia*) *moongum* "blue-black" | S | S | | | 1 | 5 | 6 | 2 |
| 78 | *Entoloma* (*Leptonia*) sp. "grey/decurrent gills" | S | S | | | | | | |
| 153 | *Entoloma* (*Leptonia*) sp. "small dark grey-brown" | S | S | | | | | | |
| 409 | *Entoloma* aff. incana | S | S | | | | 6 | 6 | |
| 222 | *Entoloma* sp. "black with grey-white gills | S | S | | | | | | |
| 410 | *Entoloma* sp. "blue-black, marginate gills" | S | S | | | | 1 | 1 | 5 |
| 347 | *Entoloma* sp. "brown striate cap" | S | S | | | | | | |

| Sp # | Species | Life Mode | Sub-strate | Treatments | | | | Well. East | Donn-elly |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E.C. | C.B. | SW. | G.R. | Total | Total |
| 227 | *Entoloma* sp. "brown-black with tan gills" | S | S | | | | 6 | 6 | |
| 530 | *Entoloma* sp. "brown-black, marginate gills, bluish-grey stem" | S | S | | | | 2 | 2 | |
| 471 | *Entoloma* sp. "buff with dimple" | S | S | | | | | | 10 |
| 30 | *Entoloma* sp. "creamy white" | S | S | 5 | | 3 | 3 | 11 | 3 |
| 167 | *Entoloma* sp. "dark grey/blue gill edge" | S | S | | | | | | |
| 25 | *Entoloma* sp. "grey-brown/blue stem" | S | S | | | 1 | | 1 | |
| 77 | *Entoloma* sp. "grey-brown/brown stem" | S | S | | | | | | 7 |
| 235 | *Entoloma* sp. "grey-brown/grey stem" | S | S | 3 | 3 | 7 | 4 | 17 | 9 |
| 135 | *Entoloma* sp. "tall, grey-brown" | S | S | | | 2 | 7 | 9 | 4 |
| 514 | *Entoloma* sp. "very large brown-grey" | S | S | | 1 | | | 1 | |
| 198 | *Entoloma* sp."brown black/tan/blue" | S | S | | | | 1 | 1 | |
| 194 | *Entoloma* sp."brown" | S | S | | | | | | 1 |
| 272 | *Entoloma* sp."grey-brown with dimple" | S | S | | | 4 | 4 | 8 | 4 |
| 278 | *Entoloma* sp."suede grey-brown with dimple" | S | S | | | | 6 | 6 | |
| 274 | *Entoloma viridomarginatum* | S | S | | | 5 | | 5 | 1 |
| 159 | *Exidia glandulosus* | S | W | | | | | | 55 |
| 187 | *Favodashia* sp."grey" | S | W | | | | | | |
| 41 | *Fistulina hepatica* | S | W | | | 1 | 1 | 2 | 2 |
| 91 | *Fistulinella mollis* | S | W | | | | | | 3 |
| 19 | *Formitopsis lilacino-gilva* | S | W | 8 | 1 | 2 | | 11 | 12 |
| 11 | *Galerina* sp. "hanging gills" and "conic" | S | S/L | 261 | 57 | 43 | 88 | 449 | 480 |
| 111 | *Galerina* sp. "large" | S | S | | | | | | |
| 58 | *Galerina* sp. "small cap, eccentric stipe - on wood" | S | W | 10 | 46 | 10 | 43 | 109 | 571 |
| 42 | *Galerina* sp. "small on bark" | S | Bark | | | | | | |
| 228 | *Geastrum* sp. | S | S/L | | | | | | 8 |
| 533 | *Geoglossum* sp. | S | S | | | | 1 | 1 | |
| 8 | *Gymnopilus allantopus* | S | W | 367 | 4 | 58 | 153 | 582 | 168 |
| 365 | *Gymnopilus junionus* | S | W | | | | | | |
| 43 | *Gymnopilus* sp. | S | W | | | | | | |
| 105 | *Gymnopilus* sp. "chestnut scales, forked gills" | S | W | | | | | | |
| 517 | *Gymnopilus* sp. "red cap, yellow gills, yellow stem" | S | W | | | 1 | | 1 | |
| 26 | *Gymnopilus* sp. "reddish cap, orange gills" | S | W | | | | | | 4 |
| 85 | *Gymnopilus* sp. "slender" | S | W | 28 | 19 | 54 | 57 | 158 | 183 |
| 217 | *Gyroporus* aff. *cyanescens* "yellow suede - intense blue stain" | M | S | | | | | | |
| 292 | *Gyroporus* sp."beige-yellow, blue stain" | M | S | | | | | | |
| 433 | *Hebeloma* aff. *westraliensis* | S | S | | | | 1 | 1 | |
| 498 | *Hebeloma* sp. "small" | S | S | 14 | | | | 14 | |
| 56 | *Heterotexus peziziformis* | S | W/T | 8 | | 4 | 45 | 57 | 136 |
| 422 | *Hohenbuehelia* aff. *atracaerulea* "grey brown" | S | W | | 4 | | 10 | 14 | |
| 480 | *Hydnellum* sp. "orange tipped spines" | S | L | | 1 | | | 1 | 2 |
| 87 | *Hydnellum* sp."red brown" | S | L/S | | | | 1 | 1 | 169 |
| 275 | Hydnoid "fleshy funnel" | ? | S/L | | | | | | |
| 297 | *Hydnum repandum* | S? | S | | | | 3 | 3 | 40 |
| 380 | *Hydnum* sp. "chestnut" | S? | S | | | | | | |
| 476 | *Hygrocybe* aff. *astatogala* | S | S | | | | | | 2 |

| Sp # | Species | Life Mode | Sub-strate | Treatments | | | | Well. East | Donn-elly |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E.C. | C.B. | SW. | G.R. | Total | Total |
| 381 | *Hygrocybe cantharellus* | M | S | 1 | | | | 1 | 1 |
| 317 | *Hygrocybe conica* | S | S | | | | | | |
| 122 | *Hygrocybe* sp. "yellow-orange" | S | Moss | | | | | | 2 |
| 281 | *Hygrocybe* sp."pallid yellow" | S | S | | | | | | |
| 100 | *Hypholoma australe* | S | W | | | | | | 24 |
| 59 | *Hypholoma brunneum* | S | W | | | | | | 6 |
| 268 | *Hyphomyces* sp."brown/yellow-orange" | M | Fungus | | | | | | 16 |
| 108 | *Hypomyces chrysospermus* | P | Bolete | | | 4 | 2 | 6 | 9 |
| 516 | *Ileodictyon gracile* | S | S | | | 5 | | 5 | |
| 204 | *Innonotus* sp. | S | W | | | | | | |
| 1 | *Inocybe australiensis* | M | S | 130 | 201 | 51 | 91 | 473 | 191 |
| 203 | *Inocybe geophylla* | M | S | 5 | | | | 5 | |
| 487 | *Inocybe* sp. "brown fibrillose, yellow gills" | M | S | 6 | 10 | 6 | 10 | 32 | |
| 378 | *Inocybe* sp. "chocolate umbonate" | M | S | | | | | | |
| 137 | *Inocybe* sp. "creamy-brown" | M | S | | | | | | |
| 48 | *Inocybe* sp. "grey" | M | S | 3 | 3 | 6 | 11 | 23 | 30 |
| 484 | *Inocybe* sp. "large firillose, umbonate, yellow-tan gills" | M | S | 4 | 2 | | | 6 | |
| 65 | *Inocybe* sp. "large scaly cap" | M | S | | | | | | 2 |
| 398 | *Inocybe* sp. "large scaly umbonate cap" | M | S | | | | 1 | 1 | |
| 226 | *Inocybe sp.* "orange brown" | M | S | | | | | | |
| 113 | *Inocybe* sp. "radially fibrillose, pink stem" | M | S | | | | | | 17 |
| 20 | *Inocybe* sp. "scaly cap" see sp. 277 Fire Fungi | M | S | 1 | 27 | 3 | 4 | 35 | 53 |
| 169 | *Inocybe* sp. "shaggy stem" | M | S | 4 | | | | 4 | 2 |
| 162 | *Inocybe* sp. "small light brown, fibrillose" | M | S | | | | | | |
| 53 | *Inocybe* sp. "tan skirt" | M | S | 2 | 51 | 12 | 4 | 69 | 26 |
| 286 | *Inocybe* sp."umbonate, shaggy" | M | S | 2 | | | 7 | 9 | 5 |
| 74 | *Laccaria* aff. *masonii* | M | S | 127 | 512 | 422 | 286 | 1347 | 974 |
| 36 | *Laccaria lateritia* | M | S | 18 | 52 | 17 | 3 | 90 | 57 |
| 384 | *Laccocephalum basilapiloides* | S | W | | | | | | |
| 383 | *Laccocephalum tumulosum* | S | W | | | | | | |
| 221 | *Lactarius clarkeae* | M | S | 13 | | 2 | | 15 | 10 |
| 142 | *Lactarius eucalypti* | M | S | 2 | | | | 2 | 11 |
| 245 | *Lactarius* sp. "cream yellow" | M | S | 33 | 20 | 75 | 22 | 150 | 22 |
| 215/220 | *Lactarius* sp."cream custard" | M | S | 2 | | 1 | | 3 | |
| 478 | *Laetiporus potentosus* | S | W | 4 | | 1 | 1 | 6 | 3 |
| 335 | *Lentinellus* sp. "brown cap, saw-toothed gills" | S | W | | | | | | |
| 457 | *Lentinellus* sp. "brown fan, white saw-gills" | S | W | | | | | | 1 |
| 468 | *Lentinellus* sp. "brown lobed, hirsute, brown gills" | S | W | | | | | | 6 |
| 271 | *Lepiota* aff. *haemorrhagica* "red stainer" | S | S | | | | | | 1 |
| 185 | *Lepiota cristata* | S | S | | | | | | 1 |
| 264 | *Lepiota* sp. "cream-grey" | S | S | 1 | | | | 1 | |
| 246 | *Lepiota* sp. "purple-grey" | S | S | | | | | | 1 |
| 166 | *Lepiota* sp."creamy-brown" | S | S | 4 | | 6 | 2 | 12 | 10 |
| 76 | *Lepiota* sp."orange with brick red scales/white gills" | S | S | | 2 | | 3 | 5 | 5 |
| 117 | *Lepista* sp. | M? | S | | | | | | |

| Sp # | Species | Life Mode | Sub-strate | Treatments | | | | Well. East | Donn-elly |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E.C. | C.B. | SW. | G.R. | Total | Total |
| 214 | *Leucapaxillus lilacinus* | M | S | | | | | | |
| 24 | *Lycoperdon* sp. | S | S | 1 | 4 | 6 | 11 | 22 | 5 |
| 190 | *Macrolepiota konradii* | S | S | | | | | | 1 |
| 318 | *Marasmellis* sp."small white, on twigs & leaves" | S | L/T | | | | | | 2 |
| 191 | *Marasmiellis* sp. "white umbrella" | S | T/W | | | | | | 1 |
| 239 | *Marasmiellus* sp. "on zamia" | S | T | | | | | | |
| 55 | *Marasmius crinis-equi* | S | L | | | | 1 | 1 | 1183 |
| 183 | *Marasmius elegans* | S | S | | | | | | |
| 341 | *Marasmius* sp. "tiny red on twigs" | S | L/T | | | | | | 26 |
| 309 | *Marasmius* sp. (see 223 Fire fungi) | S | S/L | | | | | | |
| 75 | *Marasmius* sp."large brown, on Zamia stems" | S | T | | | | | | |
| 529 | *Melanoleuca* sp. "grey-brown/white/white" | S | S | | | | 3 | 3 | |
| 22 | *Melanotus hepatocrous (Crepidotus subhaustellaris)* | S | W | | | | | | |
| 373 | *Merulius* sp "creamy yellow, on jarrah stick' | S | W | | | | | | |
| 101 | *Merulius* sp.*"*pink-buff*"* | S | W/Bark | | 2 | | | 2 | 2 |
| 238 | *Mycana yuulongicola* | S | W | 39 | 28 | | 6 | 73 | 23 |
| 503 | Mycelium "creamy-grey crust on charcoal and leaves" | S | L/W | 13 | | 7 | 3 | 23 | |
| 504 | Mycelium "creamy-orange mycelium under well rotted litter" | S | L/W | 39 | 1 | 20 | 59 | 119 | |
| 44 | *Mycena* aff. *atrata* | S | W | 1 | | 1 | 50 | 52 | 43 |
| 372 | *Mycena* aff. *fumosa* | S | W | | | | | | |
| 134 | *Mycena albidocapillaris (*aff. *subcapillaris)* | S | L | | | 25 | 6 | 31 | 24 |
| 80 | *Mycena carmeliana* | S | W | 10 | 15 | | 48 | 73 | 63 |
| 327 | *Mycena maldea* (austrocapillaris (bleach)) | S | L | | 7 | | | 7 | 8 |
| 50 | *Mycena mijoii* | S | L | 22 | 1 | 99 | | 122 | 1269 |
| 66 | *Mycena pura* | S | S/L | 41 | | | | 41 | 6 |
| 144 | *Mycena sanguinolenta* | S | S | 20 | 310 | 35 | 10 | 375 | 17 |
| 491 | *Mycena* sp. "brown pointy cap" | S | L | 156 | | | | 156 | |
| 521 | *Mycena* sp. "brown pura" | S | L | 15 | | | | 15 | |
| 523 | *Mycena* sp. "brown striate with dark umbo" | S | L | 29 | | | | 29 | |
| 456 | *Mycena* sp. "brown-grey, viscid conic" | S | L | | 5 | | | 5 | 10 |
| 51 | *Mycena* sp. "buff umbrella" | S | L/T | 637 | 43 | 47 | 19 | 746 | 276 |
| 336 | *Mycena* sp. "dk brown on burnt ground" | S | S | | | | | | |
| 285 | *Mycena* sp. "light brown striate/white stems, on wood" | S | W | | | | 12 | 12 | |
| 27 | *Mycena* sp. "long stem" | S | W | | | | | | |
| 376 | *Mycena* sp. "small brown with decurrent gills" | S | W | | | | | | 2 |
| 326 | *Mycena* sp. "small buff on wood - bleach" | S | W | | | | | | |
| 352 | Mycena sp. "small creamy yellow-white" | S | L/Bark | | | | | | |
| 165 | *Mycena* sp. "small grey - bleach" | S | S/L | 1 | 1 | | | 2 | 50 |
| 502 | *Mycena* sp. "striate cap, decurrent gills, on burnt ground" | S | S | | | 3 | 4 | 7 | |
| 477 | *Mycena* sp. "tiny rosy pink" | S | S | | | | | | 1 |

| Sp # | Species | Life Mode | Sub-strate | Treatments | | | | Well. East | Donn-elly |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E.C. | C.B. | SW. | G.R. | Total | Total |
| 88 | *Mycena* sp. "tiny white with decurrent gills" | S | S | | | | | | 19 |
| 64 | *Mycena* sp. "tiny white, on twigs" | S | T | | | | 3 | 3 | 46 |
| 308 | *Mycena* sp."grey-brown,/no bleach" | S | S | 3 | 1 | 1 | 8 | 13 | 5 |
| 302 | *Mycena* sp."nipple umbrellas" | S | W | | | | | | |
| 312 | *Mycena* sp."pink,bleach" | S | S/L | | | | | | |
| 295 | *Mycena* sp."small buff" | S | L | 6 | | 5 | 35 | 46 | 3 |
| 182 | *Mycena* spp. (unidentified) | S | | 3 | | 8 | | 11 | |
| 163/260 | *Mycena subgallericulata* | S | W | | | | 13 | 13 | 19 |
| 510 | *Mycoacia subceracea* | S | T/W | | | | | | 1 |
| 164 | *Nidula candida* | S | L/T | | | | 19 | 19 | |
| 413 | *Nidularia* aff. *farcta* "white dots on roo poo" | S | Dung | | 8 | 21 | | 29 | 12 |
| 127 | *Omphalina* aff. *umbellifera* | S | S | | | 3 | 71 | 74 | 52 |
| 112 | *Omphalina chromacea* | S | S | | | | | | 39 |
| 461 | *Omphalina* sp. | S | S | | | | | | 8 |
| 213 | *Omphalotus nidiformis* | S | W | | | | | | |
| 130 | Orange parasite on white resupinate polypore (sp.116) | P | Fungus | | | | | | |
| 104 | *Panellus ligulatus* | S | W | | | | | | 14 |
| 339 | *Panellus* sp. - on ground | S | S | | | | | | |
| 343 | *Panellus* sp. "soft brown" | S | W | | | | | | |
| 311 | *Panus fasciatus* | S | W | | | 4 | 5 | 9 | 89 |
| 356 | *Paxillus* sp. "robust with bulbous base" | M | S | | | | | | |
| 522 | *Paxillus* sp. "yellow" (*P. infundibuliformis*?) | M | S | 1 | | 7 | 5 | 13 | |
| 179 | *Paxillus* sp. "yellow, brown scales" | M | S | | 1 | | | 1 | |
| 332 | *Peziza "praetervisa"* | S | S | 73 | | 36 | 134 | 243 | |
| 524 | *Peziza* aff. *thozetii* | S | S | 1 | | | | 1 | |
| 501 | *Peziza* sp. "black, flat" | S | S | | | | 2 | 2 | |
| 455 | *Peziza* sp. "brown" | S | S | | | | | | 2 |
| 527 | *Peziza* sp. "dark brown, smooth" | S | S | | | | 2 | 2 | |
| 499 | *Peziza* sp. "dark brown-burgandy, tan underside" | S | S | 8 | | | 31 | 39 | |
| 256 | *Peziza* sp. "white cup" | ? | S | | | | | | |
| 330 | *Peziza tenacella* | S | S | 34 | | 22 | 31 | 87 | |
| 300 | *Peziza whitei* | M | S | 1 | | | 5 | 6 | 1 |
| 488 | *Phaeocollybia ratticauda* | S | W/S | | | | 14 | 14 | |
| 479 | *Phelledon* sp. "niger brown" | S | L | | | 12 | | 12 | 154 |
| 136 | *Phellinus gilvus* | S | W | | | | | | 20 |
| 37 | *Phellinus* sp. "yellow rim" | S | W | | | | | | |
| 70 | *Phellodon* aff. *niger* | S | L/S | | | | | | 153 |
| 160 | *Pholiota highlandensis* | S | S | 2 | 32 | 49 | 61 | 144 | 16 |
| 119 | *Pholiota multicingulata* | S | W | | | | | | 2 |
| 506 | *Pholiota* sp. "water soaked gills" | S | S | | | | | | 2 |
| 481 | *Phylloporus* sp. | M | S | | 1 | | | 1 | |
| 363 | *Piptoporus australiensis* | S | W | | | | | | 1 |
| 403 | *Pisolithus* aff. *arhizus* "black-yellow" | M | S | 1 | | | | 1 | |
| 353 | *Pisolithus* sp. 'small, stalked" | M | S | | | | | | |
| 192 | *Plectania* sp. "black" | S | L | | | | | | |
| 133 | *Pluteus attromarginata* | S | W | | | | | | 1 |
| 248 | *Pluteus cervinus* | S | W | | | | | | 1 |

| Sp # | Species | Life Mode | Sub-strate | Treatments | | | | Well. East | Donn-elly |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E.C. | C.B. | SW. | G.R. | Total | Total |
| 47 | *Pluteus lutescens* "orange" | S | W | | | | | | 6 |
| 47b | *Pluteus lutescens* "yellow-green" | S | W | | | | | | 2 |
| 4 | *Pluteus* sp. "brown velvet" | S | S | | | | 1 | 1 | 1 |
| 157 | *Podoserpula pusio* | S/M? | L/S | | | | | | 18 |
| 277 | Polypore "beige" | S | W | 1 | | | | 1 | |
| 13 | Polypore "brown with white margin" | S | W | | | | | | |
| 3 | Polypore "long white shelf" | S | W | | | | | | |
| 333 | Polypore "on dead waterbush" | S | W | 1 | | | | 1 | |
| 474 | Polypore "soft pored bracket" | S | W | | | | | | 9 |
| 361 | Polypore "white resuipinate on twig" | S | W/T | | | | | | |
| 116 | Polypore "white resupinate" | S | T/W | | | 1 | 1 | 2 | 6 |
| 313 | *Polyporus citreus* | S | W/T | | | | | | |
| 494 | *Polyporus* sp. "brown stalked" | S | W | | | 1 | | 1 | |
| 109 | *Poria sp.*"purple splash" | S | W | | | | | | |
| 145 | *Poronia ericii* | C | Dung | | | | 8 | 8 | 99 |
| 236/219 | *Postia* (*Tyromyces*) *peliculosa* | S | W | | | | 3 | 3 | 1 |
| 155 | *Protubera canescens* | M? | S | | | 1 | 2 | 3 | |
| 17 | *Psathyrella* sp. | S | S/L | | | | | | |
| 229 | *Psathyrella* sp. | S | L | 3 | | | | 3 | 6 |
| 250 | *Psathyrella* sp. | S | L | | | | | | 50 |
| 337 | *Psathyrella* sp. | S | S | | | | | | 1 |
| 359 | *Psathyrella* sp. "brown with white skirt" | S | S | | | | | | 1 |
| 177 | *Psilocybe coprophila* | C | Dung | 23 | 83 | 19 | 34 | 159 | 16 |
| 331 | *Pulvinula archerii* | S | S | 95 | 5 | | 118 | 218 | 23 |
| 280 | *Pulvinula* sp. | S | S | | | | | | |
| 129 | *Pulvinula* sp. (*P. tetraspora?)* | S | S | | | | 15 | 15 | 1 |
| 176 | *Pycnoporus coccineus* | S | W | 2 | | 49 | 25 | 76 | 12 |
| 366 | *Pyronema*sp. | S | S | | 1 | | | 1 | |
| 351 | *Ramaria* / *Clavulina* "creamy white" | M | S | | | | | | |
| 52 | *Ramaria* aff. *aurea* "yellow, flat tops" | M | S | | | | | | 4 |
| 72 | *Ramaria holorubella* "purple-pink with pink tips" | M | S | | | | 1 | 1 | 17 |
| 102 | *Ramaria ochroceosalmonicolor* | M | S | 3 | 35 | 25 | 27 | 90 | 30 |
| 139 | *Ramaria* sp. "bright-yellow" | M | S | | | | | | |
| 242 | *Ramaria* sp. "cream/flat" | M | S | | 1 | | | 1 | 1 |
| 247 | *Ramaria* sp. "lemon yellow" | M | S | 5 | | 5 | 8 | 18 | |
| 86 | *Ramaria* sp. "orange-red, yellow stem" | M | S | 2 | | | 1 | 3 | 3 |
| 367 | *Ramaria* sp. "small yellow" | M? | S | | | | | | |
| 490 | *Ramaria* sp. "tan, Allocasuarina litter" | S | S | 291 | | | | 291 | |
| 254 | *Ramaria vesatilis* "purple" | M | S | | | | | | |
| 79 | *Resupinatus cineroscens* | S | T/Bark | | 5 | | | 5 | 66 |
| 452 | *Rhizopogon* sp. | M | S | | | | | | 2 |
| 397 | *Rhodocybe* ? sp. "grey agaric" | S | S | | | 1 | | 1 | |
| 209 | *Rickenella fibula* | S | Moss | | | | | | 31 |
| 69 | *Russula adusta* | M | S | | | | | | 10 |
| 90 | *Russula* aff. *cyanoxantha* | M | S | 1 | | | | 1 | 5 |
| 89 | *Russula clelandii* group | M | S | 12 | 2 | 3 | 1 | 18 | 40 |
| 202 | *Russula flocktoniae* | M | S | 53 | 2 | 18 | 6 | 79 | 4 |
| 92 | *Russula neerimea* | M | S | 2 | | | | 2 | 22 |
| 178 | *Russula persanguinea* (white stem) | M | W | | | | | | 1 |
| 107 | *Russula* sp. "grey-white" | M | S | | 1 | | | 1 | 2 |

| Sp # | Species | Life Mode | Sub-strate | Treatments | | | | Well. East | Donn-elly |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E.C. | C.B. | SW. | G.R. | Total | Total |
| 10a | *Russula* sp. "small white-white-white" | | | | | | | | 5 |
| 10 | *Russula* sp. "white/white/white" | S | S | 18 | 5 | 9 | 3 | 35 | 72 |
| 276 | *Russula* sp."purple-mottled" | M | S | | | | | | |
| 342 | *Ryvardinia campyla* | S | W | | | | | | 1 |
| 263 | *Sarcodon* sp. "brown" | S | S | | | | | | 4 |
| 315 | *Scleroderma* sp."yellow/yellow mycelium" | M | S | | | | | | 1 |
| 150 | *Scutellina* aff. *margaritacea* | S | W/T | | | | | | 14 |
| 12 | Simocybe sp."olive" | S | W | | | | | | 3 |
| 306 | *Sphaerobolus stellatus* | S | L | | | | 20 | 20 | |
| 132 | *Steccherinum* sp. "creamy yellow crust" | S | W | | | 1 | | 1 | |
| 94 | *Steccherinum* sp."tiered white shelves" | S | W | | 5 | | | 5 | 30 |
| 106 | *Stemonitis herbatica* | | Fruits | | | | | | |
| 62 | *Stereum hirsutum* | S | W | 21 | | 58 | 102 | 181 | 123 |
| 149/141/152 | *Stereum illudens* | S | W | | 5 | 140 | 83 | 228 | 185 |
| 5&84 | *Stereum* sp. "grey-brown white hirsute, purple fertile layer" | S | W | | | | | | |
| 325 | *Stereum* sp. "purple margin - algae" | S | W | | | | | | 15 |
| 16 | *Stereum* sp. "translucent funnels" | S | S/Moss | | | | 67 | 67 | 16 |
| 67 | *Stropharia semiglobata* | C | Dung | 2 | 5 | | | 7 | 11 |
| 451 | *Stropharia* sp. "shaggy stem, on roo poo" | S | Dung | | | | | | 1 |
| 507 | *Tapinella curtisii* | S | W | | | | | | 6 |
| 266 | *Thelephora* sp. "white with orange margin" | M | S/Host | 1 | 35 | 5 | 10 | 51 | 40 |
| 454 | Thelephore "creamy jagged-ridged crust" | S | S | | | | 2 | 2 | 7 |
| 482 | *Torrendia* sp. | M | S | | 2 | 33 | 9 | 44 | |
| 63 | *Trametes versicolor* (brown or grey) | S | W | | | 1 | 21 | 22 | 152 |
| 60 | *Tremella mesentericia* | S | W | | | | | | 16 |
| 287 | *Tremella* sp."cloudy yellowish white" | S | W | | | 2 | | 2 | 23 |
| 289 | *Tremella* sp."tiny yellow knobs" | S | W | | | 112 | 300 | 412 | 30 |
| 288 | *Tremella* sp."yellow buttons" | S | W | | | 81 | | 81 | |
| 161 | *Tricholoma* aff. *virgatum* | M | S | | | | | | 1 |
| 483 | *Tricholoma* sp | S | S | | 2 | | | 2 | |
| 211 | *Tricholoma* sp. | M | S | | | | | | |
| 446 | *Tricholoma* sp. "orange with ring" | S | S | | 3 | | | 3 | 1 |
| 495 | *Tricholoma* sp. "orange with white stem" | S | S | | | 4 | | 4 | |
| 54 | *Tricoloma eucalypticum* | M | S | 4 | 6 | 1 | 15 | 26 | 15 |
| 322 | Truffle "black gleba" | M | S | | | | | | |
| 464 | Truffle "pale yellow" | M | S | | | | | | 3 |
| 321 | Truffle "pink gleba" | M | S | | 1 | | | 1 | |
| 258 | Truffle "sticky" | M | S | | | | | | |
| 189 | *Tubaria rufofulva* | S | W | 9 | | | | 9 | 1 |
| 305 | *Tylopilus* sp."yellow" | M | S | | | | 2 | 2 | 6 |
| 505 | *Tyromyces caesius* | S | W | | | | | | 2 |
| 440 | White mycelium on roo poo | S | Dung | | | 1 | | 1 | |
| 2 | *Xerula australis* | S | S | | | | | | |
| 175 | *Xylaria hypoxylon* | S | W | | | | | | 2 |
| 459 | *Xylaria* sp. "black and white spears" | S | W/S | | | | | | |
| 528 | Yellow discs on Emu poo | S | Dung | 150 | | | | 150 | |

| Sp # | Species | Life Mode | Sub-strate | Treatments | | | | Well. East | Donn-elly |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E.C. | C.B. | S.W. | G.R. | Total | Total |
| **482** | **Number of species** | | | **110** | **95** | **108** | **137** | **240** | **230** |
| | **Number of fruitbodies** | | | **3755** | **1979** | **2632** | **3662** | **12053** | **15324** |

[1] S = saprotrophic, M = mycorrhizal, P = parasitic, C = coprophilous
[2] S = soil, L = litter, T = twigs, W = wood
[3] E.C. = external control, C.B. = coupe buffer, S.W. = shelterwood, G.R. = gap release

# CRYPTOGAMS

Ray Cranfield

## Introduction

Cryptogam is the collective name for the lichen, moss and liverwort flora. Some species of lichens are important indicators of ecosystem health because they are sensitive to changes and disturbance in the environment in which they grow. The majority of cryptogams are resurrection species and although fully desiccated in the drier months, they rapidly re-hydrate with any opportunistic rain event. Many colonize primary substrates such as rocks and bare organic matter and are active in the initial breakdown of these materials. Mosses also play an important role in the stabilization of bare soil. Cryptogams are a major component of the biodiversity of forest ecosystems, and most species in Western Australia have unknown distributions and many are yet to be determined.

The object of this component of FORESTCHECK is to:

- Record species richness and abundance in each FORESTCHECK grid and treatment
- Record species habitat and substrate preference, and
- Monitor the effect of disturbance on cryptogam communities

## Monitoring

Usually cryptogam monitoring is carried out in the autumn, but in 2004-05, monitoring was conducted in October (spring) 2004. At each of the 10 grids, the presence and frequency of each species along with the macro and microhabitat that each species occurred on was recorded.

## Voucher Specimen Processing

All specimens collected this year have been identified or phrase-named for ease of redetermination. Information gained from several ongoing cryptogam studies enabled the current species list to be reviewed. This report reflects these changes. Several samples of terrestrial algae were also collected and prepared for incorporation in the state collection held at the WA Herbarium.

All collections were prepared for database entry and label generation prior to submitting vouchers to the Herbarium. A total of 413 collections (369 lichens, 39 mosses and 5 liverworts) were made from the 10 grids. The collections represent 162 species of lichens, 13 species of moss and 4 species of liverworts, making a total of 179 species of cryptogams. A further 6 collections of terrestrial algae were collected and 7 fungal collections. It should be noted that monitoring in spring rather than autumn resulted in a reduction in microscopic fungi collections but no real impact upon the other cryptogams normally sampled.

## Results and Discussion

### Species and habitats

Although the monitoring was conducted in spring it appears that the flora was well represented. A total of 179 species of cryptogams were recorded on the Wellington East grids (Appendix 1). However, the number of liverworts species recorded was very low. It may be that they have a naturally low occurrence in the drier eastern jarrah forest. Liverworts were located outside the grids, but appeared to be restricted to the sheltered banks of creek lines. Harvesting (Shelterwood and gap formation) also results in increased

exposure to the drying elements such as sun and wind. How such disturbances affect liverworts and other sensitive cryptogams is not yet known.

In general, a decline in species numbers occurred from external control to Shelterwood to gap release treatment (Fig. 1). In the external controls the long unburnt Nalyerin grid (FC28) had the highest number of species. In the treatments (shelterwood and gap release) there appeared to be no pattern or relationship associated with time since logging or burning. For example, the Godfrey grids had higher numbers and the Stockyard grids had lower numbers of species than would be expected from having respectively been burnt 2 and 6 years previously (compared to the controls). The unusual relationship between the treatments and time since treatment may also be due to species composition on the respective sites, which will be investigated in detail during the full analysis in 2006.

Wood (old logs), the bark of older trees and stone were the most utilised substrates in the control grids (Fig. 2). Generally, all 7 specified substrate types were present in each of the treatment grids but differences in colonization of the substrates were related to the age of the substrate. For cryptogams, time after fire is important and species substitution can be observed when primary species are replaced over time by subsequent species. On the gap release sites, although suitable substrates were present they were not always colonised because they were not yet mature enough to be colonised. On the other hand, the colonization of termite mounds was recorded on the majority of treatment grids but on the external controls the mounds were not colonized.

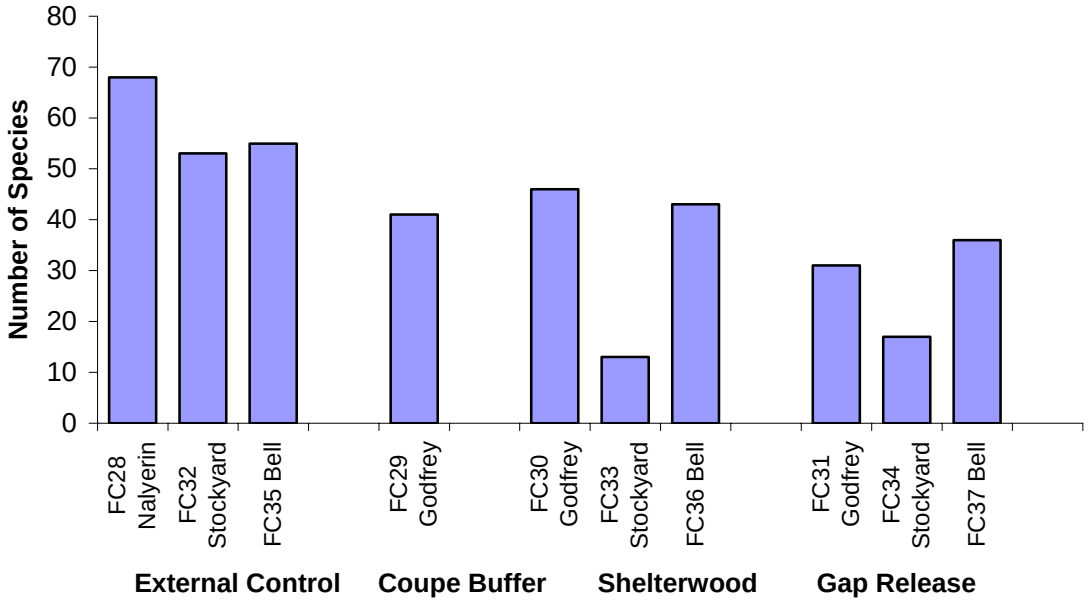



**Figure 1.** The number of species of cryptogams on each FORESTCHECK grid in Wellington East.

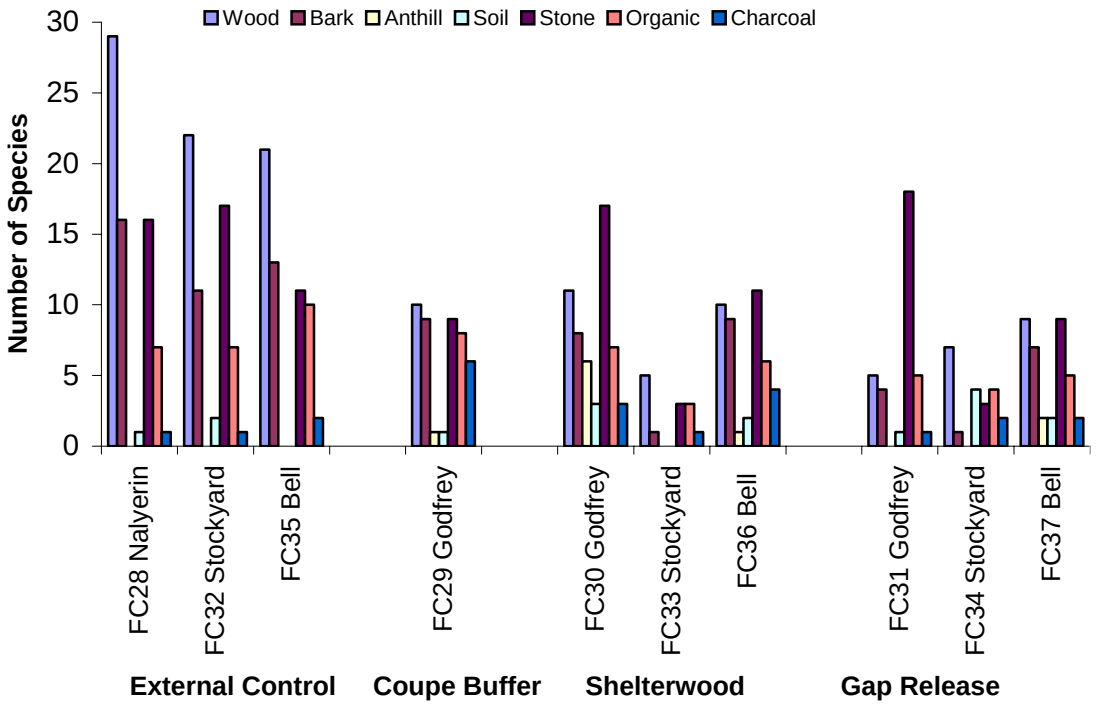



**Figure 2.** The number of cryptogam species colonizing the available microhabitats (substrates) on FORESTCHECK grids of Wellington East.

The position each species within strata was also recorded (Fig. 3). The number of species recorded at ground level (0-30 cm) was similar across all grids. At shrub level (31 cm – 3 m) the numbers of species in the grids appeared to be related to the type of treatment, with lower numbers of species being recorded in the Shelterwood and Gap release treatments respectively. This may be related to the degree of exposure and the age and structure of the regrowth. At tree level (>3.1 m) there were fewer species and they were recorded in lower numbers in the treatment (Shelterwood and gap release) grids than in the controls. This is possibly related to the age of the regrowth trees and to the number of older trees retained in the Shelterwood treatments. However, the accuracy of accessing the tree (>3.1 m) species is variable, as it depends on sampling material that occurs on fallen limbs, which may restrict the number of species actually recorded. A more thorough survey of canopy species should be considered where tree removal has occurred, as they may be a high-risk group.

An understanding of the growth requirements of individual cryptogam species and the effects of modified external influences is required to ensure the long term viability and diversity of these taxa.

The number of species of lichens, mosses and liverworts occurring on each substrate and in each level of strata is included in the summary in Appendix 1.

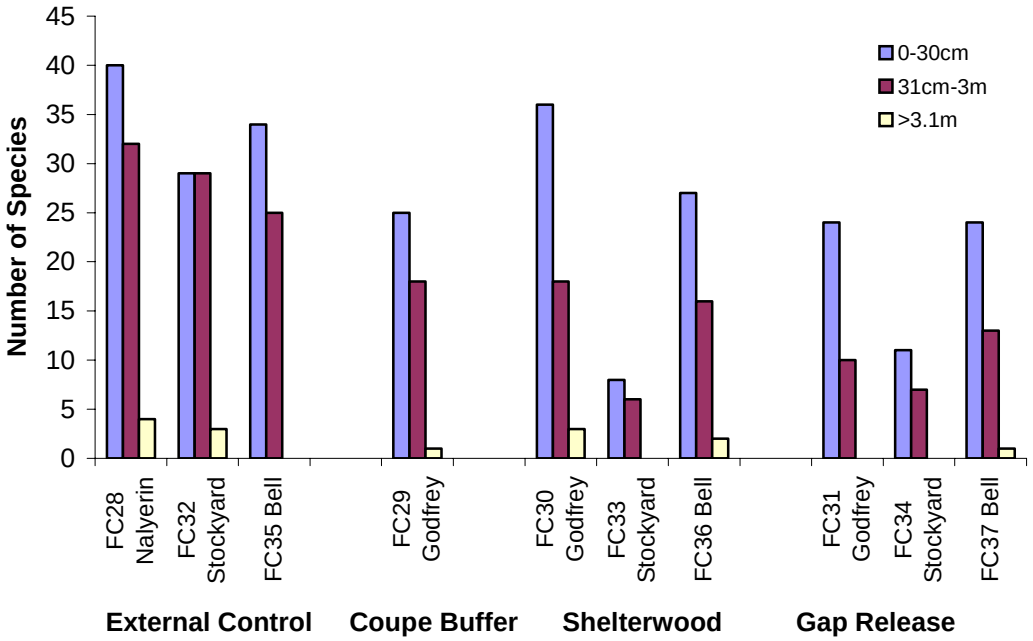



**Figure 3.** The number of cryptogam species recorded at each stratum on FORESTCHECK grids of Wellington East.

### Indicator Species

At Wellington East investigation into the use of possible indicator species continued. The list of potential indicators includes 28 species, of which 21 are lichens, 6 are mosses and 2 are liverworts (see 2002-03 Wellington report). The species were chosen on the basis of their preferred substrate and the position they occupy in the strata.

Several species on the original list have undergone taxonomic review and as a result have been subject to name changes, these changes are detailed in Table 1. An additional species that colonises old decaying wood, *Graphis* sp. (black rays), was added to the list in 2003-04, this species has now been determined as an un-named species of *Opegrapha* not previously recorded for Australia.

At each grid the presence of each potential indicator species was noted and in most instances the list of species present was close to the possible twenty-eight species listed (Fig. 4). Preliminary examination of the indicator species indicates that species not being present on a grid represents a habitat that has been lost or modified. However, the possibility that a species may have a limited geographical range cannot as yet be ruled out. FORESTCHECK includes jarrah forest that extends over a large geographical range and as yet we do not have detailed information on the extent of the range of all the potential indicator species.

**Table 1.** Recent name changes (a) of potential FORESTCHECK Indicator Species and additional taxa (b) that were added to the list in 2003-4 (B = moss, H = liverwort and L = lichen).

| Code No. | Group | Taxon | Redetermined Name |
|---|---|---|---|
| (a) Redetermined Indicator Taxa | | | |
| 23 | H | *Fossombronia* sp. (leafy & lettuce) | = *Fossombronia altilamellosa* |
| 8 | L | *Neuropogon* sp | = *Usnea* sp. (leuco) |
| 10 | L | *Parmotrema cooperi* | = *Rimelia reticulata* |
| 18 | B | *Sematophyllum contiguum* | = *Sematophyllum subhumile* var. *contiguum* |
| 21 | B | *Ceratodon purpureus* | = *Ceratodon purpureus* subsp. *convolutes* |
| 28 | L | *Graphis* sp. (blackrays) | = *Opegrapha* sp. |

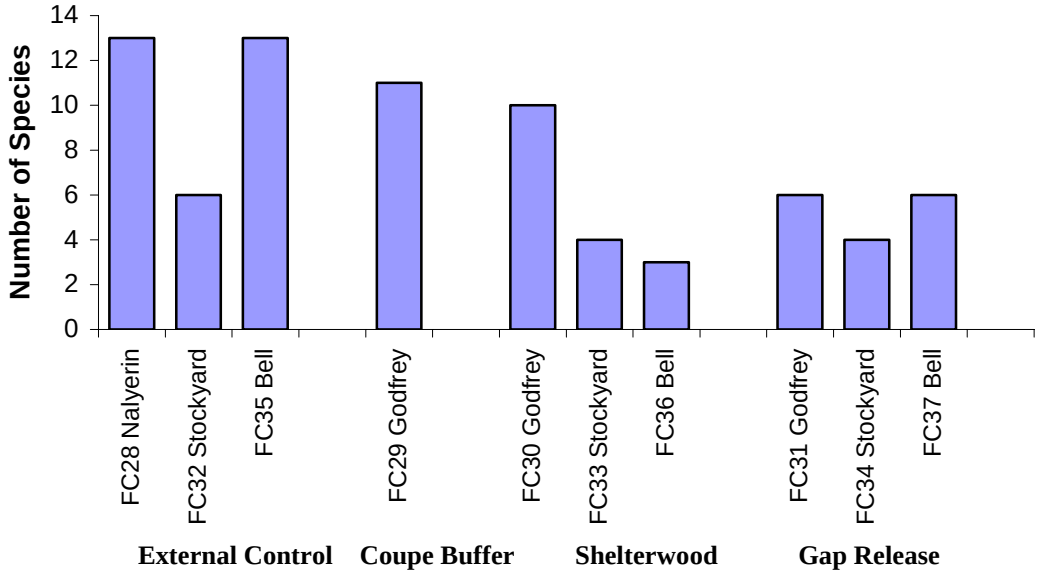



**Figure 4.** The number of indicator species (from a possible 28) recorded on each FORESTCHECK grid in Wellington East.

Other species that show up as possible indicators are included in Appendix 1 (bold type). In establishing this and previous lists an attempt has been made to include species that have specific requirements of either substrate or landscape position. It is anticipated that in the final report in 2006 that a list of indicator species can be presented along with the rationale as to why they are selected and what their absence may indicate.

### Comparison of all FORESTCHECK Locations

An overview of all FORESTCHECK locations (Donnelly, Wellington, Perth Hills and Wellington East) was undertaken in an attempt to see possible similarities and differences between the 4 areas.

### Common species

17 species of lichens, 3 species of moss and 2 species of liverworts were found to be common to 90% of the grids in the 4 FORESTCHECK locations. Many of these species appear on the proposed indicator species list. The common lichens were: *Cladia aggregata, Cladia schizopora, Cladonia krempelhuberi, Cladonia ramulosa, Cladonia rigida, Cladonia sulcata, Graphis* sp. (blackrays) [= *Opegrapha* sp.], *Hypocenomyce foveata, Hypocenomyce scalaris, Hypogymnia subphysodes* var. *subphysodes***,** *Ochrolechia* sp. (G. Kantavilis 306/92), *Pannoparmelia wilsonii, Paraporpidia glauca, Ramboldia stuartii, Tephromela atra, Thysanothecium scutellatum and Usnea inermis*. The common mosses were: *Barbula calycina*, *Campylopus introflexus* and *Sematophyllum subhumile* var. *contiguum* and the common liverworts: *Cephaloziella exiliflora* and *Chiloscyphus semiteres*.

### External control and gap release grids

#### Species richness

There was some variation observed in the number of species recorded on the control grids at each location and between locations (Fig. 5). As the preferred habitat substrates for most species are represented on most grids, the variation may be the result of varying climatic conditions and vegetation densities on each grid and between locations. The lower number of liverwort species recorded at Wellington, Wellington East and the Perth Hills for example may be indicative of the warmer drier conditions on these grids.

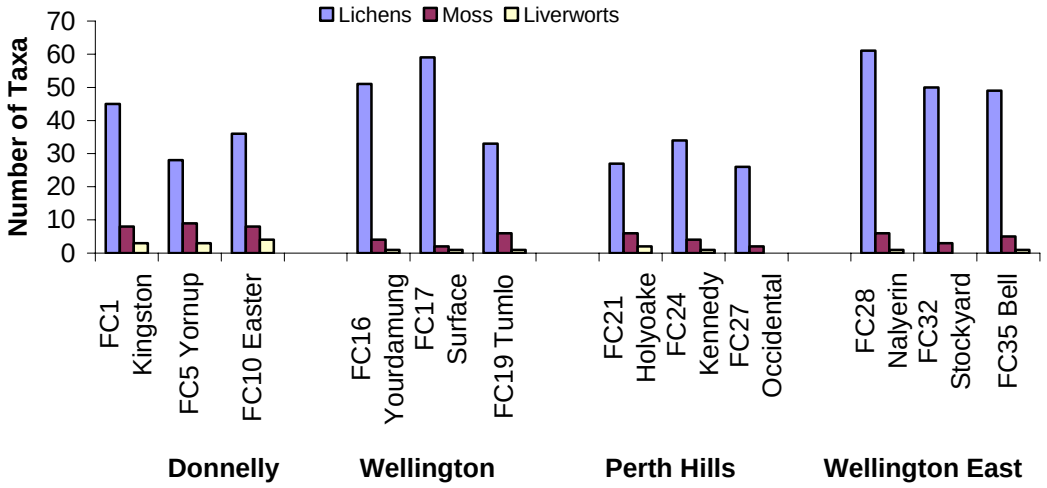



**Figure 5.** The number of cryptogam taxa recorded on external control sites at the Donnelly, Wellington, Perth Hills and Wellington East FORESTCHECK locations.

The lower number of taxa recorded on the gap release sites (Fig. 6) is a direct result of disturbance and habitat loss, or by either tree harvesting or fire or both. The loss of micro climatic niches is known to impact on several cryptogam species resulting in the loss of species or reduced population sizes. The time since treatment on the gap release sites is important in the recovery of the cryptogam flora. On disturbed sites recovery is influenced directly by the increase in size and density of understorey vascular flora and by tree species densities. Early strong regrowth of tree saplings can retard the establishment of many cryptogams as a direct result of too much shading and lack of aged substrates. Further management practices, such as thinning, may have the effect of either delaying or facilitating the recovery of the cryptogam flora on these sites and further investigation is needed in order to understand what impact this intervention would imply.

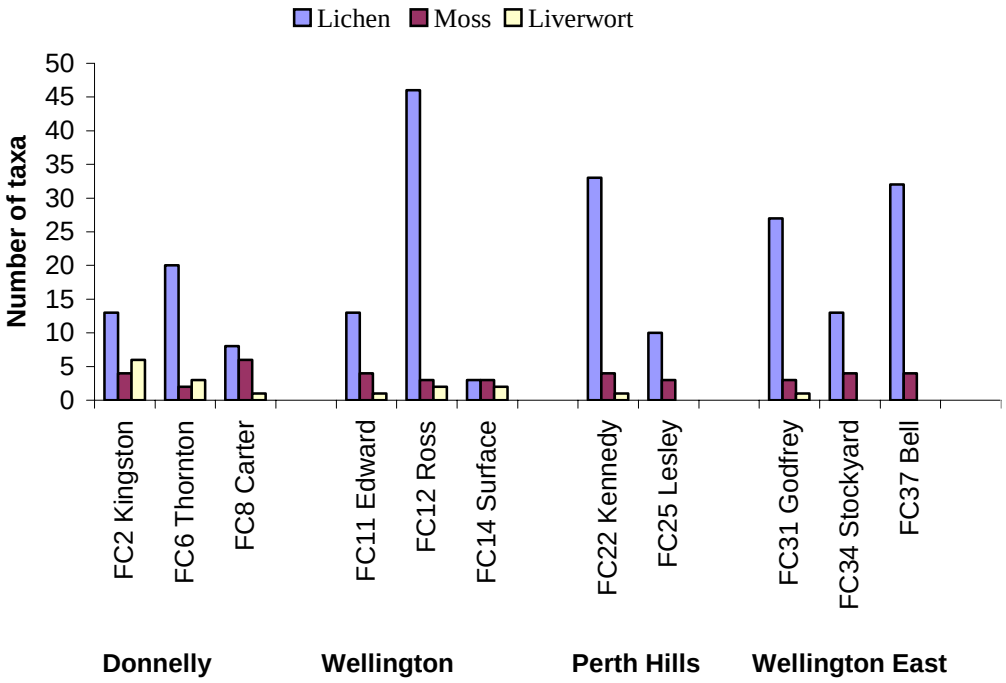



**Figure 6.** The number of cryptogam taxa recorded on gap release sites at the Donnelly, Wellington, Perth Hills and Wellington East FORESTCHECK locations.

### Strata occupied

The use of particular strata by various cryptogam flora in the external control grids varied between each location. At Donnelly, Perth Hills and Wellington East the majority of species were generally recorded on the ground layer (0-30 cm) while at Wellington it was the shrub layer (30 cm- 3 m) stratum was colonized by the majority of species (Fig. 7). The number of species recorded in the tree layer (>3 m) was low at all 4 locations but noticeably lower in the Perth Hills. This variation may be a reflection of the change in moisture and temperature from north to south in the locations.

On the gap release sites (Fig. 8), the loss of older trees, and the mature shrub cover, has reduced the availability of suitable substrates for cryptogam establishment. Rapid tree re-growth, dense canopy cover, and the removal of debris by fire in the early stages appear to restrict the establishment of ground and shrub layer occupation. On the wetter sites, however, the ground level appears to be the desired location for cryptogams but it is really a reflection of the predominance of moss species and liverworts.

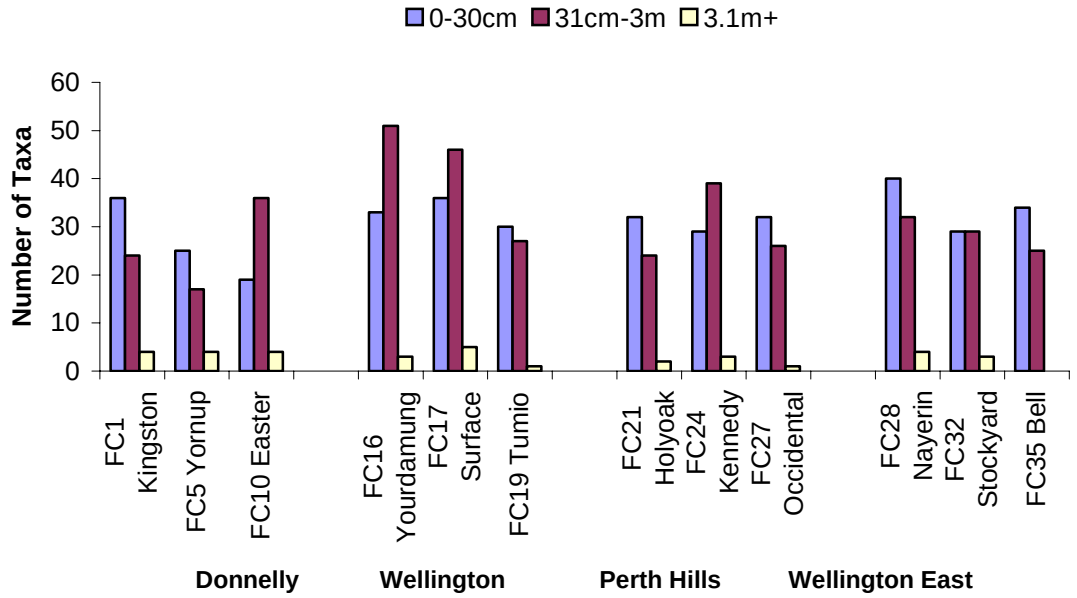



**Figure 7**. The number of cryptogam taxa occupying the different levels of forest strata in the control grids at the Donnelly, Wellington, Perth Hills and Wellington East FORESTCHECK locations.

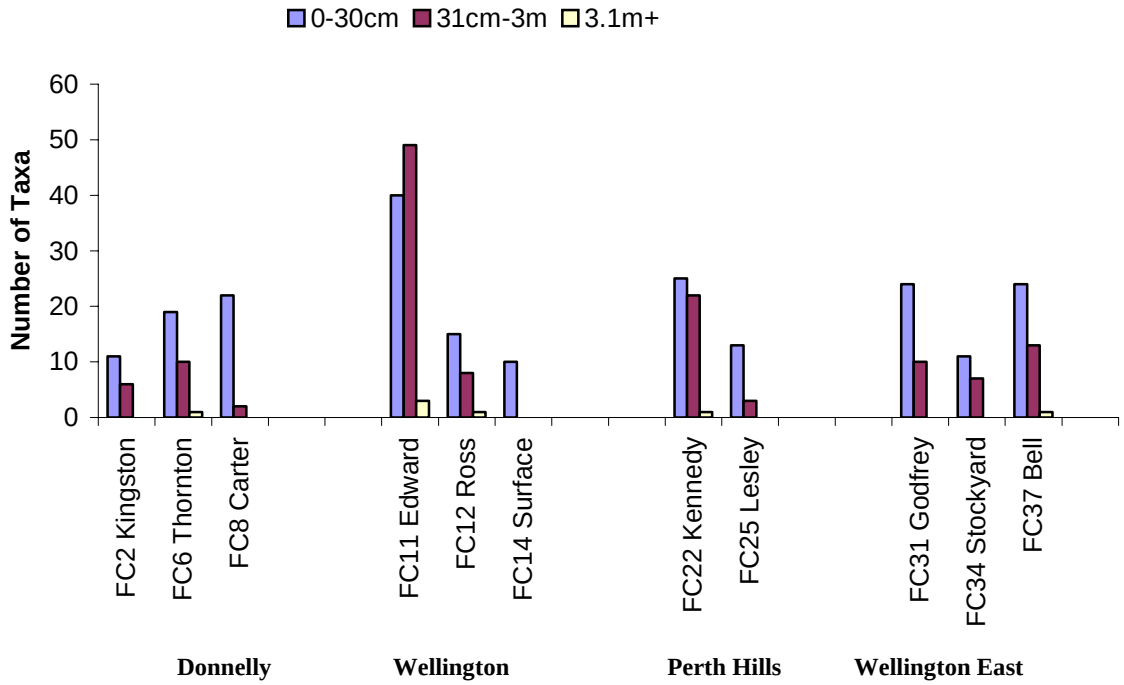



**Figure 8.** The number of cryptogam taxa occupying the different levels of forest strata in the gap release grids at the Donnelly, Wellington, Perth Hills and Wellington East FORESTCHECK locations.

## Conclusions

- Cryptogam species richness was higher in external control grids
- Anthills, a common substrate for several species of lichens and mosses, were not utilized in the external controls – reason not clear
- The most utilized substrates in all treatments were rocks and decaying logs

- Only one species of liverwort was recorded, likely due to the drier environment of the eastern jarrah forest

**Comparing Locations**

- 17 species of lichens, 3 species of moss and 2 species of liverworts were found to be common to 90% of the grids in the 4 FORESTCHECK locations
- External controls are consistently higher in species richness
- The lower number of taxa recorded on the gap release sites appears to be due to disturbance and habitat loss
- Donnelly location had a higher number of moss and liverwort species, this is due to the wetter environment

**Appendix 1.** Presence/absence and summary of Cryptogam taxa located on each FORESTCHECK grid (Names in **bold text** are the nominated indicator species).

| Taxa | External Control | | | Coupe Buffer | Shelterwood | | | Gap Release | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | FC28 Nalyerin | FC32 Stockyard | FC35 Bell | FC29 Godfrey | FC30 Godfrey | FC33 Stockyard | FC36 Bell | FC31 Godfrey | FC34 Stockyard | FC37 Bell |
| **Mosses (B)** | | | | | | | | | | |
| ***Barbula calycina*** | | ✓ | | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ |
| ***Campylopus introflexus*** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ***Ceratodon purpureus*** ssp. ***convolutus*** | ✓ | | | | | | | ✓ | ✓ | |
| *Didymodon torquatus* | | | | | | | ✓ | | | ✓ |
| ***Funaria hygrometrica*** | | | ✓ | | ✓ | | | ✓ | | |
| ***Rhynchostegium subhumile*** var. ***contiguum*** | ✓ | ✓ | ✓ | ✓ | | | | | | |
| *Rhynchostegium tenuifolium* var. *tenuifolium* | | | | | | | ✓ | | | |
| *Rosulabryum billarderi* | ✓ | | ✓ | | | | | | ✓ | |
| *Rosulabryum* sp. Stockyard (R.J. Cranfield 20799) | | | | | | ✓ | | | | |
| *Weissia controversa* | | | | | | | ✓ | | | ✓ |
| **Liverworts (H)** | | | | | | | | | | |
| ***Cephaloziella exiliflora*** | ✓ | | ✓ | ✓ | ✓ | | | ✓ | | |
| **Lichens (L)** | | | | | | | | | | |
| *Acarospora* sp. brown (R.J. Cranfield 20633) | | | | | ✓ | | | | | |
| *Biatropsis usneanum* | | | ✓ | | | | | | | |
| *Biatropsis* sp. Bell (R.J. Cranfield 20994) | | | | | | | ✓ | | | |
| *Buellia stellulata* | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | | ✓ |
| *Buellia* sp. | | | | | ✓ | | ✓ | | | |
| *Buellia* sp. brown apo (R.J. Cranfield 20714b) | | | | ✓ | | | | | | |
| *Buellia* sp. sparse (R.J. Cranfield 20619) | | | | | ✓ | | | | | |
| *Calicium abietinum* | ✓ | ✓ | | | | | | | | |
| *Calicium glaucellum* | | ✓ | ✓ | | | | | ✓ | | |
| *Calicium victorianum* subsp. *desidiosum* | | ✓ | | | | | | | | |
| *Calicium victorianum* subsp. *victorianum* | ✓ | ✓ | | ✓ | | | | | ✓ | |
| *Calicium tricolor* | ✓ | | | ✓ | | | | | | |
| *Caloplaca marina* | ✓ | ✓ | ✓ | | | | ✓ | ✓ | | ✓ |
| *Chaenotheca brunneola* | | | | | ✓ | | | | | |
| *Chaenothecopsis pusilla* | ✓ | | | | | | | | | |
| ***Cladia aggregata*** | ✓ | | ✓ | ✓ | ✓ | | | | | |
| ***Cladia schizopora*** | ✓ | | ✓ | ✓ | ✓ | | | ✓ | | |
| *Cladonia angustata* | | | | ✓ | ✓ | | | | | |
| *Cladonia capitellata* | | | | | ✓ | | | | | |
| ***Cladonia cervicornis*** var. ***verticillata*** | | | ✓ | | | | | | | |
| *Cladonia crispata* var. *cetrariiformis* | ✓ | ✓ | | | | | | | ✓ | |
| *Cladonia humilis* var. *humilis* | | | | | | | ✓ | | | |
| ***Cladonia krempelhuberi*** | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ | | ✓ |
| *Cladonia macilenta* | ✓ | | | ✓ | | | | | | |
| *Cladonia polycarpoides* | | | ✓ | | | | | | | |
| *Cladonia praetermissa* | | | | ✓ | | | | | | |
| *Cladonia ramulosa* | | | | | | | ✓ | | ✓ | |
| ***Cladonia rigida*** | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | | ✓ |
| *Cladonia scabriuscula* | | | ✓ | | | | ✓ | | | |

| Taxa | External Control | | | Coupe Buffer | Shelterwood | | | Gap Release | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | FC28 Nalyerin | FC32 Stockyard | FC35 Bell | FC29 Godfrey | FC30 Godfrey | FC33 Stockyard | FC36 Bell | FC31 Godfrey | FC34 Stockyard | FC37 Bell |
| *Cladonia southlandica* | ✓ | | | | | | | | | ✓ |
| *Cladonia sulcata* | | | | | ✓ | | ✓ | | | |
| *Cladonia ustulata* | ✓ | | | | | | | | ✓ | |
| *Cladonia* sp. Nalyerin (R.J. Cranfield 20895) | ✓ | | | | | | | | | |
| *Cladonia* sp. Stockyard (R.J. Cranfield 20788) | | ✓ | | | | | | | | |
| *Cladonia* sp. Stockyard (R.J. Cranfield 20737) | | | | | | | | | ✓ | |
| *Cyphelium trachylioides* | | | ✓ | | | | ✓ | | | |
| *Diploschistes ocellatus* | | | | | | | | | | ✓ |
| *Diploschistes scruposus* | ✓ | | | | | | | | | |
| *Diploschistes strictus* | | ✓ | ✓ | | ✓ | | | ✓ | ✓ | |
| *Diploschistes sp.* | | | | ✓ | | | | ✓ | | |
| *Diploschistes* sp.lead (R.J. Cranfield 20796) | | | | | | ✓ | | | | |
| *Ephebe* sp. | | | | | ✓ | | | | | |
| *Flavoparmelia springtonensis* | | ✓ | | | | | | | | |
| *Graphis* sp. (black beans) | | ✓ | | ✓ | | | | ✓ | | |
| *Graphis* sp. (black buns) | | | | | | | | | | |
| ***Graphis* sp. (black rays)** | ✓ | | ✓ | | | ✓ | | | | |
| *Graphis* sp. (tram lines) | ✓ | ✓ | | | | | ✓ | | ✓ | |
| *Graphis* sp. (writhing mass) | | | | ✓ | | | | | | |
| *Hafellia tetrapla* | | | ✓ | | | | | | | |
| *Hypocenomyce australis* | ✓ | ✓ | ✓ | | | | | ✓ | ✓ | ✓ |
| *Hypocenomyce foveata* | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | | ✓ |
| *Hypocenomyce scalaris* | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | ✓ |
| ***Hypogymnia subphysodes* *var.* *subphysodes*** | ✓ | | ✓ | ✓ | | | ✓ | | | |
| *Imshaugia aleurites* | | | | | | | | | | ✓ |
| *Lecanora farinacea* | | | | | | | | | | ✓ |
| *Lecidea orosthea* | | | | | ✓ | | | | | |
| *Lecidea* sp. Godfrey (R.J. Cranfield 20657) | | | | | | | | ✓ | | |
| *Lecidea* sp. grey smudge (R.J. Cranfield 20645) | | | | | ✓ | | | | | |
| *Lecidella stigmatea* | | ✓ | ✓ | ✓ | | | | | | |
| *Megularia* sp. Nalyerin (R.J. Cranfield 20906) | ✓ | | | | | | | | | |
| ***Menegazzia platytrema*** | ✓ | ✓ | | | | | | | | |
| *Neofuscelia verrucella* | | ✓ | ✓ | ✓ | | | ✓ | | | |
| *Ochrolechia* sp. (G.S. Kantavilas 306/92) | ✓ | ✓ | ✓ | | | ✓ | ✓ | | | ✓ |
| *Pannaria elixii* | | | | | | | | | ✓ | |
| ***Pannoparmelia wilsonii*** | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | | |
| ***Paraporpidia glauca*** | ✓ | | | ✓ | ✓ | | ✓ | | | |
| *Parmelia erumpens* | | | | | | | ✓ | | | |
| *Parmlinopsis minarum* | | | | | | | ✓ | | | |
| *Parmotrema praesorediosum* | ✓ | | ✓ | ✓ | | ✓ | | ✓ | | |
| *Peltula euploca* | | | | | | | | | | ✓ |
| *Pertusaria trimera* | | | | | ✓ | | | | | |
| *Pyrrhospora laeta* | | | | | ✓ | | | | | |
| *Ramalea cochleata* | | | | | ✓ | | | | | |
| *Ramboldia stuartii* | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ |
| *Rhizocarpon geographicum* | | ✓ | | | | | | | | |
| *Rhizocarpon tinei* | | ✓ | ✓ | | | | | ✓ | | |

| Taxa | External Control | | | Coupe Buffer | Shelterwood | | | Gap Release | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | FC28 Nalyerin | FC32 Stockyard | FC35 Bell | FC29 Godfrey | FC30 Godfrey | FC33 Stockyard | FC36 Bell | FC31 Godfrey | FC34 Stockyard | FC37 Bell |
| *Rhizocarpon* sp. grey (R.J. Cranfield 20894) | ✓ | | | | | | | | | |
| *Rimelia reticulata* | | ✓ | ✓ | | | | | | | |
| *Rinodina gennari* | ✓ | ✓ | ✓ | | | | | | | |
| ***Tephromela atra*** | ✓ | | | | | | | | | |
| ***Thysanothecium hookeri*** | | | | | ✓ | | ✓ | | | |
| ***Thysanothecium scutellatum*** | ✓ | ✓ | ✓ | ✓ | | | ✓ | | | ✓ |
| *Thysanothecium* sp. green scales (R.J. Cranfield 20953) | | | | | | | | | | ✓ |
| *Toninia sedifolia* | | ✓ | | ✓ | | | | | | |
| *Toninia* sp. | | ✓ | | | | | | | | ✓ |
| *Trapelia* sp. Godfrey (R.J. Cranfield 20612) | | | | | ✓ | | | | | |
| *Trapelia* sp. Godfrey (R.J. Cranfield 20718) | | | | ✓ | | | | | | |
| *Trapelia* sp. Bell (R.J. Cranfield 20850) | | | ✓ | | | | | | | |
| *Trapeliopsis* sp. Godfrey (R.J. Cranfield 20649) | | | | | ✓ | | | | | |
| *Trapeliopsis* sp. Godfrey (R.J. Cranfield 20714) | | | | ✓ | | | | | | |
| *Trapeliopsis* sp. Bell (R.J. Cranfield 20853) | | | ✓ | | | | | | | |
| *Trapeliopsis* sp. | ✓ | ✓ | | ✓ | ✓ | | | | | |
| ***Usnea inermis*** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ |
| *Usnea subalpina* | ✓ | ✓ | ✓ | | | | | | | |
| *Usnea subciliata* | | | | | | | ✓ | | | |
| ***Usnea* sp. (leuco)** | ✓ | | | | ✓ | | | | | |
| *Usnea* sp. Nalyerin (R.J. Cranfield 20883) | ✓ | | | | | | | | | |
| *Xanthoparmelia congensis* | | | | ✓ | | | | | | |
| *Xanthoparmelia flindersiana* | | | | | | | | ✓ | | |
| *Xanthoparmelia mexicana* | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| *Xanthoparmelia nana* | | | ✓ | | ✓ | | | ✓ | | ✓ |
| *Xanthoparmelia parvoincerta* | ✓ | | | | | | | | | |
| *Xylographa* sp. Stockyard (R.J. Cranfield 20739) | | | | | | | | | ✓ | |
| Genus sp. balls (R.J. Cranfield 20676) | | | | | | | | ✓ | | |
| Genus sp. Bell (R.J. Cranfield 20855) | | | ✓ | | | | | | | |
| Genus sp. Bell (R.J. Cranfield 20946) | | | | | | | | | | ✓ |
| Genus sp. black folds (R.J. Cranfield 20914) | ✓ | | | | | | | | | |
| Genus sp. black freckles (R.J. Cranfield 20747) | | ✓ | | | | | | | | |
| Genus sp (black hairy stepping stones) | | | ✓ | | | | | ✓ | | ✓ |
| Genus sp. blobs (R.J. Cranfield 20982) | | | | | | | | ✓ | | |
| Genus sp. (blue apo) | | | | | | | ✓ | | | ✓ |
| Genus sp. bread crumbs (R.J. Cranfield 20889) | ✓ | | | | | | | | | |
| Genus sp. brown crust (R.J. Cranfield 21003) | | | | | | | ✓ | | | |
| Genus sp. brown wax (R.J. Cranfield 20854a) | | | ✓ | | | | | | | |
| Genus sp. coke (R.J. Cranfield 20633) | | | | | ✓ | | | | | |
| Genus sp. Godfrey (R.J. Cranfield 20633) | | | | | ✓ | | | | | |
| Genus sp. Godfrey (R.J. Cranfield 20640) | | | | | ✓ | | | | | |
| Genus sp. Godfrey (R.J. Cranfield 20704) | | | | ✓ | | | | | | |
| Genus sp. (green crust) | | ✓ | ✓ | | | | | ✓ | | |
| Genus sp. green wax (R.J. Cranfield 20714a) | | | | ✓ | | | | | | |

| Taxa | External Control | | | Coupe Buffer | Shelterwood | | | Gap Release | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | FC28 Nalyerin | FC32 Stockyard | FC35 Bell | FC29 Godfrey | FC30 Godfrey | FC33 Stockyard | FC36 Bell | FC31 Godfrey | FC34 Stockyard | FC37 Bell |
| Genus sp. grey (R.J. Cranfield 20915) | ✓ | | | | | | | | | |
| Genus sp. grey brain (R.J. Cranfield 20616) | | ✓ | | | ✓ | | | | | |
| Genus sp. (grey corn cobs) | ✓ | | ✓ | | ✓ | | | | | |
| Genus sp. (grey crust) | | ✓ | ✓ | | | | ✓ | | | |
| Genus sp. grey scale (R.J. Cranfield 20741) | | ✓ | | | | | | | | |
| Genus sp. Stockyard (R.J. Cranfield 20803) | | | | | | ✓ | | | | |
| Genus sp. stromats (R.J. Cranfield 20639) | | | | | ✓ | | | | | |
| Genus sp. yellow crust (R.J. Cranfield 20922) | ✓ | ✓ | ✓ | | | | ✓ | | | ✓ |
| Genus sp. yellow wax (R.J. Cranfield 20770) | | ✓ | ✓ | | | | | | | |
| Genus sp. (U7) | | | | | | | ✓ | | | |
| Genus sp. RC20872 | ✓ | | | | | | | | | |

| SUMMARY | External Control | | | Coupe Buffer | Shelterwood | | | Gap Release | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | FC28 Nalyerin | FC32 Stockyard | FC35 Bell | FC29 Godfrey | FC30 Godfrey | FC33 Stockyard | FC36 Bell | FC31 Godfrey | FC34 Stockyard | FC37 Bell |
| Number of voucher collections | 68 | 53 | 55 | 41 | 46 | 13 | 43 | 31 | 17 | 36 |
| **GROUPS** (number of species) | | | | | | | | | | |
| Lichen (L) | 61 | 50 | 49 | 36 | 43 | 10 | 38 | 27 | 13 | 32 |
| Mosses (B) | 6 | 3 | 5 | 4 | 2 | 3 | 5 | 3 | 4 | 4 |
| Liverwort H) | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 |
| **Habitats** (number of individual cryptogam records) | | | | | | | | | | |
| Wood | 29 | 22 | 21 | 10 | 11 | 5 | 10 | 5 | 7 | 9 |
| Bark | 16 | 11 | 13 | 9 | 8 | 1 | 9 | 4 | 1 | 7 |
| Anthill | 0 | 0 | 0 | 1 | 6 | 0 | 1 | 0 | 0 | 2 |
| Soil | 1 | 2 | 0 | 1 | 3 | 0 | 2 | 1 | 4 | 2 |
| Stone | 16 | 17 | 11 | 9 | 17 | 3 | 11 | 18 | 3 | 9 |
| Organic Material | 7 | 7 | 10 | 8 | 7 | 3 | 6 | 5 | 4 | 5 |
| Charcoal | 1 | 1 | 2 | 6 | 3 | 1 | 4 | 1 | 2 | 2 |
| **Stratal Position** (number of individual cryptogam records | | | | | | | | | | |
| 0-30 cm | 40 | 29 | 34 | 25 | 36 | 8 | 27 | 24 | 11 | 24 |
| 31 cm-3 m | 32 | 29 | 25 | 18 | 18 | 6 | 16 | 10 | 7 | 13 |
| > 3.1 m | 4 | 3 | 0 | 1 | 3 | 0 | 2 | 0 | 0 | 1 |
| **Indicator Species (from a total of 27)** | 13 | 6 | 13 | 11 | 10 | 4 | 3 | 6 | 4 | 6 |

# VASCULAR PLANTS

Bruce Ward and Ray Cranfield

## Introduction

The vegetation complexes of jarrah forest are considered to be relatively stable and resilient to natural disturbances such as fire. In most circumstances, and in time, the species that were present before the disturbance are generally present after the event, although abundances may change. Where logging is concerned, disturbance might include soil movement, mixing and compaction. This level of disturbance may impact more severely and cause a loss in diversity either through a loss in species richness or a shift in species abundance.

The object of this component of the FORESTCHECK program is to:

- Monitor vascular plant species richness and abundance on each of the FORESTCHECK grids
- Compare species richness, abundance and composition recorded on treatment grids (shelterwood and gap release) to those on unlogged grids (external control)

As the pyric succession of plants also affects which species are present, differences found may be successional rather than from logging. Therefore an allowance for time since fire needs to be considered in determining species richness.

This report highlights the results from the fourth round of monitoring for FORESTCHECK.

## Monitoring

Spring is the preferred time to monitor understorey vascular plants as it coincides with the peak flowering time for most plants. Species richness and understorey vegetation structure were determined, by recording each species, estimating its area of cover, and measuring its position in the understorey strata, in 4 30 x 30 m plots in each grid (40 in total). Species density was measured by recording species occurrence and abundance in twenty 1 x 1 m plots in each grid (800 in total) and Vegetation structure is determined from levy contact data at various height categories in the understorey (Levy and Madden 1933). The area around each grid was used to search for voucher flowering plant specimens to aid in or confirm their identification.

## Voucher Collections

A total of 127 vouchers were collected, representing 58% of the species recorded. All specimens have been processed and following entry onto the database will be lodged with the WA Herbarium (PERTH).

## Results and Discussion

### Species Richness

A total of 159 species were recorded in the 30 x 30 m plots and 137 species in the 1 x 1 m plots, 28 of which were unique and not found in the 30 x 30 m plots. The total number of species recorded was 187 (see Table 1 for comparison of species numbers and Appendix 1 for the complete species list). A further 36 species collected from outside the plot areas were unique and increased the species numbers on site to 223.

**Table 1.** The number of vascular plant species recorded in plots on all the FORESTCHECK grids at Donnelly, Wellington, Perth Hills and Wellington East.

| Location | 30 x 30 m Plots Species Numbers | 1 x 1 m Plots Species Numbers | % Difference | Number of weed species |
|---|---|---|---|---|
| **Donnelly 2002** | 203 | 158 | 22 | 24 |
| **Wellington 2003** | 181 | 116 | 36 | 10 |
| **Perth Hills 2004** | 188 | 126 | 33 | 4 |
| **Wellington East 2005** | 159 | 137 | 14 | 10 |

Species richness across treatments showed little variation and indicated that there has been no loss of species due to logging activities. Any loss in species numbers would be reflected in lower species richness recorded on the treatment grids (shelterwood and gap release) than was recorded for external controls (Fig. 1).

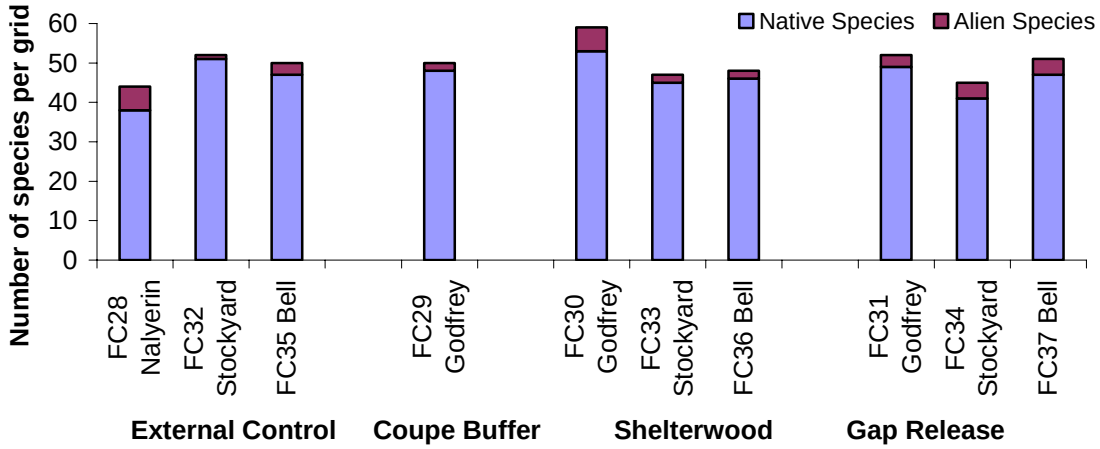



**Figure 1.** Vascualr plant species richness recorded on each of the FORESTCHECK grids in Wellington East.

The minor variation in species richness is likely due to time since fire. The plots that were most recently burnt (2 years prior) had the highest species richness and the lowest species richness was in the Nalyerin external control grid (FC28), which was burnt 17 years previously. Introduced species are present in all grids, and when expressed as a proportion of the total they show a level of about 6-8%, with no difference between any of the treatments (including external control plots).

### Species Density

Species density showed similar trends across all treatments and there appeared to be no impact associated with logging treatments (Fig. 2).

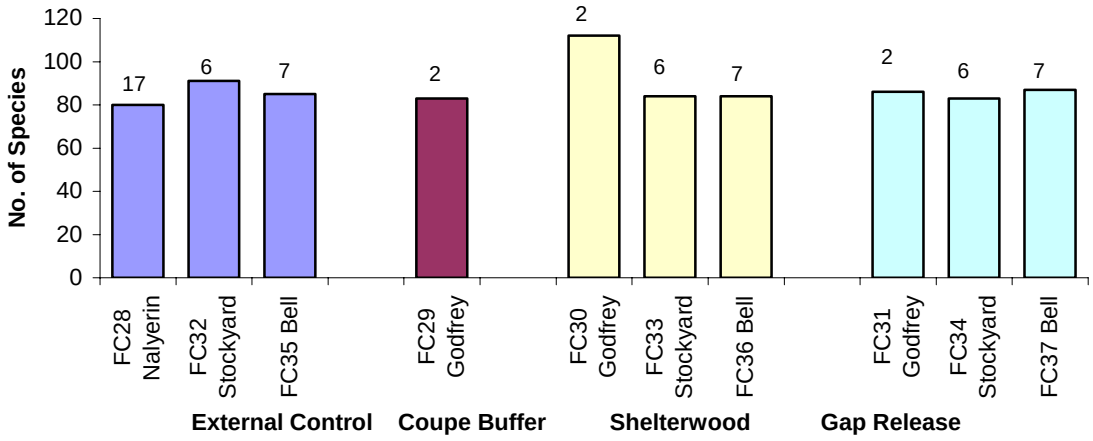



**Figure 2.** Mean species density (abundance) on each FORESTCHECK grid in Wellington East. Numbers above the columns represent years since fire.

With density (abundance) of plants, there was a clear effect of time since fire with the exception of the external control grids. The Nalyerin external control, which was unburnt for 17 years, contained fewer species at a higher density than the other external control grids. In the other treatments the most recently burnt grids had the highest plant density, which decreased with time since fire.

In order to determine the contribution that each species made to the vegetation complex, importance values were calculated. Importance values are based on cover, frequency and density of each plant. Each of the 3 attributes is rated according to predetermined ranges and the importance value is the proportion of the total for each plot. Cover, frequency and density importance values summed to provide a total importance value for each species (Mueller-Dombois and Ellenberg 1974). A mean of the total importance value was plotted for each grid (Fig. 3) and showed a high consistency across all treatments.

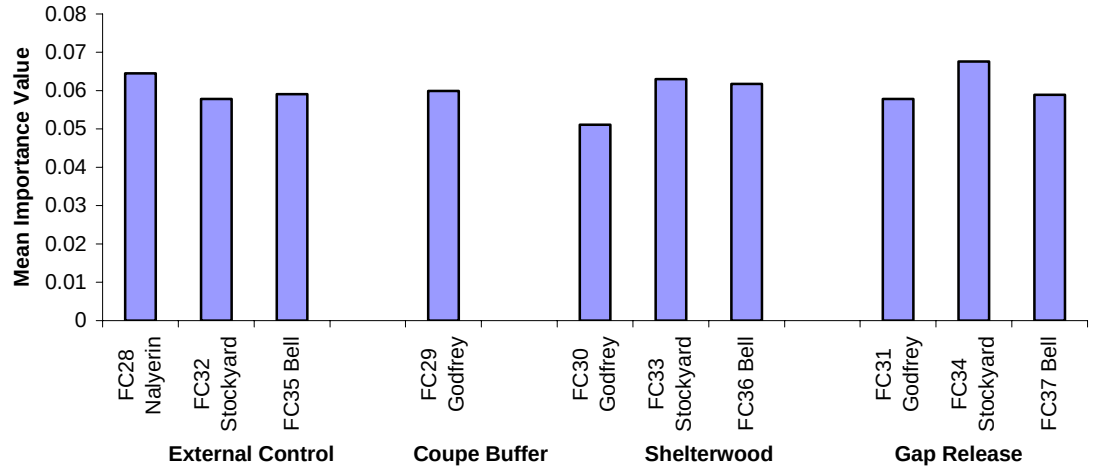
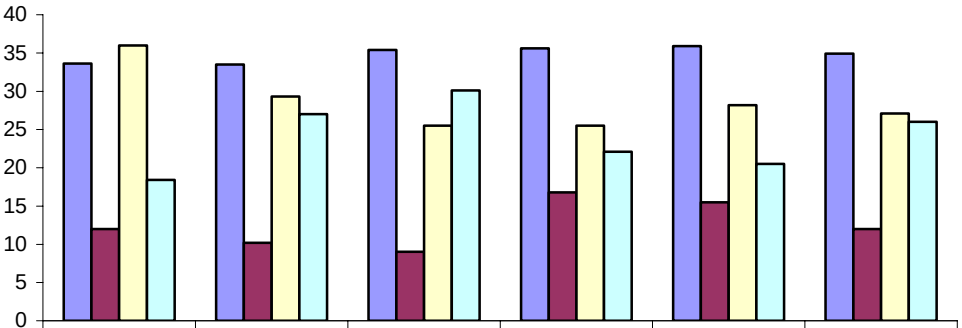



**Figure 3.** SMean total importance values for each grid.

Lifeform composition was generally consistent within each treatment, indicating that there have not been any major impacts associated with logging (Fig. 4).




| | Tree | Shrub > 30 cm | Shrub < 30 cm | Herb | Geophyte | Other Lifeforms |
|---|---|---|---|---|---|---|
| External Control | 33.6 | 33.5 | 35.4 | 35.6 | 35.9 | 34.9 |
| Coupe Buffer | 12.0 | 10.2 | 9.0 | 16.8 | 15.5 | 12.0 |
| Shelterwood | 36.0 | 29.3 | 25.5 | 25.5 | 28.2 | 27.1 |
| Gap Release | 18.4 | 27.0 | 30.1 | 22.1 | 20.5 | 26.0 |

**Figure 4.** The proportion of plants in each life-form category in each treatment.

In each lifeform category the number of plants were summed and expressed as a percentage of the total. For the control grids there was a consistent representation across all lifeform categories. The coupe buffer, however, had low representation across all categories. This may an artifact of there being only one coupe buffer compared to 3 grids in each of the other treatments.

Vegetation height was highly variable across the various grids (Fig. 5), and appeared to exhibit a successional effect linked to time since fire. Plant heights were lowest in the grids burnt 2 years previously and higher 6-7 years following fire, after which they declined as particular species reached the end of their life span. This is also reflected in the structural measurements where Levy contacts are most abundant in the lower height classes for the youngest age group (Fig. 6). Vegetation structure was similar within treatments but varied between treatments, and appeared to be related to time since fire.

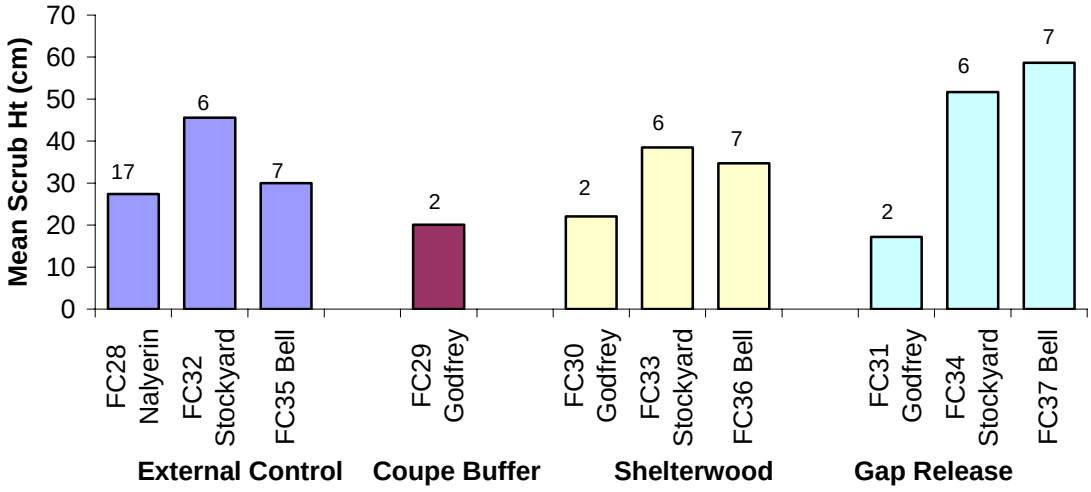



**Figure 5.** Mean scrub height (cm) measured in each FORESTCHECK grid in Wellington East. Numbers above the columns represent years since fire.

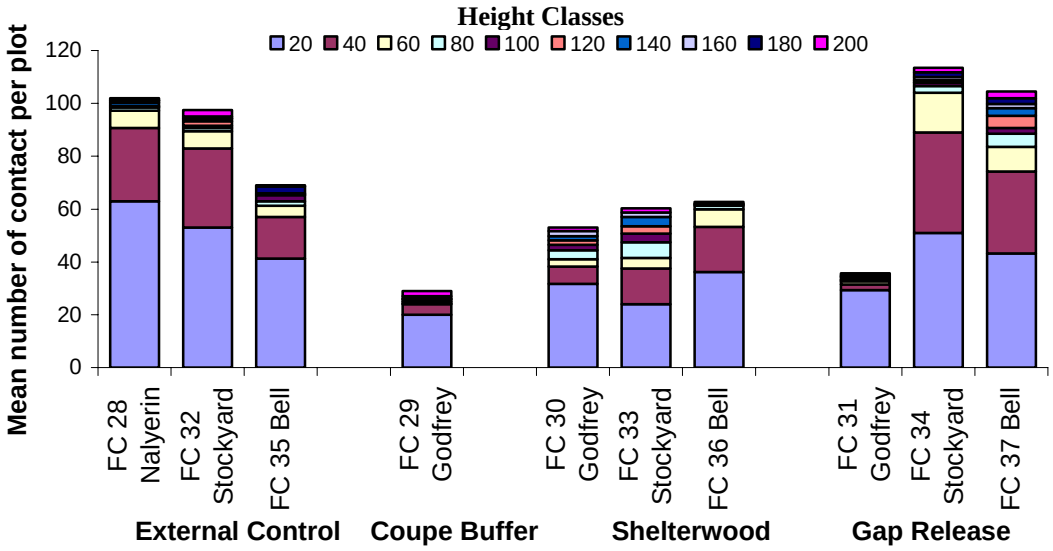



**Figure 6.** Vegetation structure in each grid (calculated from mean numbers of Levy contacts for height classes up to 2 m).

## Conclusions

- There has been no apparent impact of logging on species richness and most variation appears to be due to time since fire.
- Plant density in shelterwood shows a trend in time since fire, with highest density recorded in the most recently burnt plot.
- Some categories of lifeform may have been impacted by logging treatments. Further analysis is needed to confirm this.

## References

Levy, E.B. and Madden, E.A. 1933. The point method of pasture analysis. *New Zealand Journal of Agriculture* **46**: 267-279.

Mueller-Dombois, D. and Ellenberg, H. 1974. *Aims and Methods of Vegetation Ecology*. John Wiley & Sons, Sydney.

# APPENDIX 1

## TOTAL SPECIES LIST 2004-2005 SAMPLING

| Introduced | Taxon Name | Taxon ID | SpCode | Lifeform | Lifestyle | Fire Response |
|---|---|---|---|---|---|---|
| | *Acacia alata* | 3207 | ACAALA | S | P | A1 |
| | *Acacia browniana* | 3247 | ACABRO | S | P | A1 |
| | *Acacia celastrifolia* | 3254 | ACACEL | S | P | A1 |
| | *Acacia drummondii* | 3311 | ACADRU | S | P | A1 |
| | *Acacia drummondii* | 11661 | ACADRUDR | S | P | A1 |
| | *Acacia extensa* | 3331 | ACAEXT | S | P | A1 |
| | *Acacia myrtifolia* | 3453 | ACAMYR | S | P | A1 |
| | *Acacia preissiana* | 3456 | ACAPRE | DS | P | A1 |
| | *Acacia pulchella* | 3502 | ACAPUL | S | P | A1 |
| | *Acacia saligna* | 3527 | ACASAL | S | P | A1 |
| * | *Acaena echinata* | 3184 | ACAECH | DS | P | A1 |
| | *Actinotus glomeratus* | 6203 | ACTGLO | DS | P | A1 |
| | *Agrostocrinum scabrum* | 1261 | AGRSCA | G | P | B3 |
| * | *Aira cupaniana* | 185 | AIRCUP | GR | A | A1 |
| | *Allocasuarina fraseriana* | 1728 | ALLFRA | T | P | B1 |
| | *Anigozanthos manglesii* | 1411 | ANIMAN | S | P | B3 |
| * | *Arctotheca calendula* | 7838 | ARCCAL | H | A | A1 |
| | *Astroloma ciliatum* | 6323 | ASTCIL | DS | P | B2 |
| | *Astroloma drummodii* | 6325 | ASTDRU | DS | P | B2 |
| | *Astroloma pallidum* | 6334 | ASTPAL | DS | P | B2 |
| | *Austrodanthonia caespitosa* | 17950 | AUSCAE | GR | P | B3 |
| | *Austrostipa campylachne* | 17233 | AUSCAM | GR | P | B3 |
| | *Banksia grandis* | 1819 | BANGRA | T | P | A2 |
| | *Banksia shpaerocarpa* | 1851 | BANSPH | S | P | A2 |
| | *Billardiera variifolia* | 3165 | BILVAR | V | P | A1 |
| | *Boronia crenulata* | 4413 | BORCRE | DS | P | A1 |
| | *Boronia gracilipes* | 4422 | BORGRA | DS | P | A1 |
| | *Boronia ramosa* | 4438 | BORRAM | S | P | A1 |
| | *Boronia spathulata* | 4441 | BORSPA | S | P | B2 |
| | *Bossiaea eriocarpa* | 3710 | BOSERI | S | P | A1 |
| | *Bossiaea ornata* | 3714 | BOSORN | S | P | A1 |
| * | *Briza minor* | 245 | BRIMIN | GR | A | A1 |
| | *Burchardia umbellata* | 1387 | BURUMB | G | P | B3 |
| | *Caesia micrantha* | 1276 | CAEMIC | G | P | B3 |
| | *Caladenia flava* | 1592 | CALFLA | G | P | B3 |
| | *Caladenia macrostylis* | 1604 | CALMAC | G | P | B3 |
| | *Caladenia reptans* | 1613 | CALREP | G | P | B3 |
| | *Caladenia splendens* | 15380 | CALSPL | G | P | B3 |
| | *Cassytha racemosa* | 2957 | CASRAC | P | P | A1 |
| | *Cassytha* sp. | | CASSP. | P | P | A1 |
| * | *Centaurium erythraea* | 6539 | CENERY | H | A | A1 |
| | *Centrolepis polygyna* | 1134 | CENPOL | H | A | A1 |
| | *Chamaescilla corymbosa* | 1280 | CHACOR | G | P | B3 |
| | *Clematis pubescens* | 2929 | CLEPUB | V | P | A1 |
| | *Comesperma calymega* | 4550 | COMCAL | DS | P | B2 |
| | *Conospermum caerulesens* | 1862 | CONCAE | S | P | A1 |
| | *Conostylis aculeata* | 1418 | CONACU | DS | P | B3 |
| | *Conostylis serrulata* | 1453 | CONSER | DS | P | B2 |
| | *Conostylis setigera* | 1454 | CONSET | DS | P | B3 |
| | *Corymbia calophylla* | 17104 | CORCAL | T | P | A2 |
| | *Craspedia variabilis* | 13354 | CRAVAR | G | P | B3 |

| Introduced | Taxon Name | Taxon ID | SpCode | Lifeform | Lifestyle | Fire Response |
|---|---|---|---|---|---|---|
| | *Cyanicula sericea* | 15404 | CYASER | G | P | B3 |
| | *Cyrtostylis hugelii* | 10916 | CYRHUE | G | P | B3 |
| | *Dampiera alata* | 7420 | DAMALA | DS | P | A1 |
| | *Dampiera linearis* | 7454 | DAMLIN | DS | P | A1 |
| | *Daucus glochidiatus* | 6218 | DAUGLO | H | A | A1 |
| | *Daviesia incrassata* | 3816 | DAVINC | S | P | A1 |
| | *Daviesia preissii* | 3835 | DAVPRE | S | P | A1 |
| | *Desmocladus fasciculatus* | 17691 | DESFAS | Z | P | B3 |
| | *Desmocladus flexuosus* | 16595 | DESFLE | Z | P | B3 |
| | *Dianella revoluta* | 1259 | DIAREV | H | P | B3 |
| | *Diuris corymbosa* | 11049 | DIUCOR | G | P | B3 |
| | *Diuris longifolia* | 1635 | DIULON | G | P | B3 |
| | *Drakaea gracilis ms* | 15406 | DRAGRA | G | P | B3 |
| | *Drosera erythrorhiza* | 3095 | DROERY | G | P | B3 |
| | *Drosera huegelii* | 3102 | DROHUE | G | P | B3 |
| | *Drosera mensiesii* subsp. *menziesii* | 11853 | DROMENME | G | P | B3 |
| | *Drosera pallida* | 3118 | DROPAL | G | P | B3 |
| | *Drosera stolonifera* | 3131 | DROSTO | G | P | B3 |
| | *Dryandra bipinnatifida* | 1891 | DRYBIP | DS | P | B2 |
| | *Dryandra lindleyana* | 16672 | DRYLIN | S | P | B2 |
| | *Dryandra sessilis* | 1932 | DRYSES | S | P | A1 |
| | *Elythranthera brunonis* | 1643 | ELYBRU | G | P | B3 |
| | *Eucalyptus marginata* | 5708 | EUCMAR | T | P | A2 |
| | *Glischrocaryon aureum* | 6143 | GLIAUR | S | p | B2 |
| | *Gompholobium capitatum* | 3948 | GOMCAP | DS | P | A1 |
| | *Gompholobium confertum* | 10909 | GOMCON | S | P | A1 |
| | *Gompholobium knightianum* | 3950 | GOMKNI | DS | P | A1 |
| | *Gompholobium marginatum* | 3951 | GOMMAR | DS | P | A1 |
| | *Gompholobium preissii* | 3955 | GOMPRE | DS | P | A1 |
| | *Gompholobium scabrum* | 11083 | GOMSCA | S | P | A1 |
| | *Hakea amplexicaulis* | 2128 | HAKAMP | S | P | B2 |
| | *Hakea cyclocarpa* | 2152 | HAKCYC | S | P | B2 |
| | *Hakea lissocarpha* | 2175 | HAKLIS | S | P | B2 |
| | *Hakea undulata* | 2215 | HAKUND | S | P | B2 |
| | *Helichrysum macranthum* | 8027 | HELMAC | H | A | A1 |
| | *Hemiandra pungens* | 6839 | HEMPUN | S | P | A1 |
| | *Hemigenia rigida* | 6868 | HEMRIG | DS | P | B2 |
| | *Hibbertia amplexicaulis* | 5109 | HIBAMP | S | P | B2 |
| | *Hibbertia commutata* | 5114 | HIBCOM | S | P | B2 |
| | *Hibbertia hypericoides* | 5135 | HIBHYP | S | P | B2 |
| | *Hibbertia racemosa* | 5162 | HIBRAC | S | P | A1 |
| | *Hibbertia spicata* | 5171 | HIBSPI | S | P | B2 |
| | *Homalosciadium homalocarpum* | 6222 | HOMHOM | H | A | A1 |
| | *Hovea chorizemifolia* | 3964 | HOVCHO | DS | P | B2 |
| | *Hovea elliptica* | 3965 | HOVELL | S | P | B2 |
| | *Hovea trisperma* | 3968 | HOVTRI | S | P | A1 |
| | *Hyalopserma cotula* | 12714 | HYACOT | H | A | A1 |
| | *Hydrocotyle diantha* | 6229 | HYDDIA | H | A | A1 |
| | *Hypocalymma angustifolium* | 5817 | HYPANG | S | P | B2 |
| * | *Hypochaeris glabra* | 8086 | HYPGLA | H | A | A1 |
| | *Hypoxis occidentalis* | 1503 | HYPOCC | H | P | B3 |
| | *Isolepis marginata* | 917 | ISOMAR | R | A | A1 |
| | *Isotoma hypocrateriformis* | 7396 | ISOHYP | H | A | A1 |
| | *Kennedia coccinea* | 4037 | KENCOC | V | P | A1 |
| | *Kennedia prostrata* | 4044 | KENPRO | V | P | A1 |

| Introduced | Taxon Name | Taxon ID | SpCode | Lifeform | Lifestyle | Fire Response |
|---|---|---|---|---|---|---|
| | *Labichea punctata* | 3669 | LABPUN | DS | P | B2 |
| | *Lagenophora huegelii* | 18585 | LAGHUE | G | P | B3 |
| | *Lasiopetalum floribundum* | 5033 | LASFLO | S | P | A1 |
| | *Laxmannia squarrosa* | 1309 | LAXSQU | DS | P | A1 |
| | *Lechenaultia biloba* | 7568 | LECBIL | S | P | A1 |
| | *Lepidosperma leptostachyum* | 936 | LEPLEP | Z | P | B3 |
| | *Lepidosperma squamatum* | 945 | LEPSQU | Z | P | B3 |
| | *Leptomeria cunninghamii* | 2342 | LEPCUN | S | P | A1 |
| | *Leucopogon capitellatus* | 6367 | LEUCAP | S | P | B2 |
| | *Leucopogon propinquus* | 6436 | LEUPRO | S | P | B2 |
| | *Levenhookia pusilla* | 7676 | LEVPUS | H | A | A1 |
| | *Lobelia rarifolia* | 7405 | LOBRAR | H | A | A1 |
| | *Logania serpyllifolia* | 6511 | LOGSER | DS | P | B2 |
| | *Lomandra caespitosa* | 1223 | LOMCAE | DS | P | B3 |
| | *Lomandra drummondii* | 1225 | LOMDRU | DS | P | B3 |
| | *Lomandra hermaphrodita* | 1228 | LOMHER | DS | P | B2 |
| | *Lomandra integra* | 1229 | LOMINT | DS | P | B3 |
| | *Lomandra preissii* | 1239 | LOMPRE | DS | P | B3 |
| | *Lomandra purpurea* | 1240 | LOMPUR | DS | P | B3 |
| | *Lomandra sericea* | 1243 | LOMSER | DS | P | B3 |
| | *Lomandra* sp. | -801 | LOMSP | DS | P | B3 |
| | *Lomandra spartea* | 1245 | LOMSPA | DS | P | B3 |
| | *Lomandra suaveolens* | 1246 | LOMSUA | DS | P | B2 |
| | *Luzula merioionalis* | 1198 | LUZMER | R | P | B3 |
| | *Macrozamia riedlei* | 85 | MACRIE | C | P | B3 |
| | *Millotia tenuifolia* | 8106 | MILTEN | H | A | A1 |
| | *Monotaxis grandiflora* | 4662 | MONGRA | DS | P | A1 |
| | *Neurachne alopecuroidea* | 492 | NEUALO | GR | P | B3 |
| | *Olax benthamiana* | 2365 | OLABEN | S | P | A1 |
| | *Opercularia hispidula* | 7348 | OPEHIS | S | P | A1 |
| | *Opercularia vaginata* | 18255 | OPEVAG | S | P | A1 |
| | *Orchid* sp. | | ORCSP. | G | P | B3 |
| * | *Oxalis corniculata* | 4349 | OXACOR | G | P | B3 |
| * | *Parentucellia latifolia* | 7089 | PARLAT | H | A | A1 |
| | *Patersonia babianoides* | 1542 | PATBAB | G | P | B3 |
| | *Patersonia juncea* | 1546 | PATJUN | DS | P | B3 |
| | *Patersonia pygmaea* | 1551 | PATPYG | DS | P | B3 |
| | *Patersonia umbrosa* | 1553 | PATUMB | DS | P | B3 |
| | *Pelargonium littorale* | 4346 | PELLIT | DS | p | a1 |
| | *Pentapeltis peltigera* | 6245 | PENPEL | DS | P | B2 |
| | *Pentapeltis silvatica* | 6246 | PENSIL | S | P | B2 |
| | *Persoonia longifolia* | 2267 | PERLON | S | P | B2 |
| | *Petrophile diversifolia* | 2293 | PETDIV | S | P | A1 |
| | *Petrophile serruriae* | 2309 | PETSER | S | P | A1 |
| | *Petrophile striata* | 2312 | PETSTR | S | P | A1 |
| | *Pheladenia deformis* | 20460 | PHEDEF | G | P | B3 |
| | *Phyllangium paradoxum* | 16177 | PHYPAR | H | A | A1 |
| | *Phyllangium paradoxum* | 16177 | PHYPAR | H | A | A1 |
| | *Phyllanthus calycinus* | 4675 | PHYCAL | DS | P | B2 |
| | *Pimelea angustifolia* | 5231 | PIMANG | S | P | A1 |
| | *Pimelea imbricata* | 5251 | PIMIMB | S | P | A1 |
| | *Pimelea preissii* | 5259 | PIMPRE | S | P | A1 |
| | *Pimelea rosea* | 5261 | PIMROS | S | P | A1 |
| | *Pimelea* sp. | -42 | PIMSP. | S | P | A1 |
| | *Pimelea suaveolens* | 5266 | PIMSUA | S | P | B2 |

| Introduced | Taxon Name | Taxon ID | SpCode | Lifeform | Lifestyle | Fire Response |
|---|---|---|---|---|---|---|
| | *Pimelea suaveolens* subsp. *suaveolens* | 12041 | PIMSUASU | S | P | B2 |
| | *Poa drummoniana* | 573 | POADRU | GR | P | B3 |
| | *Podolepis canescens* | 8172 | PODCAN | H | A | A1 |
| | *Podotheca angustifolia* | 8182 | PODANG | H | A | A1 |
| | *Podotheca gnaphalioides* | 8184 | PODGNA | H | A | A1 |
| | *Poranthera huegelii* | 4690 | PORHUE | DS | A | A1 |
| | *Poranthera microphylla* | 4691 | PORMIC | DS | A | A1 |
| | *Pterostylis pyramidalis* | 11118 | PTEPYR | G | P | B3 |
| | *Pterostylis recurva* | 1693 | PTEREC | G | P | B3 |
| | *Pterostylis vittatus* | 1698 | PTEVIT | G | P | B3 |
| | *Ptilotus drummondii* | 2718 | PTIDRU | G | P | B3 |
| | *Ptilotus manglesii* | 2742 | PTIMAN | G | P | B3 |
| | *Pyrorchis nigricans* | 16367 | PYRNIG | G | P | B3 |
| | *Quinetia urvillei* | 8195 | QUIURV | H | A | A1 |
| | *Ranunculus colonorum* | 2932 | RANCOL | G | P | B3 |
| | *Rhodanthe citrina* | 13300 | RHOCIT | H | A | A1 |
| | *Rhodanthe manglesii* | 13234 | RHOMAN | H | A | A1 |
| | *Scaevola striata* | 7646 | SCASTR | DS | A | A1 |
| | *Senecio glomeratus* | 8206 | SENGLO | H | A | A1 |
| | *Senecio hispidulus* | 8208 | SENHIS | S | A | A1 |
| | *Senecio leucoglossus* | 8212 | SENLEU | S | A | A1 |
| | *Sollya fusiformis* | 8922 | SOLFUS | S | P | U |
| * | *Sonchus oleraceus* | 8231 | SONOLE | H | A | A1 |
| | *Sowerbaea laxiflora* | 1312 | SOWLAX | G | P | B3 |
| | *Stackhousia monogyna* | 4733 | STAMON | S | P | B2 |
| | *Stylidium amoenum* | 7684 | STYAMO | DS | P | A1 |
| | *Stylidium brunonianum* | 7693 | STYBRU | DS | P | A1 |
| | *Stylidium calcaratum* | 7696 | STYCAL | H | A | A1 |
| | *Stylidium ciliatum* | 7702 | STYCIL | DS | P | A1 |
| | *Stylidium lineatum* | 7752 | STYLIN | DS | P | B2 |
| | *Stylidium piliferum* | 7774 | STYPIL | DS | P | A1 |
| | *Stylidium schoenoides* | 7798 | STYSCH | DS | P | A1 |
| | *Stylidium spathulatum* | 7799 | STYSPA | DS | P | A2 |
| | *Stypandra glauca* | 1260 | STYGLA | S | P | B3 |
| | *Styphelia tenuiflora* | 6476 | STYTEN | S | P | A1 |
| | *Synaphea petiolaris* | 2324 | SYNPET | S | P | B3 |
| | *Tetraria capillaris* | 1034 | TETCAP | S | P | B3 |
| | *Tetraria octandra* | 1036 | TETOCT | Z | P | B3 |
| | *Tetrarrhena laevis* | 667 | TETLAE | GR | P | B3 |
| | *Tetratheca hirsuta* | 4535 | TETHIR | S | P | A1 |
| | *Thelymitra crinita* | 1705 | THECRI | G | P | B3 |
| | *Thysanotus manglesianus* | 1338 | THYMAN | G | P | B3 |
| | *Thysanotus multiflorus* | 1339 | THYMUL | G | P | B3 |
| | *Thysanotus patersonii* | 1343 | THYPAT | G | P | B3 |
| | *Thysanotus sparteus* | 1351 | THYSPA | G | P | B3 |
| | *Trachymene pilosa* | 6280 | TRAPIL | H | A | A1 |
| | *Trichocline spathulata* | 8251 | TRISPA | G | P | B3 |
| | *Tricoryne elatior* | 1361 | TRIELA | DS | P | A1 |
| | *Tricoryne humilis* | 1362 | TRIHUM | DS | P | A1 |
| | *Trymalium ledifolium* | 4842 | TRYLED | S | P | A1 |
| | *Velleia trinervis* | 7665 | VELTRI | DS | A | A1 |
| * | *Vulpia bromoides* | 722 | VULBRO | GR | A | A1 |
| | *Wahlenbergia gracilenta* | 7386 | WAHGRA | H | A | A1 |
| | *Waitzia acuminata* | 8275 | WAIACU | H | A | A1 |
| | *Wurmbia dioica* | 1394 | WURDIO | G | P | B3 |

| Introduced | Taxon Name | Taxon ID | SpCode | Lifeform | Lifestyle | Fire Response |
|---|---|---|---|---|---|---|
| | *Xanthorrhoea gracilis* | 1253 | XANGRA | X | P | B2 |
| | *Xanthorrhoea preissii* | 1256 | XANPRE | X | P | B2 |
| | *Xanthosia atkinsoniana* | 6283 | XANATK | S | P | B2 |
| | *Xanthosia candida* | 6284 | XANCAN | DS | P | B2 |
| | *Xanthosia huegelii* | 6289 | XANHUE | DS | P | A1 |

* 10 introduced species

# INVERTEBRATES

Janet Farr, Allan Wills, Tom Burbidge and Paul Van Heurck

## Introduction

Invertebrates, including the class Insecta, comprise > 75% of Earth's biodiversity and therefore represent a crucial component of any ecosystem. Invertebrates play a major role in decomposition, nutrient recycling and provide an important food source for vertebrates. In addition a wide range of species are already known to be exclusive to the southwest forests of Western Australia, and some of these are Gondwanan relicts. Despite this, current knowledge of the invertebrate taxa present in the jarrah forest is limited.

The objectives of this component of FORESTCHECK monitoring are to:

- Monitor and record the species of invertebrates in the various treatments of managed jarrah (Gap Release, Shelterwood) and unlogged forest.
- Analyse trends in species composition, richness and abundance
- Monitor the presence of Gondwanan relict and affinity invertebrate species with respect to the above treatments
- Monitor the presence of known insect pest species.

## Monitoring and Laboratory Work

Sampling at Wellington East was carried out in November (spring) 2004 and April (autumn) 2005 using the protocol formerly established at Donnelly. To briefly summarize: active capture samples, involving sweeping, beating, and habitat searches of coarse woody debris (CWD) and litter were conducted once at each site for a total time of 1 person hour per capture/habitat method. Light traps were run for 3 nights simultaneously at each site (there was no light trap failure), achieving one trap night per week for 3 weeks; pitfall traps were opened for 10 days simultaneously at each site. Captures were bagged and labelled according to site and other capture details in the field, then transported in an insulated container back to a base camp, where they were stored in a portable freezer. At the conclusion of a sampling period, specimens were transported to the laboratory in Manjimup where they were sorted and assigned to morphospecies. This report examines invertebrate captures made in the eastern jarrah forest at Wellington East and includes some comparison with the Donnelly and Wellington sites.

This is a preliminary report, and previously sampled results are from data as at July 2005; morphospecies assignment and Gondwanan relationships will change following ongoing taxonomic examination of specimens.

## Results

### Total Species

The Wellington East samples collected in 2004-05 increased the number of morphospecies to 1 271 (Appendix 1). Fig. 1 shows the cumulative captures for the successive sampling locations.

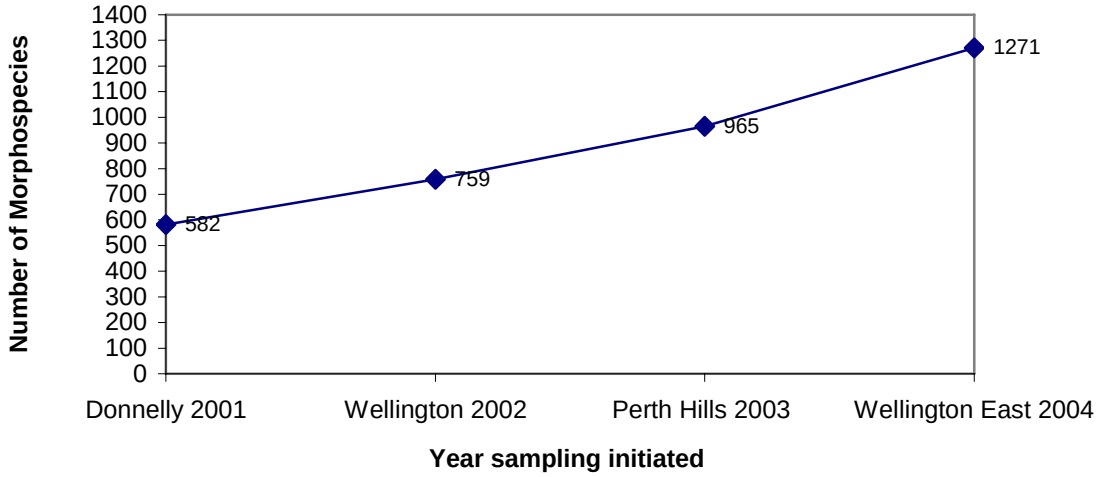



**Figure 1.** Cumulative morphospecies for all FORESTCHECK locations (2001-2005).

A total of 670 morphospecies were collected from Wellington East compared to 450, 381 and 582 from Perth Hills, Wellington and Donnelly locations respectively. Of those morphospecies collected from Wellington East, 21 were considered Gondwanan relicts and a further 65 species had Gondwanan affinities compared to 13 and 48 respectively for Donnelly. The numbers of morphospecies for orders where 10 or more morphospecies have been assigned are compared for Wellington East, Perth Hills, Wellington and Donnelly locations in Fig. 2.

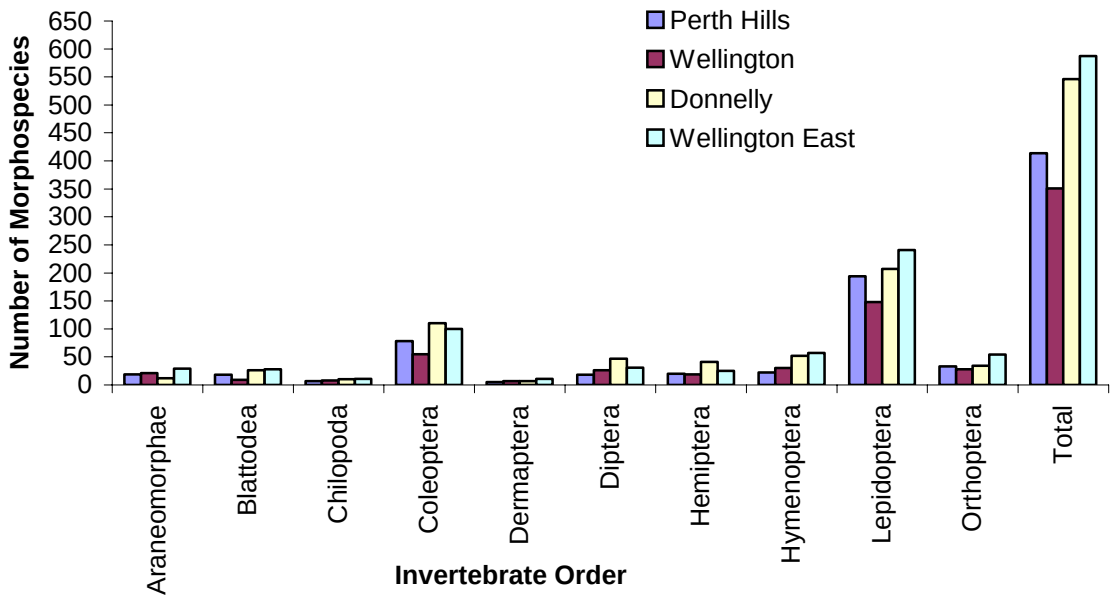



**Figure 2.** Comparison of all FORESTCHECK locations (2001-2005) morphospecies numbers for invertebrate orders where ten or greater morphospecies have been assigned.

Overall, Wellington East had the greatest species diversity, and Donnelly second, with this pattern repeated in Araneomorpha (spiders), Dermaptera (earwigs), Lepidoptera (moths) and Orthoptera (crickets and grasshoppers). Species diversity in Blattodea (cockroaches), Chilopoda (centipedes) and Hymenoptera (wasps) were similar for both Wellington East and Donnelly, whereas Donnelly had the greatest diversity in Coleoptera (beetles), Diptera (flies) and Hemiptera (bugs).

**Comparing capture methods**

Light trapping resulted in the most abundant and diverse captures (Table 1) with a spring capture of 300 morphospecies comprising 26 163 individuals. This high number of individuals was mainly due to bulk captures of a hydrophilid beetle (species # 14) of which 19 656 individuals were caught in light traps. As expected, diversity and abundance for all capture methods were highest in spring.

**Table 1.** Number of morphospecies and specimen abundance for Wellington East in spring and autumn for each capture method (CWD = coarse woody debris).

| **Capture Method** | **No of Morphospecies** | | **Abundance** | |
|---|---|---|---|---|
| | Spring | Autumn | Spring | Autumn |
| Light | 300 | 167 | 26 163 | 1 536 |
| Pitfall | 69 | 40 | 262 | 127 |
| Sweep | 49 | 23 | 130 | 38 |
| Beat | 49 | 17 | 103 | 25 |
| CWD | 52 | 34 | 77 | 53 |
| Litter | 31 | 18 | 59 | 20 |
| Targeted pursuit | 13 | 7 | 15 | 7 |
| **Total** | | | **26 809** | **1 806** |

Fig. 3 shows morphospecies comparisons for capture methods from Wellington East, Perth Hills, Wellington and Donnelly locations. Abundance comparisons are shown in Fig. 4. In spring, with the exception of the light trap and coarse woody debris (CWD) captures, the Donnelly captures are more diverse (Fig. 3a). Pit fall and Sweep captures for both Wellington samples are similar. Coarse woody debris captures are greatest at Wellington East but this could be due to a variation in the collection method for CWD at the Wellington sites, where one operator was dedicated to CWD compared to dividing CWD search between 3 operators on the other sites. However, for autumn, Wellington East and Donnelly diversity levels (number of morphospecies) for CWD are comparable (Fig. 3b) as are the other sampling methods with the exception of light traps. Also, the abundance data for autumn show Donnelly CWD captures are much greater than those for Wellington East (Fig. 4b). Therefore we may conclude that varying the active capture method by dedicating a single operator to this task has not significantly altered capture results.

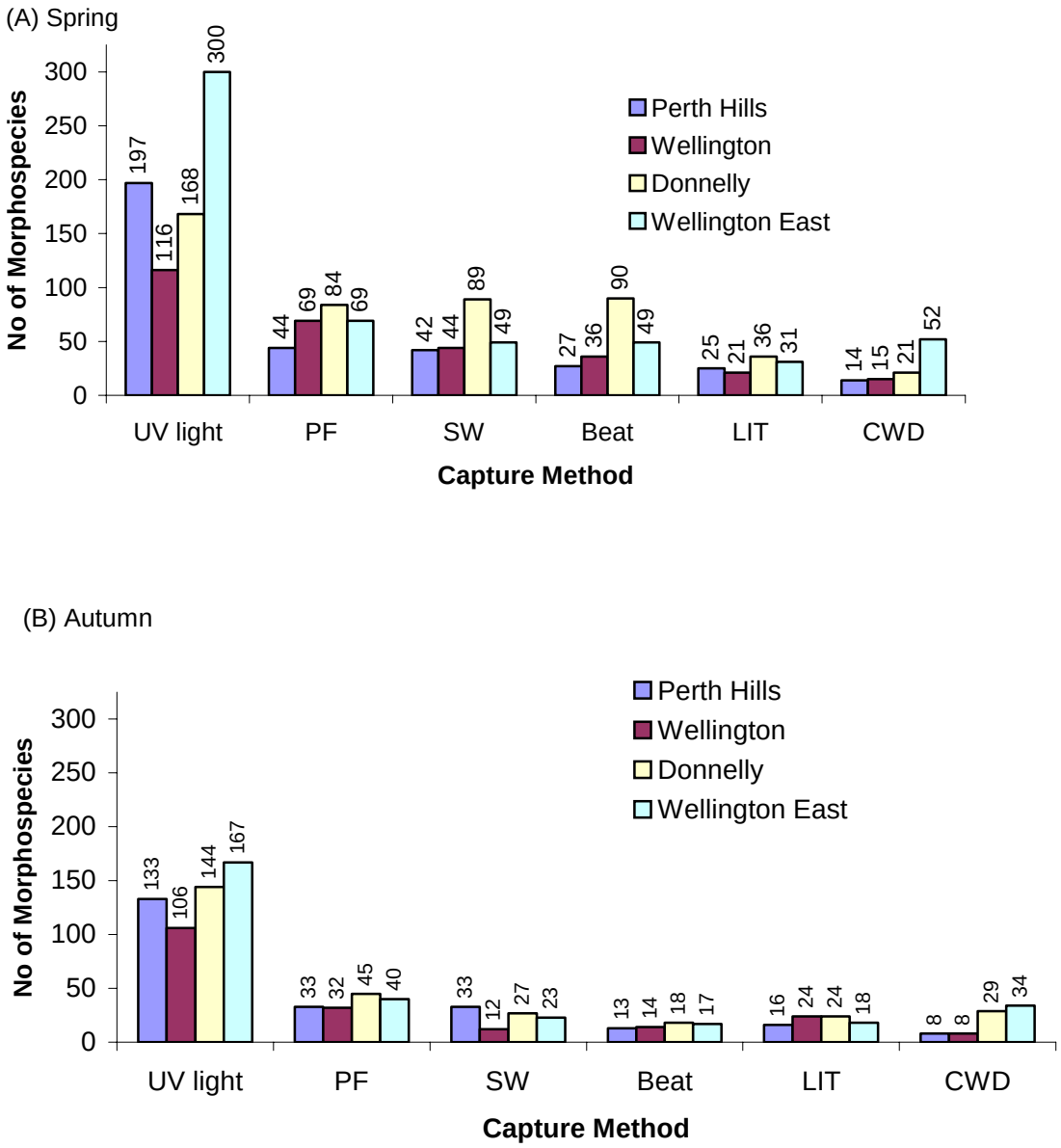



**Figure 3.** The number of morphospecies in spring (A) and autumn (B) for each capture method; Wellington East Perth Hills, Wellington and Donnelly compared. (PF= pitfall trap; SW = sweep net; Beat = beating tray, LIT = litter search, CWD = coarse woody debris search).

For abundance, spring light trap captures were most abundant for Wellington East with 26 163 individuals compared to 3 500 individuals for Perth Hills (Fig. 4a). Correcting for the high number of the hydrophilid beetle (species # 14) from spring light traps, captures reduce to 6 507 which is still much greater than the number of individuals caught at other sites. In autumn, light trap capture abundance for Wellington East was also high compared to other sampling districts (Fig. 4b). Abundances from pitfall captures were comparable between both Wellington samples. For sweep, beat and CWD, Donnelly had the highest abundance.

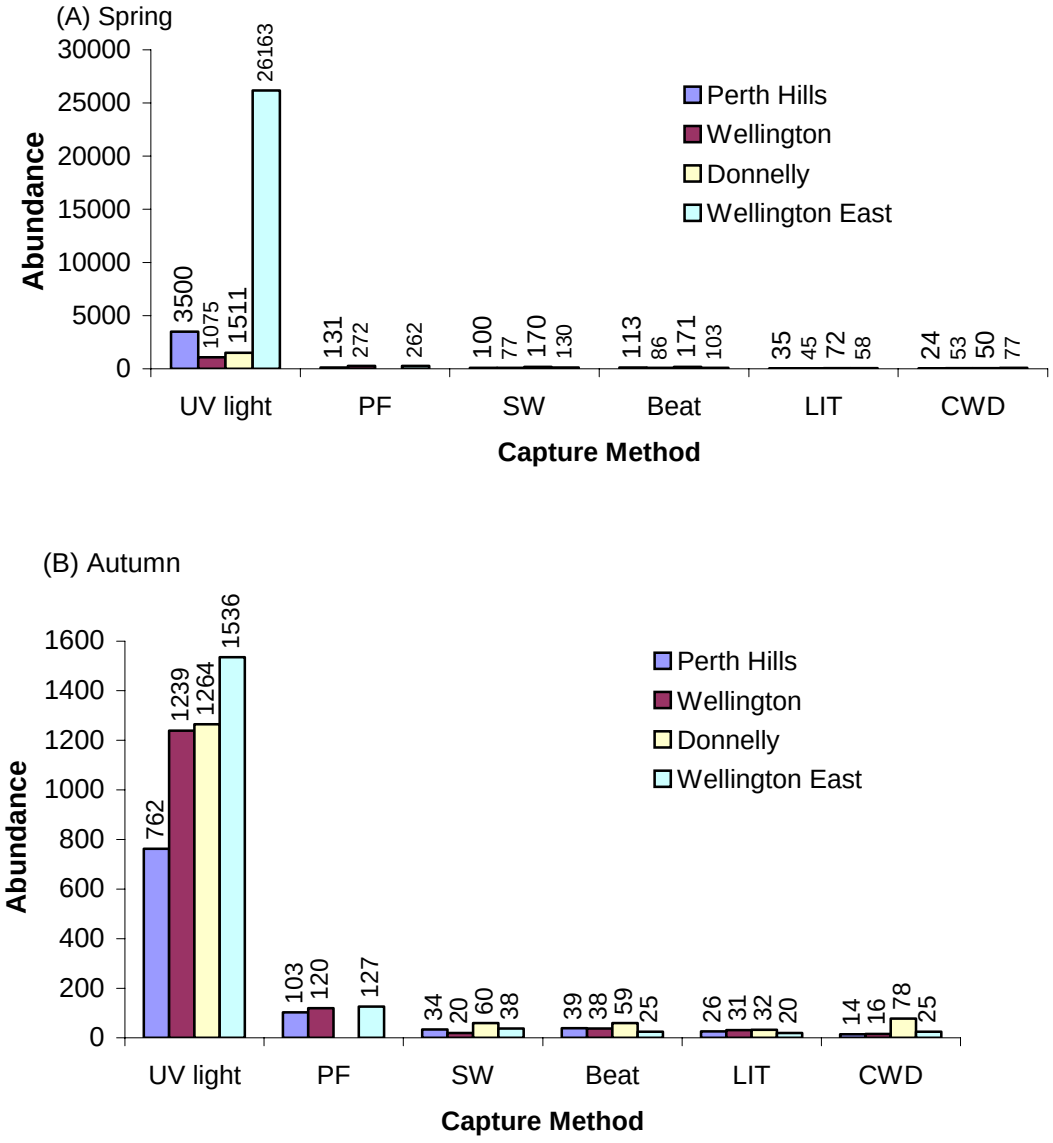



**Figure 4.** Abundance (measured as the number of individual specimens captured) in spring (A) and autumn (B) for each capture method, from Wellington East, Perth Hills, Wellington and Donnelly. (UV Light = light trap captures; PF= pitfall trap captures; SW = sweep net; Beat = beating tray; LIT = litter search; CWD = coarse woody debris search).

### Comparing sample grids and silvicultural treatments

Fig. 5 shows Wellington East grid comparisons for silvicultural treatments expressed as the total morphospecies and abundance for all capture methods and summed for spring and autumn seasons. There was very little difference in species diversity between sites. The Godfrey shelterwood (FC30) had the greatest number of species (278), followed by Stockyard gap release (FC34) treatment and the Bell external control (FC35). Abundance was highest at the Stockyard gap release grid, followed by the Stockyard shelterwood (FC33). The lowest diversity and abundance was at the Godfrey gap release (FC 31). A species of Onychophora (species # 1481) was found in the Nalyerin external control grid (FC28).

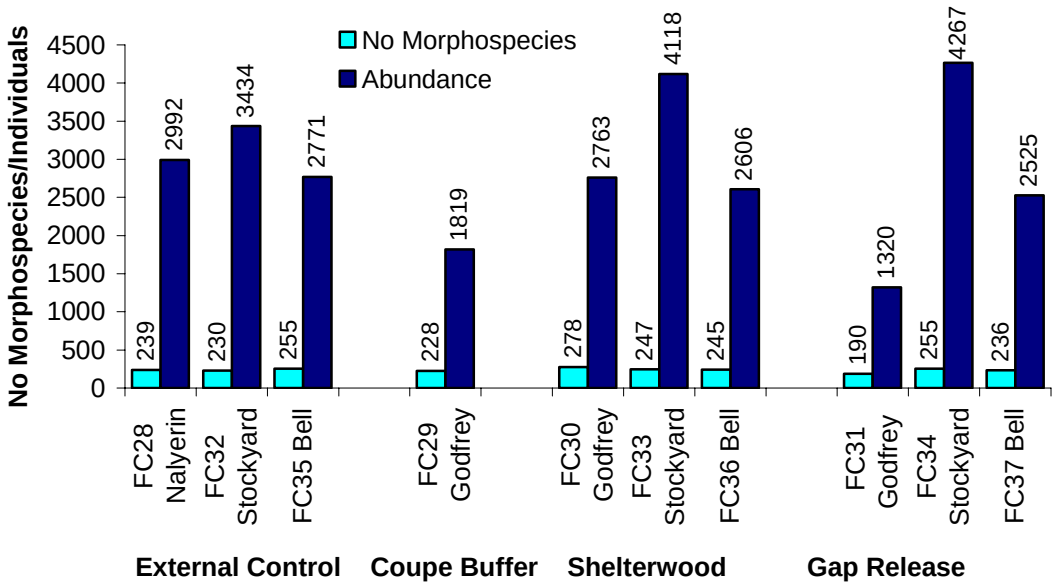



**Figure 5.** Comparison of individual Wellington East treatment grids for total morphospecies (no. of species) and abundance (no. of individuals), for all capture methods, combining both seasons.

Comparison of the means between treatments indicates few distinct patterns. For Wellington the controls are less diverse but have comparable invertebrate abundance with the shelterwood sites (Table 2). For Wellington East species number and abundance is similar across most treatments, with the gap release treatment showing a lower abundance.

**Table 2.** Comparison of means (± SE) for number of species and abundance (number of individuals) at Wellington East and Wellington in respect to silvicultural treatment (the coupe buffer site was not included in the analysis).

| | **Wellington** | | **Wellington East** | |
|---|---|---|---|---|
| Silvicultural Treatment | No. of Species | Abundance | No. of Species | Abundance |
| External Control | 108.7 (12.8) | 337.3 (31.7) | 245.0 (4.9) | 3065.7 (194.9) |
| Shelterwood | 116.3 (0.9) | 329.7 (16.3) | 227.3 (19.0) | 3162.3 (480.0) |
| Gap Release | 120.0 (7.2) | 357.0 (53.2) | 257.0 (11.0) | 2704.0 (855.4) |

The number of morphospecies and abundance (number of individuals captured at each grid) for active (beat, sweep, coarse woody debris and litter searches), light and pitfall trap capture techniques in spring and autumn is shown in Table 3.

Fig. 6 shows comparisons for silvicultural treatments for light trap captures between Wellington East and Donnelly in spring. For Wellington East, species diversity and abundance are lowest in the coupe buffer (single sample), and the gap treatment also has a lower diversity and abundance compared with the external control and shelterwood treatment. Lower captures in the coupe buffer site are also apparent for the active capture and pit falls (Table 3). For Donnelly spring light trap samples the shelterwood treatment had lower diversity and abundance. However in autumn, the external control treatment

was lowest in diversity and abundance followed closely by the gap release treatment (Fig. 7). This pattern is also evident in the Wellington East autumn data.

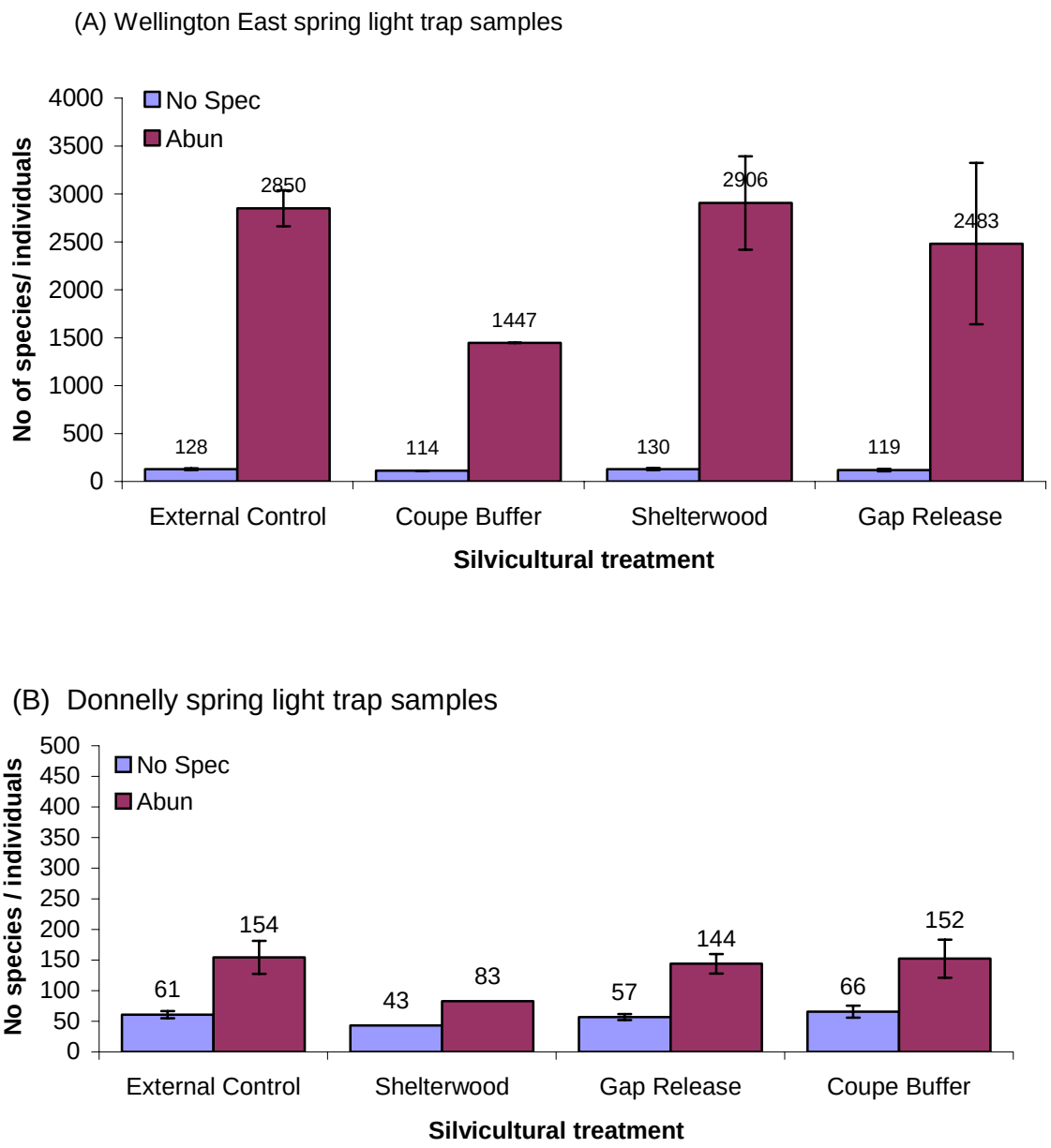



**Figure 6.** Mean (± SE) spring light trap captures against treatment grids for (a) Wellington East and (b) Donnelly. (number of morphospecies = No Spec; number of individuals = abundance).

### Species differences

Table 4 shows the most frequent species captured for Wellington East, Perth Hills, Wellington and Donnelly. Lepidopteran 436 was the most common species collected in Wellington East, Perth Hills and Wellington but does not feature in the 10 most common species captured in Donnelly (captured on 4 occasions only). Trichopteran 145 and species 52 (the introduced honey bee) were the only species present in the top 10 of all sample sites.

**Table 3.** Number of morphospecies and abundance (number of individuals captured at each grid) for active (beat, sweep, coarse woody debris, litter), light and pitfall trap capture techniques in spring and autumn for Wellington East.

| | | | | Active capture | | Light trap | | Pitfall trap | | All capture methods | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Treatment** | **Site No** | **Location** | **Season** | **No Spec** | **Abund** | **No Spec** | **Abund** | **No Spec** | **Abund** | **No Spec** | **Abund** |
| External Control | FC28 | Nalyerin | AU | 22 | 25 | 42 | 107 | 9 | 12 | 73 | 144 |
| External Control | FC28 | Nalyerin | SP | 33 | 48 | 116 | 2746 | 17 | 54 | 166 | 2848 |
| External Control | FC32 | Stockyard | AU | 14 | 15 | 42 | 128 | 6 | 17 | 62 | 160 |
| External Control | FC32 | Stockyard | SP | 32 | 35 | 119 | 3213 | 17 | 26 | 168 | 3274 |
| External Control | FC35 | Bell | AU | 13 | 15 | 47 | 93 | 6 | 8 | 66 | 116 |
| External Control | FC35 | Bell | SP | 23 | 27 | 148 | 2591 | 18 | 37 | 189 | 2655 |
| Coupe Buffer | FC29 | Godfrey | AU | 13 | 13 | 70 | 300 | 7 | 17 | 90 | 330 |
| Coupe Buffer | FC29 | Godfrey | SP | 19 | 32 | 114 | 1447 | 5 | 10 | 138 | 1489 |
| Shelterwood | FC30 | Godfrey | AU | 11 | 10 | 72 | 249 | 6 | 10 | 88 | 270 |
| Shelterwood | FC30 | Godfrey | SP | 39 | 29 | 150 | 2441 | 12 | 13 | 191 | 2493 |
| Shelterwood | FC33 | Stockyard | AU | 19 | 18 | 50 | 123 | 8 | 18 | 76 | 160 |
| Shelterwood | FC33 | Stockyard | SP | 24 | 18 | 124 | 3880 | 29 | 54 | 171 | 3958 |
| Shelterwood | FC36 | Bell | AU | 13 | 11 | 71 | 137 | 6 | 7 | 88 | 157 |
| Shelterwood | FC36 | Bell | SP | 45 | 35 | 115 | 2397 | 7 | 7 | 157 | 2449 |
| Gap Release | FC31 | Godfrey | AU | 12 | 10 | 47 | 134 | 4 | 5 | 61 | 151 |
| Gap Release | FC31 | Godfrey | SP | 36 | 25 | 100 | 1128 | 5 | 5 | 130 | 1169 |
| Gap Release | FC34 | Stockyard | AU | 11 | 9 | 49 | 137 | 12 | 17 | 70 | 165 |
| Gap Release | FC34 | Stockyard | SP | 49 | 33 | 140 | 4029 | 12 | 24 | 185 | 4102 |
| Gap Release | FC37 | Bell | AU | 9 | 8 | 51 | 128 | 9 | 16 | 68 | 153 |
| Gap Release | FC37 | Bell | SP | 49 | 33 | 118 | 2291 | 17 | 32 | 168 | 2372 |

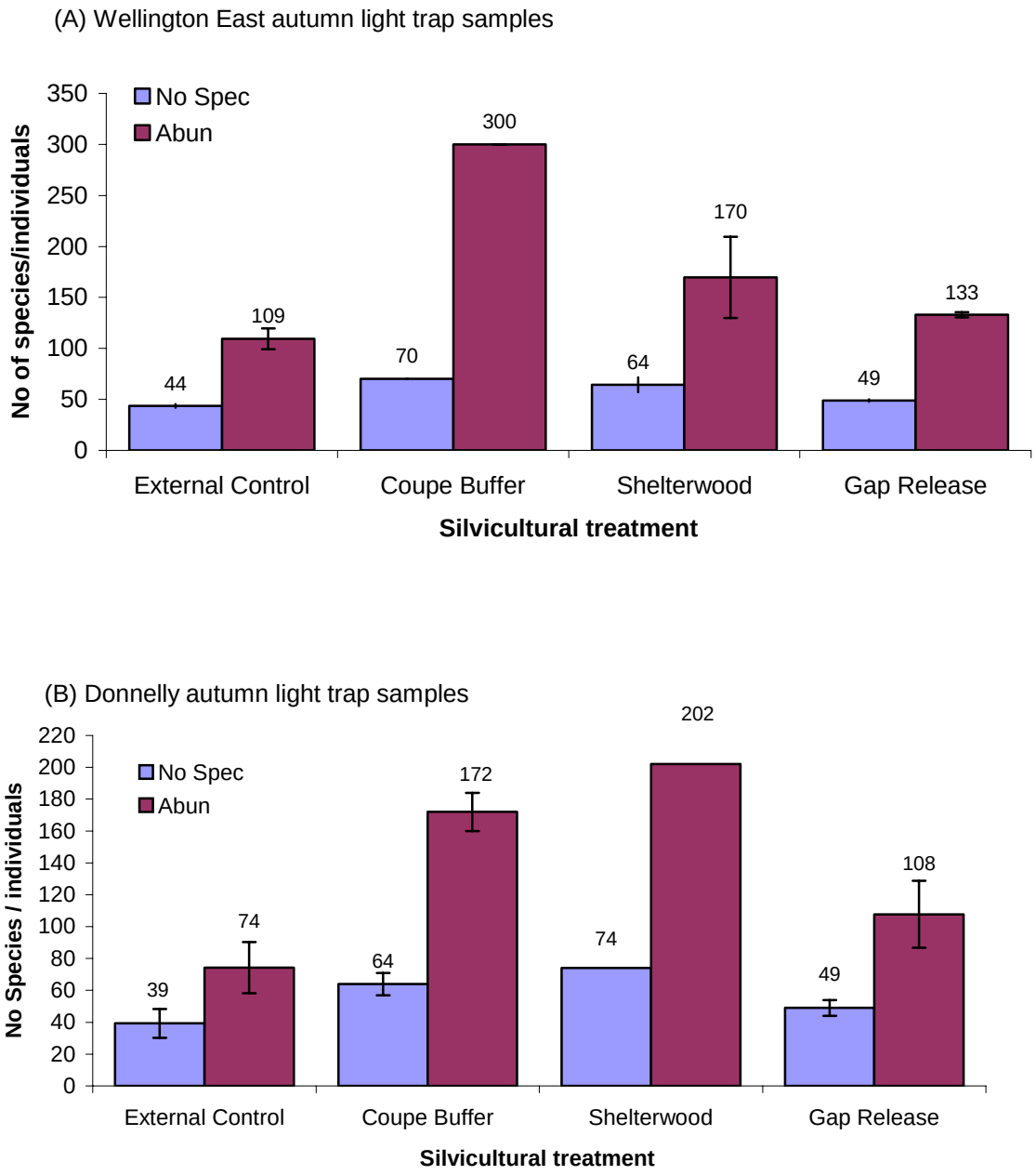



**Figure 7.** Mean (n = 3, ± SE) autumn light trap captures against treatment grids for (a) Wellington East and (b) Donnelly (note: Donnelly shelterwood is for n=1). (number of morphospecies = No Spec; number of individuals = abundance).

There were 137 morphospecies common to Perth Hills, Wellington and Donnelly (Fig. 8). Of the 960 total morphospecies, 202 were exclusive to Perth Hills (45% of the Perth Hills capture), 118 to Wellington (30% of the Wellington capture) and 299 were exclusive to Donnelly (51% of the Donnelly capture).

**Table 4**. Ten most frequent species captured for Perth Hills, Wellington and Donnelly (Capture frequency is the number of times a specimen is collected at its respective sample site and is not to be confused with abundance levels which refer to the total number of specimens collected; capture frequency ranks relate to Wellington East samples, eg. a rank of 6 for a Perth Hills specimen means this species was the 6th most frequent species at Wellington East, a rank >31 indicates single specimen only found in Wellington East, a rank = 0 indicates no specimen captured in Wellington East).

| Sample Site | Species No. | Capture frequency | Wellington East capture frequency rank | Order | Family | Genus |
|---|---|---|---|---|---|---|
| **Wellington East** | 436 | 132 | 1 | Lepidoptera | Geometridae | |
| | 14 | 49 | 2 | Coleoptera | Hydrophilidae | |
| | 4 | 45 | 3 | Lepidoptera | Notodontidae | *Destolmia* |
| | 16 | 40 | 4 | Diptera | Tipulidae | |
| | 145 | 38 | 5 | Trichoptera | | |
| | 424 | 36 | 6 | Lepidoptera | Geometridae | |
| | 52 | 36 | 6 | Hymenoptera | Apidae | *Apis* |
| | 326 | 32 | 7 | Lepidoptera | Geometridae | |
| | 39 | 32 | 7 | Lepidoptera | Noctuidae | |
| | 423 | 30 | 8 | Hymenoptera | Formicidae | *Camponotus* |
| **Perth Hills** | 436 | 92 | 1 | Lepidoptera | Geometridae | |
| | 45 | 34 | 13 | Lepidoptera | Zygaenidae | *Pollanisus* |
| | 145 | 32 | 5 | Trichoptera | | |
| | 14 | 26 | 2 | Coleoptera | Hydrophilidae | |
| | 144 | 23 | 9 | Trichoptera | | |
| | 39 | 22 | 7 | Lepidoptera | Noctuidae | |
| | 424 | 21 | 6 | Lepidoptera | Geometridae | |
| | 52 | 20 | 6 | Hymenoptera | Apidae | *Apis* |
| | 235 | 20 | 18 | Orthoptera | Acrididae | |
| | 880 | 19 | 0 | Scorpionida | | |
| | 634 | 19 | 30 | Lepidoptera | Geometridae | |
| **Wellington** | 436 | 84 | 1 | Lepidoptera | Geometridae | |
| | 52 | 72 | 6 | Hymenoptera | Apidae | *Apis* |
| | 145 | 52 | 5 | Trichoptera | | |
| | 4 | 27 | 3 | Lepidoptera | Notodontidae | *Destolmia* |
| | 235 | 25 | 18 | Orthoptera | Acrididae | |
| | 258 | 22 | 14 | Dermaptera | | |
| | 163 | 22 | 31 | Hemiptera | Reduviidae | |
| | 11 | 20 | 22 | Lepidoptera | Thaumetopoeidae | *Ochrogaster* |
| | 423 | 19 | 8 | Hymenoptera | Formicidae | *Camponotus* |
| | 1 | 19 | 21 | Lepidoptera | Carthaeidae | *Carthaea* |
| | 16 | 19 | 4 | Diptera | Tipulidae | |
| **Donnelly** | 52 | 64 | 6 | Hymenoptera | Apidae | *Apis* (honey bee) |
| | 6 | 54 | 30 | Lepidoptera | Arctiidae | |
| | 235 | 45 | 18 | Orthoptera | Acrididae | |
| | 373 | 28 | 0 | Lepidoptera | Hepialidae | *Abantiades* |
| | 39 | 28 | 7 | Lepidoptera | Noctuidae | |
| | 145 | 26 | 5 | Trichoptera | | |
| | 18 | 26 | 13 | Lepidoptera | Noctuidae | *Agrotis* |
| | 45 | 26 | 13 | Lepidoptera | Zygaenidae | |
| | 376 | 26 | 0 | Lepidoptera | | |
| | 423 | 24 | 8 | Hymenoptera | Formicidae | *Iridomyrex* |

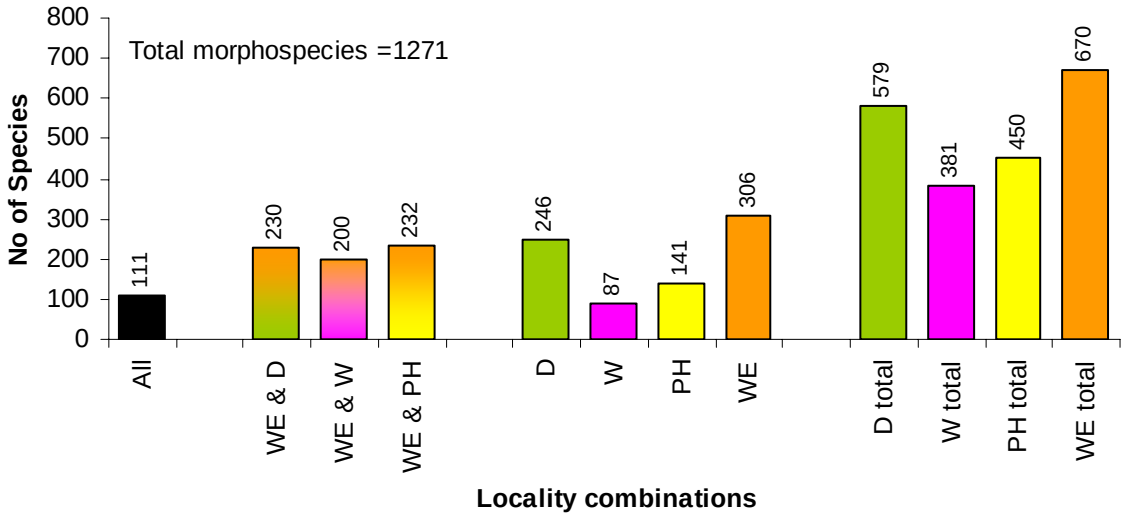



**Figure 8.** Number of species common and exclusive to Wellington East (WE), Perth Hills (PH) Wellington (W) and Donnelly (D). (All refers to number of species common to all localities; locality combinations such as WE & D refers to the number of species common to both; a single locality shows the number of species exclusive to that locality; location totals refer to total morphospecies for the respective locality and is included for comparison)

### Pest presence

Gumleaf skeletonizer was absent from all Wellington east grids (Table 5). Bullseye borer was present at all sites and Jarrah leafminer was present at all grids, with high populations at the Nalyerin external control (FC28) and Godfrey shelterwood (FC30).

**Table 5.** Pest presence and abundance assessment at each site (JLM = jarrah leafminer; GLS = gumleaf skeletonizer; BEB = bullseye borer; 0 = absent, 1 = present, 2 = abundant).

| Treatment | Site No | Location | JLM | GLS | BEB |
|---|---|---|---|---|---|
| External Control | FC28 | Nalyerin | 2 | 0 | 1 |
| External Control | FC32 | Stockyard | 1 | 0 | 1 |
| External Control | FC35 | Bell | 1 | 0 | 1 |
| Coupe Buffer | FC29 | Godfrey | 1 | 0 | 1 |
| Shelterwood | FC30 | Godfrey | 2 | 0 | 1 |
| Shelterwood | FC33 | Stockyard | 1 | 0 | 1 |
| Shelterwood | FC36 | Bell | 1 | 0 | 1 |
| Gap Release | FC31 | Godfrey | 1 | 0 | 1 |
| Gap Release | FC34 | Stockyard | 1 | 0 | 1 |
| Gap Release | FC37 | Bell | 1 | 0 | 1 |

## Conclusions

### Species composition, richness and abundance

- After 4 years of collection, 1 271 morphospecies of macroinvertebrates (>10 mm length) have been collected. After an initial collection of 582 morphospecies in 2001, about 200 new morphospecies have been collected in 2002 and in 2003. Remarkably, 306 new species were collected from Wellington East indicating high invertebrate diversity in the eastern part of the Jarrah forest.
- Light traps from Wellington East were unusually productive in spring compared to collections in previous years. Thus greater diversity of Lepidoptera, the principal catch of light traps, was collected from Wellington East than from previous years.
- Wellington East also had greatest species diversity for the Araneomorpha (spiders), Dermaptera (earwigs) and Orthoptera (crickets and grasshoppers).

### Effects of Silvicultural treatments

- Silvicultural treatment had no significant effect on overall (combined collection methods) macroinvertebrate abundance or morphospecies diversity at Wellington East.
- Further analysis is required to determine interaction between collection method and silvicultural effects.
- Further analysis is required to determine effect of silvicultural treatment on individual species.

### Presence of pest species

- Jarrah leafminer was present on all sites sampled and abundant at 2 grids (FC28, Nalyerin external control and FC30, Godfrey shelterwood).
- Gumleaf skeletonizer was not detected on any site.
- Bullseye borer was present on all sites.

**Appendix 1.** Morphospecies list for FORESTCHECK and Walpole Fire Fine Grain Mosaic invertebrates for July 2005. Data sorted on Taxa (K = assigned indicator species; GA = species with Gondwanan affinities; GR = suspected Gondwanan relic species

| Spec # | Order | Family | Tax 3 | Genus | Species | GR/K |
|---|---|---|---|---|---|---|
| 1303 | Amphipoda | | | | | GR |
| 261 | Amphipoda | | Not found | | | GR |
| 472 | Araneomorphae | | Degraded | | | |
| 1221 | Araneomorphae | Araneidae | | | | |
| 1746 | Araneomorphae | Araneidae | | | | |
| 1726 | Araneomorphae | Araneidae | | *Arachnura* | *higginsii ?* | |
| 1684 | Araneomorphae | Araneidae | | *Argiope* | | |
| 1206 | Araneomorphae | Araneidae | | *Eriophora* | | |
| 1319 | Araneomorphae | Araneidae | | *Eriophora* | | |
| 1680 | Araneomorphae | Araneidae | | *Eriophora* | | K |
| 1217 | Araneomorphae | Araneidae | | *Eriophora* | *transmarina ?* | K |
| 1710 | Araneomorphae | Araneidae | | *Gasteracantha* | | |
| 1213 | Araneomorphae | Araneidae | | *Gasteracantha* | *minax ?* | |
| 1551 | Araneomorphae | Araneidae | | *Nephila* | *edulis* | |
| 1671 | Araneomorphae | Araneidae | | *Phonographa* | *graeffei ?* | K |
| 1471 | Araneomorphae | Araneidae | | *Phonographa* | *graffei* | K |

| Spec # | Order | Family | Tax 3 | Genus | Species | GR/K |
|---|---|---|---|---|---|---|
| 285 | Araneomorphae | Araneidae | | *Eriophora* | | |
| 536 | Araneomorphae | Corinnidae | | *Supunna* | *albopunctata* | K |
| 537 | Araneomorphae | Corinnidae | | *Supunna* | *picta* | K |
| 553 | Araneomorphae | Ctenidae | | | | |
| 1682 | Araneomorphae | Deinopidae | | *Deinopis* | | |
| 1544 | Araneomorphae | Deinopidae | | *Deinopis ?* | | K |
| 941 | Araneomorphae | Gnaphosidae | | | | |
| 975 | Araneomorphae | Gnaphosidae | | | | |
| 1377 | Araneomorphae | Gnaphosidae | | | | |
| 1413 | Araneomorphae | Gnaphosidae | | | | |
| 1778 | Araneomorphae | Gnaphosidae | | | | |
| 560 | Araneomorphae | Gnaphosidae | | | | |
| 938 | Araneomorphae | Gnaphosidae | | *Rebilus* | | |
| 1427 | Araneomorphae | Gnaphosidae | | *Rebilus* | | |
| 1809 | Araneomorphae | Gnaphosidae | | *Rebilus ?* | | |
| 742 | Araneomorphae | Gnaphosidae | | | | |
| 620 | Araneomorphae | Gnaphosidae | | *Rebilus* | | |
| 1793 | Araneomorphae | Linophiidae | | | | |
| 561 | Araneomorphae | Lycosidae | | | | |
| 1294 | Araneomorphae | Lycosidae | | | | |
| 1373 | Araneomorphae | Lycosidae | | | | |
| 1558 | Araneomorphae | Lycosidae | | | | |
| 1581 | Araneomorphae | Lycosidae | | | | |
| 1588 | Araneomorphae | Lycosidae | | | | |
| 1589 | Araneomorphae | Lycosidae | | | | |
| 1593 | Araneomorphae | Lycosidae | | | | |
| 1595 | Araneomorphae | Lycosidae | | | | |
| 1786 | Araneomorphae | Lycosidae | | | | |
| 554 | Araneomorphae | Lycosidae | | | | |
| 733 | Araneomorphae | Lycosidae | | | | |
| 741 | Araneomorphae | Lycosidae | | | | |
| 743 | Araneomorphae | Lycosidae | | | | |
| 740 | Araneomorphae | Miturgidae | | | | |
| 933 | Araneomorphae | Miturgidae | | | | |
| 1428 | Araneomorphae | Miturgidae | | | | |
| 1448 | Araneomorphae | Miturgidae | | | | |
| 1449 | Araneomorphae | Miturgidae | | | | K |
| 1476 | Araneomorphae | Miturgidae | | | | |
| 1477 | Araneomorphae | Miturgidae | | | | |
| 1564 | Araneomorphae | Miturgidae | | | | |
| 1574 | Araneomorphae | Miturgidae | | | | |
| 1579 | Araneomorphae | Miturgidae | | | | |
| 1580 | Araneomorphae | Miturgidae | | | | |
| 1737 | Araneomorphae | Miturgidae | | | | |
| 597 | Araneomorphae | Miturgidae | | | | |
| 271 | Araneomorphae | Miturgidae | | | | |
| 740 | Araneomorphae | Miturgidae | | | | |
| 794 | Araneomorphae | Miturgidae | | | | |
| 812 | Araneomorphae | Miturgidae | | | | |
| 1044 | Araneomorphae | Sparassidae | | | | |
| 1282 | Araneomorphae | Sparassidae | | | | |
| 1432 | Araneomorphae | Sparassidae | | | | |
| 1446 | Araneomorphae | Sparassidae | | | | |
| 286 | Araneomorphae | Sparassidae | | | | K |

| Spec # | Order | Family | Tax 3 | Genus | Species | GR/K |
|---|---|---|---|---|---|---|
| 939 | Araneomorphae | Sparassidae | | *Olios* | | |
| 1250 | Araneomorphae | Sparassidae | | *Olios* | *diana ?* | |
| 724 | Araneomorphae | Sparassidae | | | | |
| 1403 | Araneomorphae | Stiphidiidae | | | | |
| 1570 | Araneomorphae | Stiphidiidae | | | | |
| 1609 | Araneomorphae | Stiphidiidae | | | | |
| 732 | Araneomorphae | Stiphidiidae | | *Balami* | | |
| 735 | Araneomorphae | Stiphidiidae | | *Balami* | *volucripes* | |
| 725 | Araneomorphae | Stiphidiidae | | *Balami ?* | *volucripes* | |
| 793 | Araneomorphae | Theridiidae | | | | |
| 788 | Araneomorphae | Theridiidae ? | | | | |
| 932 | Araneomorphae | Zodariidae | | | | |
| 972 | Araneomorphae | Zodariidae | | | | |
| 1007 | Araneomorphae | Zodariidae | | | | |
| 1015 | Araneomorphae | Zodariidae | | | | |
| 1244 | Araneomorphae | Zodariidae | | | | |
| 1584 | Araneomorphae | Zodariidae | | | | |
| 1610 | Araneomorphae | Zodariidae | | | | |
| 468 | Araneomorphae | Zodariidae | | *Storena* | | |
| 731 | Araneomorphae | Zodariidae | | | | |
| 783 | Araneomorphae | Zodariidae | | | | |
| 468 | Araneomorphae | Zodariidae | | *Storena* | | K |
| 1115 | Blattodea | | | | | |
| 1118 | Blattodea | | | | | |
| 1462 | Blattodea | | not found | | | |
| 269 | Blattodea | | | | | |
| 509 | Blattodea | | not found | | | |
| 926 | Blattodea | Blaberidae | | | | |
| 1101 | Blattodea | Blaberidae | | | | |
| 570 | Blattodea | Blaberidae | | | | K |
| 1578 | Blattodea | Blaberidae | | *Laxta ?* | | |
| 148 | Blattodea | Blaberidae | | | | |
| 410 | Blattodea | Blaberidae | | | | K |
| 479 | Blattodea | Blaberidae | | | | |
| 483 | Blattodea | Blaberidae | | | | |
| 27 | Blattodea | Blaberidae | | *Calolampra* | | K |
| 119 | Blattodea | Blaberidae | | *Calolampra* | | K |
| 147 | Blattodea | Blaberidae | | *Calolampra* | | |
| 292 | Blattodea | Blaberidae | | *Laxta* | | K |
| 483 | Blattodea | Blaberidae | | *Laxta* | | K |
| 781 | Blattodea | Blaberidae | | *Laxta* | | K |
| 120 | Blattodea | Blattellidae | | *Neotemnopteryx* | | K |
| 591 | Blattodea | Blattellidae | | *Neotemnopteryx* | | |
| 121 | Blattodea | Blattellidae | | *Platyzosteria* | | K |
| 122 | Blattodea | Blattellidae | | *Platyzosteria* | | K |
| 874 | Blattodea | Blattidae | | | | |
| 878 | Blattodea | Blattidae | | | | |
| 891 | Blattodea | Blattidae | | | | |
| 899 | Blattodea | Blattidae | | | | |
| 905 | Blattodea | Blattidae | | | | |
| 936 | Blattodea | Blattidae | | | | |
| 961 | Blattodea | Blattidae | | | | |
| 967 | Blattodea | Blattidae | | | | |
| 968 | Blattodea | Blattidae | | | | |

| Spec # | Order | Family | Tax 3 | Genus | Species | GR/K |
|---|---|---|---|---|---|---|
| 971 | Blattodea | Blattidae | | | | |
| 1016 | Blattodea | Blattidae | | | | |
| 1035 | Blattodea | Blattidae | | | | |
| 1247 | Blattodea | Blattidae | | | | |
| 1313 | Blattodea | Blattidae | | | | |
| 1434 | Blattodea | Blattidae | | | | |
| 1460 | Blattodea | Blattidae | | | | K |
| 1474 | Blattodea | Blattidae | | | | |
| 1555 | Blattodea | Blattidae | | | | |
| 1559 | Blattodea | Blattidae | | | | |
| 1573 | Blattodea | Blattidae | | | | |
| 1587 | Blattodea | Blattidae | | | | |
| 1741 | Blattodea | Blattidae | | | | |
| 1766 | Blattodea | Blattidae | | | | |
| 1773 | Blattodea | Blattidae | | | | |
| 1780 | Blattodea | Blattidae | | | | |
| 525 | Blattodea | Blattidae | | | | K |
| 190 | Blattodea | Blattidae | | | | K |
| 490 | Blattodea | Blattidae | | | | |
| 507 | Blattodea | Blattidae | | | | |
| 508 | Blattodea | Blattidae | | | | K |
| 706 | Blattodea | Blattidae | | | | |
| 254 | Blattodea | Blattidae | | *Platyzosteria* | | |
| 282 | Blattodea | Blattidae | | *Platyzosteria* | | K |
| 219 | Blattodea | Blattidae | | *Platyzosteria* | | K |
| 266 | Blattodea | Blattidae | | *Platyzosteria* | | K |
| 592 | Blattodea | Blattidae | | *Polyzosteria* | | |
| 777 | Blattodea | Blattidae | Michells cocky | *Polyzosteria* | *mitchelli* | K |
| 875 | Chilopoda | | | | | |
| 877 | Chilopoda | | | | | |
| 1200 | Chilopoda | | | | | |
| 1429 | Chilopoda | | | | | |
| 1531 | Chilopoda | | | | | |
| 1563 | Chilopoda | | | | | |
| 1767 | Chilopoda | | | | | |
| 223 | Chilopoda | | | | | |
| 224 | Chilopoda | | | | | |
| 225 | Chilopoda | | | | | |
| 226 | Chilopoda | | | | | |
| 227 | Chilopoda | | | | | |
| 228 | Chilopoda | | | | | |
| 229 | Chilopoda | | | | | |
| 267 | Chilopoda | | | | | |
| 277 | Chilopoda | | | | | |
| 623 | Chilopoda | | | | | |
| 716 | Chilopoda | | | | | |
| 815 | Chilopoda | | | | | |
| 1768 | Chilopoda | Scolopendridae | | | | |
| 1783 | Chilopoda | Scolopendridae | | | | |
| 1583 | Chilopoda | Scolopendridae ? | | | | |
| 865 | Coleoptera | | | | | |
| 1050 | Coleoptera | | | | | |
| 1183 | Coleoptera | | | | | |
| 1187 | Coleoptera | | | | | |

| Spec # | Order | Family | Tax 3 | Genus | Species | GR/K |
|---|---|---|---|---|---|---|
| 1208 | Coleoptera | | | | | |
| 1238 | Coleoptera | | | | | |
| 1242 | Coleoptera | | | | | |
| 1243 | Coleoptera | | | | | |
| 1245 | Coleoptera | | | | | |
| 1248 | Coleoptera | | | | | |
| 1290 | Coleoptera | | | | | |
| 1295 | Coleoptera | | | | | |
| 1307 | Coleoptera | | | | | |
| 116 | Coleoptera | ? | | | | |
| 158 | Coleoptera | ? | | | | |
| 159 | Coleoptera | ? | | | | |
| 173 | Coleoptera | ? | | | | |
| 194 | Coleoptera | ? | | | | |
| 215 | Coleoptera | ? | | | | |
| 1298 | Coleoptera | Belidae | | | | GR |
| 100 | Coleoptera | Belidae | | | | GR |
| 201 | Coleoptera | Belidae | | *Araiobelus* | | GR |
| 168 | Coleoptera | Belidae | | *Rhinotia* | | GR |
| 1300 | Coleoptera | Buprestidae | | | | K |
| 1309 | Coleoptera | Buprestidae | | | | K |
| 1435 | Coleoptera | Buprestidae | | | | K |
| 1437 | Coleoptera | Buprestidae | | | | K |
| 1443 | Coleoptera | Buprestidae | | | | K |
| 1464 | Coleoptera | Buprestidae | | | | K |
| 1708 | Coleoptera | Buprestidae | | | | K |
| 299 | Coleoptera | Buprestidae | | | | K |
| 701 | Coleoptera | Buprestidae | | *Melobasis* | | K |
| 1724 | Coleoptera | Cantharidae | | *Chauliognathus* | | |
| 198 | Coleoptera | Cantharidae | | *Heteromastix* | | |
| 851 | Coleoptera | Carabidae | | | | GA |
| 992 | Coleoptera | Carabidae | | | | GA |
| 1000 | Coleoptera | Carabidae | | | | GA |
| 1059 | Coleoptera | Carabidae | | | | GA |
| 1087 | Coleoptera | Carabidae | | | | GA |
| 1100 | Coleoptera | Carabidae | | | | GA |
| 1104 | Coleoptera | Carabidae | | | | GA |
| 1107 | Coleoptera | Carabidae | | | | GA |
| 1306 | Coleoptera | Carabidae | | | | GA |
| 1347 | Coleoptera | Carabidae | | | | GA |
| 1363 | Coleoptera | Carabidae | | | | GA |
| 1364 | Coleoptera | Carabidae | | | | GA |
| 1366 | Coleoptera | Carabidae | | | | GA |
| 1387 | Coleoptera | Carabidae | | | | GA |
| 1442 | Coleoptera | Carabidae | | | | GA |
| 1522 | Coleoptera | Carabidae | | | | GA |
| 1605 | Coleoptera | Carabidae | | | | GA |
| 1642 | Coleoptera | Carabidae | | | | GA |
| 1785 | Coleoptera | Carabidae | | | | |
| 1791 | Coleoptera | Carabidae | | | | |
| 1058 | Coleoptera | Carabidae | | *Calosoma* | *schayeri* | K |
| 956 | Coleoptera | Carabidae | | *Philophloeus* | *eucalypti* | GA |
| 93 | Coleoptera | Carabidae | | | | GA |
| 253 | Coleoptera | Carabidae | | | | GA |

| Spec # | Order | Family | Tax 3 | Genus | Species | GR/K |
|---|---|---|---|---|---|---|
| 528 | Coleoptera | Carabidae | | | | K |
| 529 | Coleoptera | Carabidae | | | | K |
| 727 | Coleoptera | Carabidae | | | | GA |
| 746 | Coleoptera | Carabidae | | | | GA |
| 747 | Coleoptera | Carabidae | | *?Notonomus* | | GA |
| 280 | Coleoptera | Carabidae | | *Carenum* | | GA |
| 288 | Coleoptera | Carabidae | | *Chlaenius* | | GA |
| 557 | Coleoptera | Carabidae | | | | K |
| 587 | Coleoptera | Carabidae | | | | K |
| 839 | Coleoptera | Carabidae | | | | GA |
| 842 | Coleoptera | Carabidae | | | | GA |
| 439 | Coleoptera | Carabidae | Carabinae | | | GA |
| 340 | Coleoptera | Carabidae | Chlaeniiae | | | GA |
| 265 | Coleoptera | Carabidae | Esydrinae | | | GA |
| 264 | Coleoptera | Carabidae | Harpalinae | *?Cenogmus* | | GA |
| 914 | Coleoptera | Carabidae | Licininae | *Dicrochile* | | GA |
| 558 | Coleoptera | Carabidae | Pentagonicinae | *Scapodes* | *boops* | GA |
| 1033 | Coleoptera | Cerambycidae | | | | |
| 1040 | Coleoptera | Cerambycidae | | | | |
| 1041 | Coleoptera | Cerambycidae | | | | |
| 1067 | Coleoptera | Cerambycidae | | | | |
| 1082 | Coleoptera | Cerambycidae | | | | |
| 1177 | Coleoptera | Cerambycidae | | | | |
| 1283 | Coleoptera | Cerambycidae | | | | |
| 1334 | Coleoptera | Cerambycidae | | | | |
| 1418 | Coleoptera | Cerambycidae | | | | |
| 1417 | Coleoptera | Cerambycidae | | *Sceleocantha ?* | | |
| 654 | Coleoptera | Cerambycidae | | *Coptocercus* | *rubripes* | |
| 762 | Coleoptera | Cerambycidae | | *Phoracantha* | *semipunctata* | |
| 673 | Coleoptera | Cerambycidae | | *Stenoderus* | *suturalis* | |
| 351 | Coleoptera | Cerambycidae | | *Uracantha* | *triangularis* | K |
| 476 | Coleoptera | Cerambycidae | Laminae | | | |
| 182 | Coleoptera | Chrysomelidae | Chrysomelinae | | | |
| 56 | Coleoptera | Chrysomelidae | Chrysomelinae | *Calomela* | | |
| 101 | Coleoptera | Chrysomelidae | Chrysomelinae | *Calomela* | | |
| 115 | Coleoptera | Chrysomelidae | Chrysomelinae | *Calomela* | | |
| 155 | Coleoptera | Chrysomelidae | Chrysomelinae | *Calomela* | | |
| 807 | Coleoptera | Chrysomelidae | Chrysomelinae | *Chalcolampra* | | K |
| 112 | Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta* | | |
| 308 | Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta* | | K |
| 463 | Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta* | | K |
| 677 | Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta* | | |
| 786 | Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta* | | |
| 800 | Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta* | | |
| 803 | Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta* | | |
| 804 | Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta* | | |
| 805 | Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta* | | |
| 1205 | Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta* | | |
| 1254 | Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta* | | |
| 1263 | Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta* | | |
| 1279 | Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta* | | |
| 1322 | Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta* | | |
| 1329 | Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta* | | |
| 1444 | Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta* | | |

| Spec # | Order | Family | Tax 3 | Genus | Species | GR/K |
|---|---|---|---|---|---|---|
| 1540 | Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta* | | |
| 1669 | Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta* | | |
| 1745 | Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta* | | |
| 1752 | Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta* | | |
| 1772 | Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta* | | |
| 175 | Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta* | | |
| 248 | Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta* | | |
| 471 | Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta* | | |
| 307 | Coleoptera | Chrysomelidae | Chrysomelinae | *Paropsis* | | K |
| 665 | Coleoptera | Chrysomelidae | Chrysomelinae | *Paropsis* | | |
| 667 | Coleoptera | Chrysomelidae | Chrysomelinae | *Paropsis* | | K |
| 707 | Coleoptera | Chrysomelidae | Chrysomelinae | *Paropsis* | | |
| 913 | Coleoptera | Chrysomelidae | Chrysomelinae | *Paropsis* | | |
| 1554 | Coleoptera | Chrysomelidae | Chrysomelinae | *Paropsis* | | |
| 1825 | Coleoptera | Chrysomelidae | Chrysomelinae | *Paropsis* | | |
| 1826 | Coleoptera | Chrysomelidae | Chrysomelinae | *Paropsis* | | |
| 1827 | Coleoptera | Chrysomelidae | Chrysomelinae | *Paropsis* | | |
| 665 | Coleoptera | Chrysomelidae | Chrysomelinae | *Paropsis* | *yilgarnensis ?* | K |
| 1092 | Coleoptera | Chrysomelidae | Chrysomelinae | *Paropsisterna* | | |
| 1253 | Coleoptera | Chrysomelidae | Cryptocephalinae | *Cadmus* | *excrementarius* | |
| 1103 | Coleoptera | Cleridae | | | | |
| 684 | Coleoptera | Cleridae | | | | |
| 695 | Coleoptera | Cleridae | | *Eleale* | | |
| 1310 | Coleoptera | Coccinellidae | | | | |
| 912 | Coleoptera | Coccinellidae | | *Parapriasus* | | |
| 193 | Coleoptera | Coccinellidae | | *Coccinella* | *repanda* | |
| 852 | Coleoptera | Curculionidae | | | | |
| 911 | Coleoptera | Curculionidae | | | | |
| 993 | Coleoptera | Curculionidae | | | | |
| 1110 | Coleoptera | Curculionidae | | | | |
| 1175 | Coleoptera | Curculionidae | | | | |
| 1182 | Coleoptera | Curculionidae | | | | |
| 1216 | Coleoptera | Curculionidae | | | | |
| 1225 | Coleoptera | Curculionidae | | | | |
| 1270 | Coleoptera | Curculionidae | | | | |
| 1292 | Coleoptera | Curculionidae | | | | |
| 1304 | Coleoptera | Curculionidae | | | | |
| 1331 | Coleoptera | Curculionidae | | | | |
| 1414 | Coleoptera | Curculionidae | | | | |
| 1438 | Coleoptera | Curculionidae | | | | |
| 1505 | Coleoptera | Curculionidae | | | | |
| 1716 | Coleoptera | Curculionidae | | | | |
| 368 | Coleoptera | Curculionidae | | | | K |
| 1219 | Coleoptera | Curculionidae | | *Catasarcus* | | |
| 898 | Coleoptera | Curculionidae | | *Oxyops* | | |
| 1278 | Coleoptera | Curculionidae | | *Oxyops* | | |
| 102 | Coleoptera | Curculionidae | | | | |
| 114 | Coleoptera | Curculionidae | | | | |
| 156 | Coleoptera | Curculionidae | | | | |
| 169 | Coleoptera | Curculionidae | | | | |
| 199 | Coleoptera | Curculionidae | | | | |
| 209 | Coleoptera | Curculionidae | | | | K |
| 214 | Coleoptera | Curculionidae | | | | |
| 244 | Coleoptera | Curculionidae | | | | K |

| Spec # | Order | Family | Tax 3 | Genus | Species | GR/K |
|---|---|---|---|---|---|---|
| 349 | Coleoptera | Curculionidae | | | | K |
| 514 | Coleoptera | Curculionidae | | | | |
| 709 | Coleoptera | Curculionidae | | | | |
| 736 | Coleoptera | Curculionidae | | | | |
| 702 | Coleoptera | Curculionidae | | *Gonipterus* | | |
| 841 | Coleoptera | Curculionidae | | | | |
| 843 | Coleoptera | Curculionidae | | | | |
| 906 | Coleoptera | Curculionidae | Amycterinae | | | GR |
| 910 | Coleoptera | Curculionidae | Amycterinae | | | GR |
| 934 | Coleoptera | Curculionidae | Amycterinae | | | GR |
| 1014 | Coleoptera | Curculionidae | Amycterinae | | | GR |
| 1251 | Coleoptera | Curculionidae | Amycterinae | | | GR |
| 1318 | Coleoptera | Curculionidae | Amycterinae | | | GR |
| 1352 | Coleoptera | Curculionidae | Amycterinae | | | GR |
| 1361 | Coleoptera | Curculionidae | Amycterinae | | | GR |
| 1396 | Coleoptera | Curculionidae | Amycterinae | | | GR |
| 1397 | Coleoptera | Curculionidae | Amycterinae | | | GR |
| 1409 | Coleoptera | Curculionidae | Amycterinae | | | GR |
| 1461 | Coleoptera | Curculionidae | Amycterinae | | | GR |
| 1486 | Coleoptera | Curculionidae | Amycterinae | | | GR |
| 1543 | Coleoptera | Curculionidae | Amycterinae | | | GR |
| 1596 | Coleoptera | Curculionidae | Amycterinae | | | GR |
| 1597 | Coleoptera | Curculionidae | Amycterinae | | | GR |
| 1624 | Coleoptera | Curculionidae | Amycterinae | | | GR |
| 1672 | Coleoptera | Curculionidae | Amycterinae | | | GR |
| 300 | Coleoptera | Curculionidae | Amycterinae | | | GR |
| 744 | Coleoptera | Curculionidae | Amycterinae | | | GR |
| 748 | Coleoptera | Curculionidae | Amycterinae | | | GR |
| 814 | Coleoptera | Curculionidae | Amycterinae | | | GR |
| 817 | Coleoptera | Curculionidae | Amycterinae | | | GR |
| 496 | Coleoptera | Curculionidae | Amycterinae | *Acantholophus* | | GR |
| 869 | Coleoptera | Curculionidae | Amycterinae | *Acantholophus* | | GR |
| 970 | Coleoptera | Curculionidae | Amycterinae | *Acantholophus* | | GR |
| 1215 | Coleoptera | Curculionidae | Amycterinae | *Acantholophus* | | GR |
| 1262 | Coleoptera | Curculionidae | Amycterinae | *Acantholophus* | | GR |
| 1523 | Coleoptera | Curculionidae | Amycterinae | *Acantholophus* | | GR |
| 1774 | Coleoptera | Curculionidae | Amycterinae | *Acantholophus* | | GR |
| 1775 | Coleoptera | Curculionidae | Amycterinae | *Acantholophus* | | GR |
| 1803 | Coleoptera | Curculionidae | Amycterinae | *Acantholophus* | | GR |
| 1571 | Coleoptera | Curculionidae | Amycterinae | *Cucullothorax* | *horridus* | GR |
| 1764 | Coleoptera | Curculionidae | Amycterinae | *Euomus* | | GR |
| 1747 | Coleoptera | Curculionidae | Amycterinae | *Euomus* | sp *nova* | GR |
| 1376 | Coleoptera | Curculionidae | Amycterinae | *Sclerorinus* | | GR |
| 1763 | Coleoptera | Curculionidae | Amycterinae | *Sclerorinus* | | GR |
| 1810 | Coleoptera | Curculionidae | Amycterinae | *Sclerorinus* | | GR |
| 1789 | Coleoptera | Curculionidae | Amycterinae | *Sclerorinus ?* | | GR |
| 1801 | Coleoptera | Curculionidae | Amycterinae | *Sclerorinus ?* | | GR |
| 157 | Coleoptera | Curculionidae | Aterpinae | *Rhadinosomus* | *lacordairei* | K |
| 103 | Coleoptera | Curculionidae | Aterpinae | *Rhinaria* | *aberrans (?)* | |
| 710 | Coleoptera | Curculionidae | Entiminae | | | |
| 210 | Coleoptera | Curculionidae | Entiminae | *Aesolithna* | | |
| 113 | Coleoptera | Curculionidae | Entiminae | *Polyphrades* | *aesalon (?)* | |
| 160 | Coleoptera | Curculionidae | Gonipterinae | *Gonipterus* | | |
| 488 | Coleoptera | Curculionidae | Gonipterinae | *Gonipterus* | | |

| Spec # | Order | Family | Tax 3 | Genus | Species | GR/K |
|---|---|---|---|---|---|---|
| 462 | Coleoptera | Curculionidae | Gonipterinae | *Oxyops* | | |
| 470 | Coleoptera | Curculionidae | Gonipterinae | *Oxyops* | | |
| 161 | Coleoptera | Curculionidae | Gonipterinae | *Oxyops* | *fasciata* | K |
| 98 | Coleoptera | Curculionidae | Gonipterinae | *Oxyops* | *pictipennis* | |
| 290 | Coleoptera | Curculionidae | Molytinae | *Helanotranes* | *roei* | K |
| 291 | Coleoptera | Curculionidae | Molytinae | *Tranes* | *vigorsii* | K |
| 1412 | Coleoptera | Dytiscidae | | | | |
| 1123 | Coleoptera | Dytiscidae | | *Cybister* | | K |
| 850 | Coleoptera | Dytiscidae | | *Lancetes* | | |
| 13 | Coleoptera | Dytiscidae | | | | |
| 440 | Coleoptera | Dytiscidae | | | | |
| 774 | Coleoptera | Dytiscidae | | *Eretes* | | |
| 651 | Coleoptera | Dytiscidae | | *Lancetes* | | |
| 989 | Coleoptera | Elateridae | | | | K |
| 1083 | Coleoptera | Elateridae | | | | |
| 1817 | Coleoptera | Elateridae | | | | |
| 909 | Coleoptera | Elateridae | | *Conoderus* | | |
| 1816 | Coleoptera | Elateridae | | *Conoderus* | | |
| 1818 | Coleoptera | Elateridae | | *Conoderus* | | |
| 1819 | Coleoptera | Elateridae | | *Conoderus* | | |
| 997 | Coleoptera | Elateridae | | *Conoderus ?* | | |
| 1062 | Coleoptera | Elateridae | | *Conoderus ?* | | |
| 1109 | Coleoptera | Elateridae | | *Conoderus ?* | | |
| 1120 | Coleoptera | Elateridae | | *Conoderus ?* | | |
| 1121 | Coleoptera | Elateridae | | *Conoderus ?* | | |
| 15 | Coleoptera | Elateridae | | | | |
| 220 | Coleoptera | Elateridae | | | | |
| 444 | Coleoptera | Elateridae | | | | |
| 571 | Coleoptera | Elateridae | | | | |
| 621 | Coleoptera | Elateridae | | | | |
| 636 | Coleoptera | Elateridae | | | | |
| 26 | Coleoptera | Elateridae | | *Conoderus* | | |
| 135 | Coleoptera | Elateridae | | *Conoderus ?* | | |
| 831 | Coleoptera | Geotrupidae | | *Blackbolbus* | | K |
| 959 | Coleoptera | Histeridae | | | | |
| 14 | Coleoptera | Hydrophilidae | | | | |
| 1338 | Coleoptera | Lucanidae | | | | |
| 1629 | Coleoptera | Lucanidae | | | | |
| 1640 | Coleoptera | Lucanidae | | | | |
| 1797 | Coleoptera | Lucanidae | | | | |
| 437 | Coleoptera | Lucanidae | | *Syndesus* | | K |
| 795 | Coleoptera | Lycidae | | | | |
| 99 | Coleoptera | Lycidae | | *Metriorrhynchus* | | K |
| 208 | Coleoptera | Lycidae | | *Metriorrhynchus* | | K |
| 802 | Coleoptera | Lycidae | | *Metriorrhynchus* | | K |
| 191 | Coleoptera | Phycosecidae | Phycosecis | | | |
| 824 | Coleoptera | Scarabaeidae | Dynastinae | | | |
| 189 | Coleoptera | Scarabaeidae | Dynastinae | *Cryptodus* | | K |
| 1160 | Coleoptera | Scarabaeidae | Dynastinae | *Cryptodus* | | |
| 824 | Coleoptera | Scarabaeidae | Dynastinae | *Semanopterus* | | |
| 1562 | Coleoptera | Scarabaeidae | Dynastinae | *Trissodon* | | |
| 1133 | Coleoptera | Scarabaeidae | Melolonthinae | | | |
| 550 | Coleoptera | Scarabaeidae | Melolonthinae | | | |
| 212 | Coleoptera | Scarabaeidae | Melolonthinae | *Automolus ?* | | |

| Spec # | Order | Family | Tax 3 | Genus | Species | GR/K |
|---|---|---|---|---|---|---|
| 1823 | Coleoptera | Scarabaeidae | Melolonthinae | *Colpochila* | | |
| 1138 | Coleoptera | Scarabaeidae | Melolonthinae | *Colpochila* | *andersoni* | |
| 846 | Coleoptera | Scarabaeidae | Melolonthinae | *Colpochila* | *antennalis ?* | K |
| 1063 | Coleoptera | Scarabaeidae | Melolonthinae | *Colpochila* | *bogaria ?* | |
| 353 | Coleoptera | Scarabaeidae | Melolonthinae | *Colpochila* | *major* | K |
| 55 | Coleoptera | Scarabaeidae | Melolonthinae | *Colymbomorpha* | *vittata* | |
| 28 | Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | |
| 29 | Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | |
| 70 | Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | |
| 94 | Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | |
| 154 | Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | |
| 171 | Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | |
| 172 | Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | |
| 289 | Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | |
| 363 | Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | |
| 562 | Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | |
| 823 | Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | |
| 951 | Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | |
| 991 | Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | |
| 1073 | Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | |
| 1116 | Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | |
| 1133 | Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | |
| 1154 | Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | |
| 1192 | Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | |
| 1566 | Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | |
| 1612 | Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | |
| 1660 | Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | |
| 1820 | Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | |
| 1821 | Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | |
| 1822 | Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | |
| 347 | Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | |
| 359 | Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | |
| 363 | Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | |
| 427 | Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | |
| 162 | Coleoptera | Scarabaeidae | Melolonthinae | *Liparetrus* | *jenkinsi* | |
| 287 | Coleoptera | Scarabaeidae | Melolonthinae | *Maechidius* | | |
| 287 | Coleoptera | Scarabaeidae | Melolonthinae | *Maechidius* | | |
| 1388 | Coleoptera | Scarabaeidae | Melolonthinae | *Maechidus ?* | | |
| 668 | Coleoptera | Scarabaeidae | Melolonthinae | *Phyllotocus* | *ustulatus* | |
| 1813 | Coleoptera | Scarabaeidae | Melolonthinae | *Scitalini* | | |
| 1405 | Coleoptera | Scarabaeidae | Scarabaeinae | *Onthophagus* | | |
| 1608 | Coleoptera | Scarabaeidae | Scarabaeinae | *Onthophagus* | | |
| 1824 | Coleoptera | Scarabaeidae | Scarabaeinae | *Onthophagus* | | |
| 511 | Coleoptera | Scarabaeidae | Scarabaeinae | *Onthophagus* | | |
| 17 | Coleoptera | Scarabaeidae | Scarabaeinae | *Onthophagus* | *ferox* | K |
| 1656 | Coleoptera | Silphidae | | | | |
| 924 | Coleoptera | Silphidae | | *Ptomophila* | *lacrymosa* | GR |
| 628 | Coleoptera | Staphylinidae | | | | K |
| 904 | Coleoptera | Tenebrionidae | | | | GA |
| 995 | Coleoptera | Tenebrionidae | | | | GA |
| 1076 | Coleoptera | Tenebrionidae | | | | GA |
| 1117 | Coleoptera | Tenebrionidae | | | | GA |
| 1246 | Coleoptera | Tenebrionidae | | | | GA |
| 1392 | Coleoptera | Tenebrionidae | | | | GA |

| Spec # | Order | Family | Tax 3 | Genus | Species | GR/K |
|---|---|---|---|---|---|---|
| 1400 | Coleoptera | Tenebrionidae | | | | GA |
| 1536 | Coleoptera | Tenebrionidae | | | | GA |
| 1614 | Coleoptera | Tenebrionidae | | | | GA |
| 1717 | Coleoptera | Tenebrionidae | | | | GA |
| 1721 | Coleoptera | Tenebrionidae | | | | GA |
| 1722 | Coleoptera | Tenebrionidae | | | | GA |
| 1734 | Coleoptera | Tenebrionidae | | | | GA |
| 930 | Coleoptera | Tenebrionidae | | *Chalcopteroides* | | K |
| 1012 | Coleoptera | Tenebrionidae | | *Helea* | | K |
| 1389 | Coleoptera | Tenebrionidae | | *Pterohelaeus* | | GA |
| 711 | Coleoptera | Tenebrionidae | | *Oectosis* | | K |
| 778 | Coleoptera | Tenebrionidae | | *Oectosis* | | GA |
| 192 | Coleoptera | Tenebrionidae | Lagriinae | *Lagria* | *aneouiobcea* | GA |
| 1061 | Coleoptera | Trogidae | | | | |
| 1086 | Coleoptera | Trogidae | | | | |
| 1097 | Coleoptera | Trogidae | | | | |
| 1136 | Coleoptera | Trogidae | | | | |
| 1189 | Coleoptera | Trogidae | | | | |
| 825 | Coleoptera | Trogidae | | *Omorgus* | | K |
| 848 | Coleoptera | Trogidae | | *Omorgus* | | |
| 935 | Coleoptera | Trogidae | | *Omorgus* | | K |
| 1112 | Dermaptera | | | | | |
| 1113 | Dermaptera | | | | | |
| 1390 | Dermaptera | | | | | |
| 1433 | Dermaptera | | | | | |
| 1538 | Dermaptera | | | | | |
| 1678 | Dermaptera | | | | | |
| 1723 | Dermaptera | | | | | |
| 1790 | Dermaptera | | | | | |
| 123 | Dermaptera | | | | | K |
| 257 | Dermaptera | | | | | K |
| 258 | Dermaptera | | | | | K |
| 484 | Dermaptera | | | | | K |
| 491 | Dermaptera | | | | | |
| 492 | Dermaptera | | | | | |
| 522 | Dermaptera | | | | | |
| 734 | Dermaptera | | | | | K |
| 682 | Dermaptera | Anisolabididae | Isolabellinae | | | |
| 999 | Dermaptera | Spongiphoridae | | | | |
| 876 | Diplopoda | | | | | |
| 966 | Diplopoda | | | | | |
| 1526 | Diplopoda | | | | | |
| 1546 | Diplopoda | | | | | |
| 259 | Diplopoda | | | | | |
| 260 | Diplopoda | | | | | K |
| 717 | Diplopoda | | | | | |
| 1336 | Diptera | Acroceridae | | | | K |
| 1472 | Diptera | Acroceridae | | | | K |
| 127 | Diptera | Anthomyiidae | | | | |
| 530 | Diptera | Anthomyiidae | | | | |
| 1343 | Diptera | Apioceridae | | | | K |
| 1393 | Diptera | Apioceridae | | | | |
| 1812 | Diptera | Apioceridae | | | | K |
| 1232 | Diptera | Asilidae | | | | GA |

| Spec # | Order | Family | Tax 3 | Genus | Species | GR/K |
|---|---|---|---|---|---|---|
| 1255 | Diptera | Asilidae | | | | GA |
| 1273 | Diptera | Asilidae | | | | GA |
| 1369 | Diptera | Asilidae | | | | GA |
| 1370 | Diptera | Asilidae | | | | GA |
| 1411 | Diptera | Asilidae | | | | GA |
| 1424 | Diptera | Asilidae | | | | GA |
| 1478 | Diptera | Asilidae | | | | GA |
| 1529 | Diptera | Asilidae | | | | GA |
| 1690 | Diptera | Asilidae | | | | GA |
| 1703 | Diptera | Asilidae | | | | GA |
| 1732 | Diptera | Asilidae | | | | GA |
| 1755 | Diptera | Asilidae | | | | GA |
| 1756 | Diptera | Asilidae | | | | GA |
| 1760 | Diptera | Asilidae | | | | GA |
| 1784 | Diptera | Asilidae | | | | GA |
| 1811 | Diptera | Asilidae | | | | GA |
| 564 | Diptera | Asilidae | | | | GA |
| 165 | Diptera | Asilidae | | | | GA |
| 204 | Diptera | Asilidae | | | | GA |
| 217 | Diptera | Asilidae | | | | GA |
| 312 | Diptera | Asilidae | | | | GA |
| 313 | Diptera | Asilidae | | | | GA |
| 532 | Diptera | Asilidae | | | | GA |
| 541 | Diptera | Asilidae | | | | GA |
| 751 | Diptera | Asilidae | | | | GA |
| 775 | Diptera | Asilidae | | | | GA |
| 810 | Diptera | Asilidae | | | | GA |
| 907 | Diptera | Bombyliidae | | | | K |
| 1053 | Diptera | Bombyliidae | | | | K |
| 1202 | Diptera | Bombyliidae | | | | |
| 1542 | Diptera | Bombyliidae | | | | K |
| 245 | Diptera | Bombyliidae | | | | K |
| 506 | Diptera | Bombyliidae | | | | K |
| 683 | Diptera | Bombyliidae | | | | K |
| 719 | Diptera | Bombyliidae | | | | K |
| 745 | Diptera | Bombyliidae | | | | K |
| 1190 | Diptera | Calliphoridae | | | | |
| 1603 | Diptera | Calliphoridae | | | | |
| 1634 | Diptera | Calliphoridae | | | | |
| 53 | Diptera | Calliphoridae | | *Calliphora* | | |
| 480 | Diptera | Calliphoridae | | *Calliphora* | | |
| 1419 | Diptera | Calliphoridae ? | | | | |
| 1561 | Diptera | Calliphoridae ? | | | | |
| 676 | Diptera | Conopoidea | Conopidae | | | |
| 1291 | Diptera | Dolichopodidae | | | | |
| 125 | Diptera | Drosophilidae | | | | |
| 179 | Diptera | Drosophilidae | | | | |
| 1230 | Diptera | Empididae | | | | |
| 1725 | Diptera | Helosciomyzidae | | | | |
| 68 | Diptera | Lauxaniidae | | | | |
| 1358 | Diptera | Muscidae | | | | |
| 51 | Diptera | Muscidae | | | | |
| 128 | Diptera | Muscidae | | | | |
| 134 | Diptera | Muscidae | | | | |

| Spec # | Order | Family | Tax 3 | Genus | Species | GR/K |
|---|---|---|---|---|---|---|
| 205 | Diptera | Muscidae | | | | |
| 498 | Diptera | Muscidae | | | | |
| 675 | Diptera | Muscidae | | | | |
| 818 | Diptera | Muscidae | | | | |
| 88 | Diptera | Pyrgotidae | | | | K |
| 1151 | Diptera | Sarcophagidae | | | | |
| 1191 | Diptera | Sarcophagidae | | | | |
| 1229 | Diptera | Sarcophagidae | | | | |
| 1267 | Diptera | Sarcophagidae | | | | K |
| 1274 | Diptera | Sarcophagidae | | | | |
| 1704 | Diptera | Sarcophagidae | | | | |
| 579 | Diptera | Sarcophagidae | | | | |
| 1203 | Diptera | Syrphidae | | | | |
| 1268 | Diptera | Syrphidae | | | | K |
| 1421 | Diptera | Syrphidae | | | | |
| 1422 | Diptera | Syrphidae | | | | |
| 1425 | Diptera | Syrphidae | | | | |
| 1439 | Diptera | Syrphidae | | | | |
| 1455 | Diptera | Syrphidae | | | | |
| 1480 | Diptera | Syrphidae | | | | |
| 54 | Diptera | Syrphidae | | | | |
| 129 | Diptera | Syrphidae | | | | |
| 130 | Diptera | Syrphidae | | | | |
| 143 | Diptera | Syrphidae | | | | |
| 206 | Diptera | Syrphidae | | | | |
| 242 | Diptera | Syrphidae | | | | |
| 565 | Diptera | Syrphidae | | | | K |
| 884 | Diptera | Tabanidae | | | | GA |
| 901 | Diptera | Tabanidae | | | | GA |
| 1297 | Diptera | Tabanidae | | | | GA |
| 1321 | Diptera | Tabanidae | | | | |
| 1440 | Diptera | Tabanidae | | | | GA |
| 1548 | Diptera | Tabanidae | | | | GA |
| 1630 | Diptera | Tabanidae | | | | GA |
| 603 | Diptera | Tabanidae | | | | GA |
| 126 | Diptera | Tabanidae | | | | GA |
| 178 | Diptera | Tabanidae | | | | GA |
| 466 | Diptera | Tabanidae | | | | GA |
| 467 | Diptera | Tabanidae | | | | GA |
| 473 | Diptera | Tabanidae | | | | GA |
| 495 | Diptera | Tabanidae | | | | GA |
| 531 | Diptera | Tabanidae | | | | GA |
| 929 | Diptera | Tachinidae | | | | |
| 1398 | Diptera | Tachinidae | | | | |
| 136 | Diptera | Tachinidae | | | | K |
| 464 | Diptera | Tachinidae | | | | K |
| 1382 | Diptera | Therevidae | | | | K |
| 1395 | Diptera | Therevidae | | | | K |
| 1769 | Diptera | Therevidae | | | | K |
| 1802 | Diptera | Therevidae | | | | K |
| 142 | Diptera | Therevidae | | | | K |
| 1233 | Diptera | Tipulidae | | | | |
| 1324 | Diptera | Tipulidae | | | | |
| 1615 | Diptera | Tipulidae | | | | |

| Spec # | Order | Family | Tax 3 | Genus | Species | GR/K |
|---|---|---|---|---|---|---|
| 577 | Diptera | Tipulidae | | | | |
| 16 | Diptera | Tipulidae | | | | K |
| 588 | Diptera | Tipulidae | | | | |
| 792 | Diptera | Tipulidae | | | | K |
| 195 | Diptera | UNKNOWN | | | | |
| 969 | Gastropoda | | | | | |
| 1330 | Gastropoda | | | | | |
| 1431 | Gastropoda | | | | | |
| 1527 | Gastropoda | | | | | |
| 1565 | Gastropoda | | | | | |
| 1590 | Gastropoda | | | | | |
| 1692 | Gastropoda | | | | | |
| 1714 | Gastropoda | | | | | |
| 963 | Hemiptera | | | | | |
| 964 | Hemiptera | | | | | |
| 1024 | Hemiptera | | | | | |
| 1049 | Hemiptera | | | | | |
| 1072 | Hemiptera | | | | | |
| 1090 | Hemiptera | | | | | |
| 1122 | Hemiptera | | | | | |
| 1195 | Hemiptera | | | | | |
| 1196 | Hemiptera | | | | | |
| 1227 | Hemiptera | | | | | |
| 1239 | Hemiptera | | | | | |
| 1240 | Hemiptera | | | | | |
| 1257 | Hemiptera | | | | | |
| 1260 | Hemiptera | | | | | |
| 1281 | Hemiptera | | | | | |
| 1299 | Hemiptera | | | | | |
| 1302 | Hemiptera | | | | | |
| 1320 | Hemiptera | | | | | |
| 1524 | Hemiptera | | | | | |
| 1697 | Hemiptera | | | | | |
| 1751 | Hemiptera | | | | | |
| 107 | Hemiptera | | | | | |
| 109 | Hemiptera | | | | | |
| 110 | Hemiptera | | | | | |
| 164 | Hemiptera | | | | | |
| 166 | Hemiptera | | | | | |
| 170 | Hemiptera | | | | | |
| 177 | Hemiptera | | | | | |
| 187 | Hemiptera | | | | | |
| 188 | Hemiptera | | | | | |
| 200 | Hemiptera | | | | | |
| 239 | Hemiptera | | | | | |
| 241 | Hemiptera | | | | | |
| 249 | Hemiptera | | | | | |
| 489 | Hemiptera | | | | | K |
| 1753 | Hemiptera | Alydidae | | | | |
| 1748 | Hemiptera | Alydidae | | *Riptortus* | | |
| 787 | Hemiptera | Cicadellidae | | | | GA |
| 1288 | Hemiptera | Cicadidae | | | | |
| 1394 | Hemiptera | Cicadidae | | | | |
| 49 | Hemiptera | Cicadidae | | *Cicadetta* | | |

| Spec # | Order | Family | Tax 3 | Genus | Species | GR/K |
|---|---|---|---|---|---|---|
| 207 | Hemiptera | Cicadidae | | *Cicadetta* | | K |
| 916 | Hemiptera | Cicadidae | | | | |
| 1667 | Hemiptera | Coreidae | | *Amorbus ?* | | |
| 700 | Hemiptera | Coreidae | | *Amorbus* | *bispinus* | |
| 503 | Hemiptera | Eurymelidae | | *Pogonoscopus* | | K |
| 1415 | Hemiptera | Flatidae | | | | |
| 764 | Hemiptera | Fulgoridae | | | | |
| 1351 | Hemiptera | Gelastocoridae | | | | |
| 1383 | Hemiptera | Gelastocoridae | | | | |
| 1567 | Hemiptera | Gelastocoridae | | | | |
| 1611 | Hemiptera | Gelastocoridae | | | | |
| 527 | Hemiptera | Gelastocoridae | | *Nerthra* | | |
| 1445 | Hemiptera | Lygaeidae | | | | K |
| 679 | Hemiptera | Lygaeidae | | | | GA |
| 108 | Hemiptera | Membracidae | | | | K |
| 301 | Hemiptera | Membracidae | | | | K |
| 302 | Hemiptera | Membracidae | | | | K |
| 1683 | Hemiptera | Nabidae | | | | |
| 838 | Hemiptera | Pentatomidae | | | | |
| 960 | Hemiptera | Pentatomidae | | | | |
| 962 | Hemiptera | Pentatomidae | | | | |
| 990 | Hemiptera | Pentatomidae | | | | |
| 1466 | Hemiptera | Pentatomidae | | | | |
| 105 | Hemiptera | Pentatomidae | | | | K |
| 117 | Hemiptera | Pentatomidae | | | | |
| 153 | Hemiptera | Pentatomidae | | | | |
| 176 | Hemiptera | Pentatomidae | | | | |
| 221 | Hemiptera | Pentatomidae | | | | |
| 240 | Hemiptera | Pentatomidae | | | | K |
| 251 | Hemiptera | Pentatomidae | | | | |
| 475 | Hemiptera | Pentatomidae | | | | K |
| 513 | Hemiptera | Pentatomidae | | | | K |
| 669 | Hemiptera | Pentatomidae | | | | |
| 670 | Hemiptera | Pentatomidae | | | | |
| 680 | Hemiptera | Pentatomidae | | | | |
| 678 | Hemiptera | Pentatomidae | (green) | | | |
| 779 | Hemiptera | Pentatomidae | (nymph) | | | |
| 230 | Hemiptera | Pseudococcidae | | | | |
| 433 | Hemiptera | Reduvidae | | | | |
| 433 | Hemiptera | Reduvidae | | | | |
| 863 | Hemiptera | Reduviidae | | | | |
| 885 | Hemiptera | Reduviidae | | | | |
| 886 | Hemiptera | Reduviidae | | | | |
| 1379 | Hemiptera | Reduviidae | | | | |
| 1576 | Hemiptera | Reduviidae | | | | |
| 1647 | Hemiptera | Reduviidae | | | | |
| 150 | Hemiptera | Reduviidae | | | | K |
| 163 | Hemiptera | Reduviidae | | | | |
| 196 | Hemiptera | Reduviidae | | | | |
| 270 | Hemiptera | Reduviidae | | | | |
| 284 | Hemiptera | Reduviidae | | | | K |
| 311 | Hemiptera | Reduviidae | | | | K |
| 482 | Hemiptera | Reduviidae | | | | K |
| 512 | Hemiptera | Reduviidae | | | | K |

| Spec # | Order | Family | Tax 3 | Genus | Species | GR/K |
|---|---|---|---|---|---|---|
| 714 | Hemiptera | Reduviidae | | | | |
| 573 | Hemiptera | Reduviidae | | | | |
| 504 | Hymenoptera | | | | | |
| 1264 | Hymenoptera | Apidae | | | | K |
| 1271 | Hymenoptera | Apidae | | | | |
| 1328 | Hymenoptera | Apidae | | | | |
| 52 | Hymenoptera | Apidae | | *Apis* | *melifera* | K |
| 1093 | Hymenoptera | Braconidae | | | | |
| 1258 | Hymenoptera | Braconidae | | | | |
| 1259 | Hymenoptera | Braconidae | | | | |
| 1467 | Hymenoptera | Braconidae | | | | |
| 1525 | Hymenoptera | Braconidae | | | | |
| 1528 | Hymenoptera | Braconidae | | | | |
| 184 | Hymenoptera | Braconidae | | | | |
| 493 | Hymenoptera | Braconidae | | | | K |
| 1552 | Hymenoptera | Chrysididae | | | | K |
| 893 | Hymenoptera | Colletidae | | | | K |
| 1272 | Hymenoptera | Colletidae | | | | K |
| 1289 | Hymenoptera | Colletidae | | | | K |
| 1410 | Hymenoptera | Colletidae | | | | K |
| 1794 | Hymenoptera | Colletidae | | | | K |
| 1808 | Hymenoptera | Colletidae | | | | K |
| 545 | Hymenoptera | Colletidae | | | | K |
| 596 | Hymenoptera | Colletidae | | | | K |
| 183 | Hymenoptera | Colletidae | | | | K |
| 186 | Hymenoptera | Colletidae | | | | K |
| 203 | Hymenoptera | Colletidae | | | | K |
| 546 | Hymenoptera | Colletidae | | | | K |
| 696 | Hymenoptera | Colletidae | | | | K |
| 704 | Hymenoptera | Colletidae | | | | K |
| 730 | Hymenoptera | Colletidae | | | | K |
| 1362 | Hymenoptera | Evaniidae | | | | K |
| 1553 | Hymenoptera | Evaniidae | | | | K |
| 243 | Hymenoptera | Evaniidae | | | | K |
| 500 | Hymenoptera | Evaniidae | | | | K |
| 888 | Hymenoptera | Formicidae | | | | |
| 889 | Hymenoptera | Formicidae | | | | |
| 952 | Hymenoptera | Formicidae | | | | |
| 1006 | Hymenoptera | Formicidae | | | | |
| 1011 | Hymenoptera | Formicidae | | | | |
| 1495 | Hymenoptera | Formicidae | | | | |
| 1496 | Hymenoptera | Formicidae | | | | |
| 1497 | Hymenoptera | Formicidae | | | | |
| 1507 | Hymenoptera | Formicidae | | | | |
| 1537 | Hymenoptera | Formicidae | | | | |
| 1569 | Hymenoptera | Formicidae | | | | |
| 1664 | Hymenoptera | Formicidae | | | | |
| 1700 | Hymenoptera | Formicidae | | | | |
| 1776 | Hymenoptera | Formicidae | | | | |
| 423 | Hymenoptera | Formicidae | | *Camponotus* | | K |
| 1661 | Hymenoptera | Formicidae | | *Camponotus* | | |
| 1770 | Hymenoptera | Formicidae | | *Camponotus* | | |
| 1585 | Hymenoptera | Formicidae | | *Camponotus* | | |
| 1594 | Hymenoptera | Formicidae | | *Camponotus* | | |

| Spec # | Order | Family | Tax 3 | Genus | Species | GR/K |
|---|---|---|---|---|---|---|
| 1602 | Hymenoptera | Formicidae | | *Camponotus* | | |
| 1575 | Hymenoptera | Formicidae | | *Rhytidoponera* | | |
| 1618 | Hymenoptera | Formicidae | | *Rhytidoponera* | | |
| 510 | Hymenoptera | Formicidae | | | | |
| 275 | Hymenoptera | Formicidae | | *Iridomyrmex* | | |
| 737 | Hymenoptera | Formicidae | | *Pachycondyla* | | 11 |
| 535 | Hymenoptera | Formicidae | Dolichoderinae | *Iridomyrmex* | | |
| 1676 | Hymenoptera | Formicidae | Formicinae | | | |
| 222 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 252 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 279 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 281 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 343 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 478 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 486 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 487 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 552 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 712 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 945 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 974 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 998 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 1209 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 1226 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 1266 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 1269 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 1280 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 1287 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 1293 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 1317 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 1374 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 1384 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 1391 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 1406 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 1457 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 1473 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 1534 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 1535 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 1577 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 1649 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 1668 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 1673 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 1686 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 1687 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 1689 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 1718 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 1757 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 1759 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 1782 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 1787 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 1795 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 1805 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 1807 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 408 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 409 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |

| Spec # | Order | Family | Tax 3 | Genus | Species | GR/K |
|---|---|---|---|---|---|---|
| 487 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 664 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | GA |
| 477 | Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | *callima* | GA |
| 543 | Hymenoptera | Formicidae | Poneri | *Rhytidoponera* | | |
| 542 | Hymenoptera | Formicidae | Ponerinae | *Prionopella* | | |
| 697 | Hymenoptera | Gasteruptiidae | | | | |
| 1771 | Hymenoptera | Ichneumonidae | | | | GA |
| 1037 | Hymenoptera | Ichneumonidae | | | | GA |
| 1038 | Hymenoptera | Ichneumonidae | | | | GA |
| 1055 | Hymenoptera | Ichneumonidae | | | | GA |
| 1077 | Hymenoptera | Ichneumonidae | | | | GA |
| 1079 | Hymenoptera | Ichneumonidae | | | | GA |
| 1089 | Hymenoptera | Ichneumonidae | | | | GA |
| 1105 | Hymenoptera | Ichneumonidae | | | | GA |
| 1146 | Hymenoptera | Ichneumonidae | | | | GA |
| 1153 | Hymenoptera | Ichneumonidae | | | | GA |
| 1156 | Hymenoptera | Ichneumonidae | | | | GA |
| 1164 | Hymenoptera | Ichneumonidae | | | | GA |
| 1165 | Hymenoptera | Ichneumonidae | | | | GA |
| 1436 | Hymenoptera | Ichneumonidae | | | | GA |
| 1606 | Hymenoptera | Ichneumonidae | | | | GA |
| 1637 | Hymenoptera | Ichneumonidae | | | | GA |
| 1648 | Hymenoptera | Ichneumonidae | | | | GA |
| 1662 | Hymenoptera | Ichneumonidae | | | | GA |
| 1685 | Hymenoptera | Ichneumonidae | | | | GA |
| 1688 | Hymenoptera | Ichneumonidae | | | | GA |
| 1720 | Hymenoptera | Ichneumonidae | | | | GA |
| 1740 | Hymenoptera | Ichneumonidae | | | | GA |
| 1743 | Hymenoptera | Ichneumonidae | | | | GA |
| 515 | Hymenoptera | Ichneumonidae | | | | GA |
| 698 | Hymenoptera | Ichneumonidae | | | | GA |
| 87 | Hymenoptera | Ichneumonidae | | *Ophion* | | GA |
| 533 | Hymenoptera | Ichneumonidae | Branchinae | *Australoglypta* | | GA |
| 1359 | Hymenoptera | Mutillidae | | | | K |
| 1613 | Hymenoptera | Mutillidae | | | | K |
| 1623 | Hymenoptera | Mutillidae | | | | K |
| 534 | Hymenoptera | Mutillidae | | | | |
| 580 | Hymenoptera | Mutillidae | | | | K |
| 1380 | Hymenoptera | Mutillidae | | | | |
| 1804 | Hymenoptera | Mutillidae | | | | K |
| 1694 | Hymenoptera | Pergidae | | | | GA |
| 1550 | Hymenoptera | Pergidae | | *Perga* | | GA |
| 1002 | Hymenoptera | Pompilidae | | | | GA |
| 1017 | Hymenoptera | Pompilidae | | | | GA |
| 1204 | Hymenoptera | Pompilidae | | | | GA |
| 1356 | Hymenoptera | Pompilidae | | | | GA |
| 1591 | Hymenoptera | Pompilidae | | | | GA |
| 1598 | Hymenoptera | Pompilidae | | | | GA |
| 1601 | Hymenoptera | Pompilidae | | | | GA |
| 1777 | Hymenoptera | Pompilidae | | | | GA |
| 1781 | Hymenoptera | Pompilidae | | | | GA |
| 1788 | Hymenoptera | Pompilidae | | | | GA |
| 584 | Hymenoptera | Pompilidae | | | | GA |
| 607 | Hymenoptera | Pompilidae | | | | GA |

| Spec # | Order | Family | Tax 3 | Genus | Species | GR/K |
|---|---|---|---|---|---|---|
| 611 | Hymenoptera | Pompilidae | | | | GA |
| 616 | Hymenoptera | Pompilidae | | | | GA |
| 295 | Hymenoptera | Pompilidae | | | | GA |
| 494 | Hymenoptera | Pompilidae | | | | GA |
| 612 | Hymenoptera | Pompilidae | | | | GA |
| 617 | Hymenoptera | Pompilidae | | | | GA |
| 619 | Hymenoptera | Pompilidae | | | | GA |
| 699 | Hymenoptera | Pompilidae | | | | GA |
| 790 | Hymenoptera | Pompilidae | | | | GA |
| 813 | Hymenoptera | Pompilidae | | | | GA |
| 622 | Hymenoptera | Pompilidae | | *Cryptocheilus* | *fabricolor* | GA |
| 1742 | Hymenoptera | Scoliidae | | | | |
| 1212 | Hymenoptera | Sphecidae | | | | K |
| 1344 | Hymenoptera | Sphecidae | | | | K |
| 1402 | Hymenoptera | Sphecidae | | | | |
| 1408 | Hymenoptera | Sphecidae | | | | K |
| 1727 | Hymenoptera | Sphecidae | | | | |
| 505 | Hymenoptera | Sphecidae | | | | K |
| 720 | Hymenoptera | Sphecidae | | | | |
| 723 | Hymenoptera | Sphecidae | | | | |
| 1806 | Hymenoptera | Sphecidae | Larrinae | | | |
| 1071 | Hymenoptera | Tiphiidae | | | | GA |
| 1234 | Hymenoptera | Tiphiidae | | | | GA |
| 1335 | Hymenoptera | Tiphiidae | | | | GA |
| 1458 | Hymenoptera | Tiphiidae | | | | GA |
| 1479 | Hymenoptera | Tiphiidae | | | | GA |
| 1706 | Hymenoptera | Tiphiidae | | | | GA |
| 1707 | Hymenoptera | Tiphiidae | | | | GA |
| 604 | Hymenoptera | Tiphiidae | | | | GA |
| 614 | Hymenoptera | Tiphiidae | | | | GA |
| 796 | Hymenoptera | Tiphiidae | | | | GA |
| 801 | Hymenoptera | Tiphiidae | | | | GA |
| 806 | Hymenoptera | Tiphiidae | | | | GA |
| 1712 | Hymenoptera | Tiphiidae | Thyninnae | | | GA |
| 1713 | Hymenoptera | Tiphiidae | Thyninnae | | | GA |
| 1730 | Hymenoptera | Tiphiidae | Thyninnae | | | GA |
| 1731 | Hymenoptera | Tiphiidae | Thyninnae | | | GA |
| 1286 | Hymenoptera | Tiphiidae | Thynninae | | | GA |
| 1325 | Hymenoptera | Tiphiidae | Thynninae | | | GA |
| 1530 | Hymenoptera | Tiphiidae | Thynninae | | | GA |
| 1663 | Hymenoptera | Tiphiidae | Thynninae | | | GA |
| 1709 | Hymenoptera | Tiphiidae | Thynninae | | | GA |
| 481 | Hymenoptera | Tiphiidae | Thynninae | | | GA |
| 516 | Hymenoptera | Tiphiidae | Thynninae | | | GA |
| 685 | Hymenoptera | Tiphiidae | Thynninae | | | GA |
| 894 | Hymenoptera | Vespidae | | | | |
| 1198 | Hymenoptera | Vespidae | | | | K |
| 1371 | Hymenoptera | Vespidae | | | | |
| 1701 | Hymenoptera | Vespidae | | | | K |
| 1339 | Hymenoptera | Vespidae | Eumeninae | | | K |
| 544 | Isopoda | | | | | |
| 549 | Isopoda | | | | | |
| 1305 | Isopoda | | | | | GR |
| 1430 | Isopoda | | | | | |

| Spec # | Order | Family | Tax 3 | Genus | Species | GR/K |
|---|---|---|---|---|---|---|
| 1586 | Isopoda | | | | | |
| 1735 | Isopoda | | | | | |
| 519 | Isopoda | | collective sample | | | |
| 262 | Isopoda | | | | | GR |
| 539 | Isopoda | | | | | |
| 540 | Isopoda | | | | | |
| 671 | Isopoda | | | | | |
| 73 | Lepidoptera | | | | | |
| 345 | Lepidoptera | | | | | |
| 556 | Lepidoptera | | | | | |
| 627 | Lepidoptera | | | | | |
| 797 | Lepidoptera | | | | | |
| 1023 | Lepidoptera | | | | | |
| 1027 | Lepidoptera | | | | | |
| 1028 | Lepidoptera | | | | | |
| 1029 | Lepidoptera | | | | | |
| 1030 | Lepidoptera | | | | | |
| 1031 | Lepidoptera | | | | | |
| 1032 | Lepidoptera | | | | | |
| 1034 | Lepidoptera | | | | | |
| 1036 | Lepidoptera | | | | | |
| 1045 | Lepidoptera | | | | | |
| 1046 | Lepidoptera | | | | | |
| 1047 | Lepidoptera | | | | | |
| 1048 | Lepidoptera | | | | | |
| 1051 | Lepidoptera | | | | | |
| 1054 | Lepidoptera | | | | | |
| 1056 | Lepidoptera | | | | | |
| 1060 | Lepidoptera | | | | | |
| 1066 | Lepidoptera | | | | | |
| 1068 | Lepidoptera | | | | | |
| 1070 | Lepidoptera | | | | | |
| 1075 | Lepidoptera | | | | | |
| 1078 | Lepidoptera | | | | | |
| 1081 | Lepidoptera | | | | | |
| 1084 | Lepidoptera | | | | | |
| 1085 | Lepidoptera | | | | | |
| 1088 | Lepidoptera | | | | | |
| 1091 | Lepidoptera | | | | | |
| 1094 | Lepidoptera | | | | | |
| 1095 | Lepidoptera | | | | | |
| 1096 | Lepidoptera | | | | | |
| 1098 | Lepidoptera | | | | | |
| 1099 | Lepidoptera | | | | | |
| 1106 | Lepidoptera | | | | | |
| 1119 | Lepidoptera | | | | | |
| 1127 | Lepidoptera | | | | | |
| 1128 | Lepidoptera | | | | | |
| 1129 | Lepidoptera | | | | | |
| 1130 | Lepidoptera | | | | | |
| 1131 | Lepidoptera | | | | | |
| 1132 | Lepidoptera | | | | | |
| 1134 | Lepidoptera | | | | | |
| 1135 | Lepidoptera | | | | | |

| Spec # | Order | Family | Tax 3 | Genus | Species | GR/K |
|---|---|---|---|---|---|---|
| 1137 | Lepidoptera | | | | | |
| 1139 | Lepidoptera | | | | | |
| 1140 | Lepidoptera | | | | | |
| 1141 | Lepidoptera | | | | | |
| 1142 | Lepidoptera | | | | | |
| 1144 | Lepidoptera | | | | | |
| 1145 | Lepidoptera | | | | | |
| 1147 | Lepidoptera | | | | | |
| 1148 | Lepidoptera | | | | | |
| 1149 | Lepidoptera | | | | | |
| 1150 | Lepidoptera | | | | | |
| 1152 | Lepidoptera | | | | | |
| 1155 | Lepidoptera | | | | | |
| 1157 | Lepidoptera | | | | | |
| 1158 | Lepidoptera | | | | | |
| 1161 | Lepidoptera | | | | | |
| 1162 | Lepidoptera | | | | | |
| 1163 | Lepidoptera | | | | | |
| 1166 | Lepidoptera | | | | | |
| 1167 | Lepidoptera | | | | | |
| 1168 | Lepidoptera | | | | | |
| 1169 | Lepidoptera | | | | | |
| 1170 | Lepidoptera | | | | | |
| 1171 | Lepidoptera | | | | | |
| 1173 | Lepidoptera | | | | | |
| 1174 | Lepidoptera | | | | | |
| 1178 | Lepidoptera | | | | | |
| 1179 | Lepidoptera | | | | | |
| 1180 | Lepidoptera | | | | | |
| 1181 | Lepidoptera | | | | | |
| 1184 | Lepidoptera | | | | | |
| 1193 | Lepidoptera | | | | | |
| 1194 | Lepidoptera | | | | | |
| 1201 | Lepidoptera | | | | | |
| 1222 | Lepidoptera | | | | | |
| 1256 | Lepidoptera | | | | | |
| 1296 | Lepidoptera | | | | | K |
| 1301 | Lepidoptera | | | | | |
| 1454 | Lepidoptera | | | | | |
| 1488 | Lepidoptera | | | | | |
| 1489 | Lepidoptera | | | | | |
| 1490 | Lepidoptera | | | | | |
| 1491 | Lepidoptera | | | | | |
| 1492 | Lepidoptera | | | | | |
| 1493 | Lepidoptera | | | | | |
| 1494 | Lepidoptera | | | | | |
| 1499 | Lepidoptera | | | | | |
| 1501 | Lepidoptera | | | | | |
| 1502 | Lepidoptera | | | | | |
| 1503 | Lepidoptera | | | | | |
| 1504 | Lepidoptera | | | | | |
| 1506 | Lepidoptera | | | | | |
| 1509 | Lepidoptera | | | | | |
| 1510 | Lepidoptera | | | | | |

| Spec # | Order | Family | Tax 3 | Genus | Species | GR/K |
|---|---|---|---|---|---|---|
| 1512 | Lepidoptera | | | | | |
| 1513 | Lepidoptera | | | | | |
| 1514 | Lepidoptera | | | | | |
| 1515 | Lepidoptera | | | | | |
| 1516 | Lepidoptera | | | | | |
| 1517 | Lepidoptera | | | | | |
| 1518 | Lepidoptera | | | | | |
| 1519 | Lepidoptera | | | | | |
| 1521 | Lepidoptera | | | | | |
| 1626 | Lepidoptera | | | | | |
| 1627 | Lepidoptera | | | | | |
| 1628 | Lepidoptera | | | | | |
| 1631 | Lepidoptera | | | | | |
| 1632 | Lepidoptera | | | | | |
| 1633 | Lepidoptera | | | | | |
| 1635 | Lepidoptera | | | | | |
| 1638 | Lepidoptera | | | | | |
| 1641 | Lepidoptera | | | | | |
| 1643 | Lepidoptera | | | | | |
| 1645 | Lepidoptera | | | | | |
| 1646 | Lepidoptera | | | | | |
| 1650 | Lepidoptera | | | | | |
| 1651 | Lepidoptera | | | | | |
| 1652 | Lepidoptera | | | | | |
| 1654 | Lepidoptera | | | | | |
| 1655 | Lepidoptera | | | | | |
| 1657 | Lepidoptera | | | | | |
| 1658 | Lepidoptera | | | | | |
| 1659 | Lepidoptera | | | | | |
| 1665 | Lepidoptera | | | | | |
| 1674 | Lepidoptera | | | | | |
| 1729 | Lepidoptera | | | | | |
| 1815 | Lepidoptera | | | | | |
| 322 | Lepidoptera | | | | | |
| 752 | Lepidoptera | | | | | |
| 20 | Lepidoptera | | | | | |
| 21 | Lepidoptera | | | | | |
| 25 | Lepidoptera | | | | | |
| 32 | Lepidoptera | | | | | |
| 33 | Lepidoptera | | | | | |
| 38 | Lepidoptera | | | | | |
| 48 | Lepidoptera | | | | | |
| 60 | Lepidoptera | | | | | |
| 61 | Lepidoptera | | | | | |
| 62 | Lepidoptera | | | | | K |
| 63 | Lepidoptera | | | | | |
| 65 | Lepidoptera | | | | | |
| 67 | Lepidoptera | | | | | |
| 73 | Lepidoptera | | | | | |
| 76 | Lepidoptera | | | | | |
| 77 | Lepidoptera | | | | | |
| 80 | Lepidoptera | | | | | K |
| 104 | Lepidoptera | | | | | |
| 111 | Lepidoptera | | | | | |

| Spec # | Order | Family | Tax 3 | Genus | Species | GR/K |
|---|---|---|---|---|---|---|
| 138 | Lepidoptera | | | | | |
| 197 | Lepidoptera | | | | | |
| 236 | Lepidoptera | | | | | |
| 238 | Lepidoptera | | | | | |
| 315 | Lepidoptera | | | | | |
| 316 | Lepidoptera | | | | | |
| 337 | Lepidoptera | | | | | |
| 350 | Lepidoptera | | | | | |
| 362 | Lepidoptera | | | | | |
| 366 | Lepidoptera | | | | | |
| 367 | Lepidoptera | | | | | |
| 369 | Lepidoptera | | | | | |
| 376 | Lepidoptera | | | | | |
| 380 | Lepidoptera | | | | | |
| 382 | Lepidoptera | | | | | |
| 383 | Lepidoptera | | | | | |
| 387 | Lepidoptera | | | | | |
| 394 | Lepidoptera | | | | | |
| 399 | Lepidoptera | | | | | |
| 406 | Lepidoptera | | | | | |
| 407 | Lepidoptera | | | | | |
| 411 | Lepidoptera | | | | | |
| 413 | Lepidoptera | | | | | |
| 414 | Lepidoptera | | | | | |
| 419 | Lepidoptera | | | | | |
| 420 | Lepidoptera | | | | | |
| 421 | Lepidoptera | | | | | |
| 422 | Lepidoptera | | | | | |
| 428 | Lepidoptera | | | | | |
| 429 | Lepidoptera | | | | | |
| 430 | Lepidoptera | | | | | |
| 431 | Lepidoptera | | | | | |
| 434 | Lepidoptera | | | | | |
| 438 | Lepidoptera | | | | | |
| 441 | Lepidoptera | | | | | |
| 442 | Lepidoptera | | | | | |
| 443 | Lepidoptera | | | | | |
| 446 | Lepidoptera | | | | | K |
| 452 | Lepidoptera | | | | | K |
| 453 | Lepidoptera | | | | | |
| 454 | Lepidoptera | | | | | |
| 456 | Lepidoptera | | | | | |
| 459 | Lepidoptera | | | | | |
| 657 | Lepidoptera | | | | | K |
| 660 | Lepidoptera | | | | | |
| 661 | Lepidoptera | | | | | |
| 662 | Lepidoptera | | | | | |
| 750 | Lepidoptera | | | | | |
| 754 | Lepidoptera | | | | | |
| 760 | Lepidoptera | | | | | |
| 773 | Lepidoptera | | | | | |
| 797 | Lepidoptera | | | | | |
| 798 | Lepidoptera | | | | | |
| 5 | Lepidoptera | | | *Agrotis ?* | | |

| Spec # | Order | Family | Tax 3 | Genus | Species | GR/K |
|---|---|---|---|---|---|---|
| 341 | Lepidoptera | ? | | | | |
| 821 | Lepidoptera | ? | | | | |
| 828 | Lepidoptera | ? | | | | |
| 829 | Lepidoptera | ? | | | | |
| 849 | Lepidoptera | ? | | | | |
| 855 | Lepidoptera | ? | | | | |
| 856 | Lepidoptera | ? | | | | |
| 861 | Lepidoptera | ? | | | | |
| 864 | Lepidoptera | ? | | | | |
| 866 | Lepidoptera | ? | | | | |
| 896 | Lepidoptera | ? | | | | |
| 900 | Lepidoptera | ? | | | | |
| 915 | Lepidoptera | ? | | | | |
| 917 | Lepidoptera | ? | | | | |
| 918 | Lepidoptera | ? | | | | |
| 920 | Lepidoptera | ? | | | | |
| 921 | Lepidoptera | ? | | | | |
| 944 | Lepidoptera | ? | | | | |
| 946 | Lepidoptera | ? | | | | |
| 947 | Lepidoptera | ? | | | | |
| 950 | Lepidoptera | ? | | | | |
| 954 | Lepidoptera | ? | | | | |
| 958 | Lepidoptera | ? | | | | |
| 978 | Lepidoptera | ? | | | | |
| 983 | Lepidoptera | ? | | | | |
| 984 | Lepidoptera | ? | | | | |
| 985 | Lepidoptera | ? | | | | |
| 986 | Lepidoptera | ? | | | | |
| 1018 | Lepidoptera | ? | | | | |
| 1019 | Lepidoptera | ? | | | | |
| 1020 | Lepidoptera | ? | | | | |
| 840 | Lepidoptera | ? | | | | |
| 381 | Lepidoptera | Anthelidae | | | | K |
| 457 | Lepidoptera | Anthelidae | | | | K |
| 352 | Lepidoptera | Anthelidae | | *Anthela* | | K |
| 91 | Lepidoptera | Anthelidae | | *Chenuala* | | K |
| 987 | Lepidoptera | Arctiidae | | *Utetheisa* | *pulchelloides* | |
| 6 | Lepidoptera | Arctiidae | | | | K |
| 445 | Lepidoptera | Arctiidae | Arctiinae | *Spilosoma* | | K |
| 749 | Lepidoptera | Bombycidae | | | | |
| 1 | Lepidoptera | Carthaeidae | | *Carthaea* | *saturnioides* | K |
| 658 | Lepidoptera | Gelechiodea | | | | |
| 820 | Lepidoptera | Geometridae | | | | |
| 827 | Lepidoptera | Geometridae | | | | |
| 835 | Lepidoptera | Geometridae | | | | |
| 836 | Lepidoptera | Geometridae | | | | |
| 858 | Lepidoptera | Geometridae | | | | |
| 862 | Lepidoptera | Geometridae | | | | |
| 919 | Lepidoptera | Geometridae | | | | |
| 923 | Lepidoptera | Geometridae | | | | |
| 925 | Lepidoptera | Geometridae | | | | |
| 927 | Lepidoptera | Geometridae | | | | |
| 942 | Lepidoptera | Geometridae | | | | |
| 977 | Lepidoptera | Geometridae | | | | |

| Spec # | Order | Family | Tax 3 | Genus | Species | GR/K |
|---|---|---|---|---|---|---|
| 955 | Lepidoptera | Geometridae | | *Hypobapta* | *percomptaria* | K |
| 832 | Lepidoptera | Geometridae | | *Lissomma* | | |
| 12 | Lepidoptera | Geometridae | | | | K |
| 23 | Lepidoptera | Geometridae | | | | K |
| 24 | Lepidoptera | Geometridae | | | | K |
| 41 | Lepidoptera | Geometridae | | | | K |
| 46 | Lepidoptera | Geometridae | | | | |
| 47 | Lepidoptera | Geometridae | | | | |
| 50 | Lepidoptera | Geometridae | | | | K |
| 59 | Lepidoptera | Geometridae | | | | K |
| 66 | Lepidoptera | Geometridae | | | | |
| 72 | Lepidoptera | Geometridae | | | | |
| 82 | Lepidoptera | Geometridae | | | | |
| 83 | Lepidoptera | Geometridae | | | | |
| 85 | Lepidoptera | Geometridae | | | | |
| 86 | Lepidoptera | Geometridae | | | | |
| 95 | Lepidoptera | Geometridae | | | | |
| 96 | Lepidoptera | Geometridae | | | | |
| 97 | Lepidoptera | Geometridae | | | | |
| 317 | Lepidoptera | Geometridae | | | | |
| 318 | Lepidoptera | Geometridae | | | | |
| 321 | Lepidoptera | Geometridae | | | | K |
| 323 | Lepidoptera | Geometridae | | | | |
| 326 | Lepidoptera | Geometridae | | | | |
| 327 | Lepidoptera | Geometridae | | | | |
| 338 | Lepidoptera | Geometridae | | | | |
| 339 | Lepidoptera | Geometridae | | | | |
| 355 | Lepidoptera | Geometridae | | | | |
| 358 | Lepidoptera | Geometridae | | | | |
| 375 | Lepidoptera | Geometridae | | | | K |
| 389 | Lepidoptera | Geometridae | | | | K |
| 392 | Lepidoptera | Geometridae | | | | K |
| 393 | Lepidoptera | Geometridae | | | | K |
| 395 | Lepidoptera | Geometridae | | | | |
| 402 | Lepidoptera | Geometridae | | | | |
| 403 | Lepidoptera | Geometridae | | | | K |
| 415 | Lepidoptera | Geometridae | | | | K |
| 424 | Lepidoptera | Geometridae | | | | K |
| 425 | Lepidoptera | Geometridae | | | | K |
| 436 | Lepidoptera | Geometridae | | | | K |
| 436 | Lepidoptera | Geometridae | | | | |
| 451 | Lepidoptera | Geometridae | | | | K |
| 517 | Lepidoptera | Geometridae | | | | |
| 634 | Lepidoptera | Geometridae | | | | |
| 637 | Lepidoptera | Geometridae | | | | |
| 638 | Lepidoptera | Geometridae | | | | |
| 639 | Lepidoptera | Geometridae | | | | |
| 644 | Lepidoptera | Geometridae | | | | |
| 655 | Lepidoptera | Geometridae | | | | |
| 691 | Lepidoptera | Geometridae | | | | |
| 694 | Lepidoptera | Geometridae | | | | |
| 756 | Lepidoptera | Geometridae | | | | |
| 757 | Lepidoptera | Geometridae | | | | |
| 758 | Lepidoptera | Geometridae | | | | |

| Spec # | Order | Family | Tax 3 | Genus | Species | GR/K |
|---|---|---|---|---|---|---|
| 759 | Lepidoptera | Geometridae | | | | |
| 765 | Lepidoptera | Geometridae | | | | |
| 776 | Lepidoptera | Geometridae | | | | |
| 320 | Lepidoptera | Geometridae | | *Arhodia* | | K |
| 22 | Lepidoptera | Geometridae | | *Chlorocoma* | | K |
| 19 | Lepidoptera | Geometridae | | *Chlorocoma* | *dicloraria* | K |
| 330 | Lepidoptera | Geometridae | | *Crypsiphona* | *ocultaria* | K |
| 357 | Lepidoptera | Geometridae | | *Eucyclodes* | *buprestaria* | K |
| 417 | Lepidoptera | Geometridae | | *Gastrina* | | K |
| 42 | Lepidoptera | Geometridae | | *Gastrina* | *cristaria* | K |
| 455 | Lepidoptera | Geometridae | | *Gastrina* | *cristaria* | |
| 334 | Lepidoptera | Geometridae | | *Gastrina* | *cristarina* | K |
| 663 | Lepidoptera | Geometridae | | *Heliomystis* | | |
| 31 | Lepidoptera | Geometridae | | *Parepisparis* | *excusata* | K |
| 377 | Lepidoptera | Geometridae | | *Phallaria* | *ophiusaria* | K |
| 384 | Lepidoptera | Geometridae | | *Pholodes* | | K |
| 385 | Lepidoptera | Geometridae | | *Pholodes* | | K |
| 450 | Lepidoptera | Geometridae | | *Thalaina* | *clara* | K |
| 976 | Lepidoptera | Geometridae | Oenochrominae | | | K |
| 2 | Lepidoptera | Geometridae | Oenochrominae | *Arhodia* | | K |
| 79 | Lepidoptera | Geometridae | Oenochrominae | *Arhodia* | | K |
| 625 | Lepidoptera | Geometridae ? | | | | |
| 830 | Lepidoptera | Geometridae ? | | | | |
| 1022 | Lepidoptera | Geometridae ? | | | | |
| 41 | Lepidoptera | Geometridae ? | | | | |
| 753 | Lepidoptera | Geometridae ? | | | | |
| 772 | Lepidoptera | Geometridae ? | | | | |
| 761 | Lepidoptera | Hepialidae | | *Abantiades* | | K |
| 372 | Lepidoptera | Hepialidae | | *Abantiades* | *hydrographis* | GA |
| 373 | Lepidoptera | Hepialidae | | *Abantiades* | *ocellatus* | GA |
| 1228 | Lepidoptera | Hesperiidae | | *Exometoeca* | *nycteris* | K |
| 593 | Lepidoptera | Hesperiidae | | *Hesperilla* | *chrysotricha* | K |
| 1340 | Lepidoptera | Hesperiidae | Trapezitinae | *Mesodina* | *cyanophracta* | |
| 693 | Lepidoptera | Lasiocampidae | | | | |
| 755 | Lepidoptera | Lasiocampidae | | | | |
| 426 | Lepidoptera | Lasiocampidae | | *Entometa* | | K |
| 371 | Lepidoptera | Lasiocampidae | | *Entometa* | *fervens* | K |
| 895 | Lepidoptera | Limacodidae | | *Doratifera* | | |
| 1625 | Lepidoptera | Limacodidae | | *Doratifera* | | |
| 551 | Lepidoptera | Limacodidae | | *Doratifera* | *quadriguttata* | |
| 90 | Lepidoptera | Limacodidae | | | | K |
| 81 | Lepidoptera | Limacodidae | | *Doratifera* | | K |
| 332 | Lepidoptera | Limacodidae | | *Doratifera* | | K |
| 398 | Lepidoptera | Limacodidae | | *Doratifera* | | K |
| 870 | Lepidoptera | Lycaenidae | | | | |
| 1341 | Lepidoptera | Lycaenidae | | | | |
| 1249 | Lepidoptera | Lycaenidae | | *Candalides* | | |
| 296 | Lepidoptera | Lycaenidae | | | | K |
| 34 | Lepidoptera | Lymantriidae | | *Teia* | *athlophora* | K |
| 345 | Lepidoptera | Noctuidae | | | | K |
| 523 | Lepidoptera | Noctuidae | | | | |
| 626 | Lepidoptera | Noctuidae | | | | |
| 833 | Lepidoptera | Noctuidae | | | | |
| 847 | Lepidoptera | Noctuidae | | | | |

| Spec # | Order | Family | Tax 3 | Genus | Species | GR/K |
|---|---|---|---|---|---|---|
| 853 | Lepidoptera | Noctuidae | | | | |
| 996 | Lepidoptera | Noctuidae | | | | |
| 1003 | Lepidoptera | Noctuidae | | | | |
| 1511 | Lepidoptera | Noctuidae | | | | |
| 345 | Lepidoptera | Noctuidae | | | | K |
| 844 | Lepidoptera | Noctuidae | | *Agrotis* | | |
| 39 | Lepidoptera | Noctuidae | | | | K |
| 74 | Lepidoptera | Noctuidae | | | | |
| 75 | Lepidoptera | Noctuidae | | | | |
| 133 | Lepidoptera | Noctuidae | | | | |
| 137 | Lepidoptera | Noctuidae | | | | |
| 139 | Lepidoptera | Noctuidae | | | | |
| 140 | Lepidoptera | Noctuidae | | | | |
| 329 | Lepidoptera | Noctuidae | | | | K |
| 344 | Lepidoptera | Noctuidae | | | | K |
| 346 | Lepidoptera | Noctuidae | | | | K |
| 364 | Lepidoptera | Noctuidae | | | | |
| 386 | Lepidoptera | Noctuidae | | | | |
| 391 | Lepidoptera | Noctuidae | | | | |
| 405 | Lepidoptera | Noctuidae | | | | |
| 412 | Lepidoptera | Noctuidae | | | | K |
| 435 | Lepidoptera | Noctuidae | | | | K |
| 449 | Lepidoptera | Noctuidae | | | | K |
| 518 | Lepidoptera | Noctuidae | | | | |
| 589 | Lepidoptera | Noctuidae | | | | |
| 598 | Lepidoptera | Noctuidae | | | | |
| 642 | Lepidoptera | Noctuidae | | | | |
| 648 | Lepidoptera | Noctuidae | | | | |
| 649 | Lepidoptera | Noctuidae | | | | |
| 650 | Lepidoptera | Noctuidae | | | | |
| 656 | Lepidoptera | Noctuidae | | | | |
| 769 | Lepidoptera | Noctuidae | | | | |
| 770 | Lepidoptera | Noctuidae | | | | |
| 771 | Lepidoptera | Noctuidae | | | | |
| 799 | Lepidoptera | Noctuidae | | | | |
| 18 | Lepidoptera | Noctuidae | | *Agrotis* | *munda* | K |
| 659 | Lepidoptera | Noctuidae | | *Chrysodeixis* | | |
| 336 | Lepidoptera | Noctuidae | | *Chrysodeixis* | *argentifera* | K |
| 30 | Lepidoptera | Noctuidae | | *Dasypodia* | *selenophora* | |
| 388 | Lepidoptera | Noctuidae | | *Pantydia* | | |
| 379 | Lepidoptera | Noctuidae | | *Peripyra* | *sanguinipucta* | K |
| 185 | Lepidoptera | Noctuidae | | *Periscepta* | *polystieta* | K |
| 40 | Lepidoptera | Noctuidae | | *Persectania* | | K |
| 686 | Lepidoptera | Noctuidae | | *Uraba* | *lugens* | K |
| 859 | Lepidoptera | Noctuidae | Mythimna (?) | | | |
| 643 | Lepidoptera | Noctuidae ? | | | | |
| 766 | Lepidoptera | Noctuidae ? | | | | |
| 1738 | Lepidoptera | Notodontidae | | *Danima* | | |
| 4 | Lepidoptera | Notodontidae | | *Destolmia* | *lineata* | K |
| 58 | Lepidoptera | Notodontidae | | | | K |
| 374 | Lepidoptera | Notodontidae | | | | K |
| 57 | Lepidoptera | Notodontidae | | *Danima* | *banksiae* | K |
| 58 | Lepidoptera | Notodontidae | | *Hylaeora* | *dilucida* | K |
| 306 | Lepidoptera | Nymphalidae | | *Geitoneura* | *klugii* | K |

| Spec # | Order | Family | Tax 3 | Genus | Species | GR/K |
|---|---|---|---|---|---|---|
| 594 | Lepidoptera | Nymphalidae | | *Vanessa* | *kershawi* | K |
| 298 | Lepidoptera | Nymphalidae | Heteronympha | *Merope* | *duboulayi* | K |
| 64 | Lepidoptera | Oecophoridae | | | | K |
| 396 | Lepidoptera | Oecophoridae | | | | |
| 331 | Lepidoptera | Oecophoridae | | *Wingia* | *aurata* | K |
| 325 | Lepidoptera | Psychidae | | *Iphierga* | *euphragma* | K |
| 948 | Lepidoptera | Pyralidae | | | | |
| 953 | Lepidoptera | Pyralidae | | | | |
| 957 | Lepidoptera | Pyralidae | | | | |
| 979 | Lepidoptera | Pyralidae | | | | |
| 982 | Lepidoptera | Pyralidae | | | | |
| 922 | Lepidoptera | Pyralidae | | *Hedonota* | *recurvella* | |
| 333 | Lepidoptera | Pyralidae | | | | |
| 341 | Lepidoptera | Pyralidae | | | | |
| 342 | Lepidoptera | Pyralidae | | | | |
| 356 | Lepidoptera | Pyralidae | | | | |
| 365 | Lepidoptera | Pyralidae | | | | |
| 397 | Lepidoptera | Pyralidae | | | | |
| 401 | Lepidoptera | Pyralidae | | | | |
| 432 | Lepidoptera | Pyralidae | | | | K |
| 631 | Lepidoptera | Pyralidae | | | | K |
| 635 | Lepidoptera | Pyralidae | | | | |
| 641 | Lepidoptera | Pyralidae | | | | |
| 645 | Lepidoptera | Pyralidae | | | | |
| 646 | Lepidoptera | Pyralidae | | | | |
| 84 | Lepidoptera | Pyralidae | | *Uresiphita* | *ornithopteralis* | K |
| 460 | Lepidoptera | Pyralidae | Epipaschinae | | | |
| 837 | Lepidoptera | Pyralidae ? | | | | |
| 928 | Lepidoptera | Pyralidae ? | | | | |
| 1126 | Lepidoptera | Pyralidae ? | | | | |
| 43 | Lepidoptera | Pyralidae ? | | | | K |
| 768 | Lepidoptera | Pyralidae ? | | | | |
| 328 | Lepidoptera | Saturniidae | | *Opodiphthera* | *helena* | K |
| 819 | Lepidoptera | Thaumetopoeidae | | *Ochrogaster* | | K |
| 32 | Lepidoptera | Thaumetopoeidae | | | | K |
| 692 | Lepidoptera | Thaumetopoeidae | | | | K |
| 3 | Lepidoptera | Thaumetopoeidae | | *Epicoma* | *melanosticta* | K |
| 7 | Lepidoptera | Thaumetopoeidae | | *Ochrogaster* | | K |
| 8 | Lepidoptera | Thaumetopoeidae | | *Ochrogaster* | | K |
| 9 | Lepidoptera | Thaumetopoeidae | | *Ochrogaster* | | K |
| 11 | Lepidoptera | Thaumetopoeidae | | *Ochrogaster* | | K |
| 35 | Lepidoptera | Thaumetopoeidae | | *Ochrogaster* | | K |
| 36 | Lepidoptera | Thaumetopoeidae | | *Ochrogaster* | | K |
| 10 | Lepidoptera | Thaumetopoeidae | | *Ochrogaster* | *lunifer* | K |
| 404 | Lepidoptera | Thaumetopoeidae | | *Oenosandra* | | K |
| 324 | Lepidoptera | Tineidae | | *Moerarchis* | | K |
| 141 | Lepidoptera | Tineidae | | *Moerarchis* | *australasiella* | K |
| 319 | Lepidoptera | Tineidae | | *Moerarchis* | *clathrella* | K |
| 943 | Lepidoptera | Tortricidae | | | | |
| 1814 | Lepidoptera | Tortricidae ? | | | | |
| 92 | Lepidoptera | Tortricidae ? | | | | |
| 1172 | Lepidoptera | UNIDENTIFIABLE | | unidentifiable | unidentifiable | |
| 45 | Lepidoptera | Zygaenidae | | *Pollanisus* | *viridipulverulenta* | K |
| 1459 | Mantodea | | | | | |

| Spec # | Order | Family | Tax 3 | Genus | Species | GR/K |
|---|---|---|---|---|---|---|
| 132 | Mantodea | | | | | |
| 309 | Mantodea | | | | | |
| 674 | Mantodea | | | | | |
| 718 | Mantodea | | | | | |
| 784 | Mantodea | | | | | |
| 789 | Mantodea | | | | | |
| 739 | Mantodea | Amorphoscelidae | | *Paroxypilus* | *tasmaniensis?* | |
| 854 | Mantodea | Amorphoscelidae | Paraoxypilinae | | | |
| 1124 | Mantodea | Mantidae | | | | K |
| 1541 | Mantodea | Mantidae | | | | |
| 767 | Mantodea | Mantidae | | | | |
| 981 | Mantodea | Mantidae | Mantinae | | | |
| 1001 | Mantodea | Mantidae | Mantinae | | | |
| 1277 | Mecoptera | Bittacidae | | | | GA |
| 1453 | Mecoptera | Bittacidae | | | | GA |
| 1456 | Mecoptera | Bittacidae | | | | GA |
| 1463 | Mecoptera | Bittacidae | | | | GA |
| 908 | Mecoptera | Bittacidae | | *Harpobittacus* | | GA |
| 250 | Mecoptera | Bittacidae | | *Harpobittacus* | | GA |
| 89 | Mecoptera | Meropeidae | | *Austromerope* | *poultoni* | GR |
| 1636 | Megaloptera | Corydalidae | Chauliodinae | | | GR |
| 1532 | Mygalomorphae | Barychelidae | | | | GR |
| 497 | Mygalomorphae | Barychelidae ? | | | | GR |
| 1468 | Mygalomorphae | Idiopidae | | | | GR |
| 887 | Mygalomorphae | Nemesiidae | | | | GR |
| 1367 | Mygalomorphae | Nemesiidae | | | | GR |
| 1401 | Mygalomorphae | Nemesiidae | | | | GR |
| 1560 | Mygalomorphae | Nemesiidae | | | | GR |
| 1792 | Mygalomorphae | Nemesiidae | | | | GR |
| 567 | Mygalomorphae | Nemesiidae | | *Chenistonia* | | GR |
| 581 | Mygalomorphae | Nemesiidae | | *Chenistonia* | | GR |
| 1350 | Mygalomorphae | Nemesiidae | | *Chenistonia* | | GR |
| 590 | Mygalomorphae | Nemesiidae | | | juvenile | GR |
| 283 | Mygalomorphae | Nemesiidae | | | | GR |
| 502 | Mygalomorphae | Nemesiidae | | | | GR |
| 538 | Mygalomorphae | Nemesiidae | | | juvenile | GR |
| 585 | Mygalomorphae | Nemesiidae | | | juvenile | GR |
| 721 | Mygalomorphae | Nemesiidae | | *Chenistonia* | | GR |
| 949 | Neuroptera | Chrysopidae | | | | |
| 1057 | Neuroptera | Chrysopidae | | | | |
| 1186 | Neuroptera | Chrysopidae | | | | |
| 1639 | Neuroptera | Chrysopidae | | | | |
| 822 | Neuroptera | Chrysopidae | | *Chrysopa* | | |
| 361 | Neuroptera | Chrysopidae | | *Chrysopa* | | |
| 131 | Neuroptera | Hemerobiidae | | | | |
| 360 | Neuroptera | Hemerobiidae | | | | |
| 653 | Neuroptera | Hemerobiidae | | | | |
| 1315 | Neuroptera | Mantispidae | | | | |
| 687 | Neuroptera | Mantispidae | | | | |
| 305 | Neuroptera | Myrmeleontidae | | | | |
| 400 | Neuroptera | Myrmeleontidae | | | | |
| 1005 | Odonata | Zygoptera | | | | GR |
| 1758 | Odonata | Zygoptera | | | | GR |
| 1004 | Odonata | Zygoptera | Lestoidea | | | GR |

| Spec # | Order | Family | Tax 3 | Genus | Species | GR/K |
|---|---|---|---|---|---|---|
| 1237 | Odonata | Zygoptera | Lestoidea | | | GR |
| 237 | Odonata | Zygoptera | Lestoidea | | | GR |
| 1381 | Oligochaeta | Megascolecidae | | | | |
| 1407 | Oligochaeta | Megascolecidae | | | | |
| 1475 | Oligochaeta | Megascolecidae | | | | |
| 1482 | Oligochaeta | Megascolecidae | | | | |
| 1484 | Oligochaeta | Megascolecidae | | | | |
| 1556 | Oligochaeta | Megascolecidae | | | | |
| 1798 | Oligochaeta | Megascolecidae | | | | |
| 520 | Oligochaeta | Megascolecidae | collective sp | | | |
| 937 | Onychophora | | | | | GR |
| 1481 | Onychophora | | | | | GR |
| 1365 | Opiliones | | | | | GR |
| 1447 | Opiliones | | | | | GR |
| 1616 | Opiliones | | | | | GR |
| 1799 | Opiliones | | | | | |
| 1125 | Orthoptera | | | | | K |
| 1176 | Orthoptera | | | | | |
| 1199 | Orthoptera | | | | | |
| 1210 | Orthoptera | | | | | |
| 1214 | Orthoptera | | | | | |
| 1218 | Orthoptera | | | | | |
| 1224 | Orthoptera | | | | | |
| 1235 | Orthoptera | | | | | |
| 1236 | Orthoptera | | | | | |
| 1241 | Orthoptera | | | | | |
| 1252 | Orthoptera | | | | | |
| 1261 | Orthoptera | | | | | |
| 1275 | Orthoptera | | | | | |
| 1284 | Orthoptera | | | | | |
| 1285 | Orthoptera | | | | | |
| 1308 | Orthoptera | | | | | |
| 1311 | Orthoptera | | | | | |
| 1312 | Orthoptera | | | | | |
| 1316 | Orthoptera | | | | | |
| 1323 | Orthoptera | | | | | |
| 1353 | Orthoptera | | | | | |
| 1372 | Orthoptera | | | | | |
| 1420 | Orthoptera | | | | | |
| 1426 | Orthoptera | | | | | |
| 1452 | Orthoptera | | | | | |
| 1465 | Orthoptera | | | | | |
| 1679 | Orthoptera | | | | | |
| 1711 | Orthoptera | | | | | |
| 294 | Orthoptera | | | | | |
| 276 | Orthoptera | | | | | |
| 278 | Orthoptera | | | | | |
| 310 | Orthoptera | | | | | |
| 314 | Orthoptera | | | | | |
| 485 | Orthoptera | | | | | |
| 688 | Orthoptera | | | | | |
| 705 | Orthoptera | | | | | |
| 708 | Orthoptera | | | | | |
| 715 | Orthoptera | | | | | |

| Spec # | Order | Family | Tax 3 | Genus | Species | GR/K |
|---|---|---|---|---|---|---|
| 791 | Orthoptera | | | | | |
| 1010 | Orthoptera | Acrididae | | | | |
| 1265 | Orthoptera | Acrididae | | | | GR |
| 1337 | Orthoptera | Acrididae | | | | |
| 1348 | Orthoptera | Acrididae | | | | |
| 1354 | Orthoptera | Acrididae | | | | |
| 1360 | Orthoptera | Acrididae | | | | |
| 1368 | Orthoptera | Acrididae | | | | |
| 1399 | Orthoptera | Acrididae | | | | |
| 1441 | Orthoptera | Acrididae | | | | |
| 1498 | Orthoptera | Acrididae | | | | |
| 1533 | Orthoptera | Acrididae | | | | |
| 1545 | Orthoptera | Acrididae | | | | |
| 1547 | Orthoptera | Acrididae | | | | |
| 1599 | Orthoptera | Acrididae | | | | |
| 1619 | Orthoptera | Acrididae | | | | |
| 1620 | Orthoptera | Acrididae | | | | |
| 1621 | Orthoptera | Acrididae | | | | |
| 1666 | Orthoptera | Acrididae | | | | |
| 1677 | Orthoptera | Acrididae | | | | |
| 1699 | Orthoptera | Acrididae | | | | |
| 1762 | Orthoptera | Acrididae | | | | |
| 1800 | Orthoptera | Acrididae | | | | |
| 890 | Orthoptera | Acrididae | | *Cedarinia* | | |
| 892 | Orthoptera | Acrididae | | *Cedarinia* | | |
| 1572 | Orthoptera | Acrididae | | *Cedarinia* | | |
| 1728 | Orthoptera | Acrididae | | *Gonia* | | |
| 871 | Orthoptera | Acrididae | | *Goniaea* | | K |
| 872 | Orthoptera | Acrididae | | *Goniaea* | | K |
| 940 | Orthoptera | Acrididae | | *Goniaea* | | |
| 1470 | Orthoptera | Acrididae | | *Goniaea* | | |
| 174 | Orthoptera | Acrididae | | | | K |
| 231 | Orthoptera | Acrididae | | | | K |
| 235 | Orthoptera | Acrididae | | | | K |
| 501 | Orthoptera | Acrididae | | | | K |
| 548 | Orthoptera | Acrididae | | | | |
| 613 | Orthoptera | Acrididae | | | | |
| 304 | Orthoptera | Acrididae | | *Goniae* | | K |
| 232 | Orthoptera | Acrididae | | *Goniaea* | | K |
| 233 | Orthoptera | Acrididae | | *Goniaea* | | K |
| 293 | Orthoptera | Acrididae | | *Phaulacridium* | *vitatum* | K |
| 681 | Orthoptera | Acrididae | Acridinae | | | |
| 703 | Orthoptera | Acrididae | Acridinae | | | |
| 576 | Orthoptera | Acrididae | Catantopinae | *Cedarinia* | | |
| 690 | Orthoptera | Acrididae | Catantopinae | *Cedarinia* | | |
| 722 | Orthoptera | Acrididae | Catantopinae | *Cedarinia* | | |
| 726 | Orthoptera | Acrididae | Catantopinae | *Cedarinia* | | |
| 868 | Orthoptera | Acrididae | Oxyinae | | | |
| 883 | Orthoptera | Eumastacidae | | | | |
| 1345 | Orthoptera | Eumastacidae | | | | |
| 1469 | Orthoptera | Eumastacidae | | | | |
| 1549 | Orthoptera | Eumastacidae | | | | |
| 738 | Orthoptera | Eumastacidae | | | | |
| 816 | Orthoptera | Eumastacidae | | | | |

| Spec # | Order | Family | Tax 3 | Genus | Species | GR/K |
|---|---|---|---|---|---|---|
| 834 | Orthoptera | Gryllidae | | | | |
| 857 | Orthoptera | Gryllidae | | | | |
| 1333 | Orthoptera | Gryllidae | | | | |
| 1349 | Orthoptera | Gryllidae | | | | |
| 1508 | Orthoptera | Gryllidae | | | | |
| 1604 | Orthoptera | Gryllidae | | | | |
| 1617 | Orthoptera | Gryllidae | | | | |
| 1653 | Orthoptera | Gryllidae | | | | |
| 1702 | Orthoptera | Gryllidae | | | | |
| 180 | Orthoptera | Gryllidae | | | | K |
| 216 | Orthoptera | Gryllidae | | | | |
| 608 | Orthoptera | Gryllidae | | | | |
| 609 | Orthoptera | Gryllidae | | | | |
| 618 | Orthoptera | Gryllidae | | | | |
| 672 | Orthoptera | Gryllidae | | | | |
| 729 | Orthoptera | Gryllidae | | | | |
| 809 | Orthoptera | Gryllidae | | | | |
| 811 | Orthoptera | Gryllidae | | *Apterogryllus* | | |
| 555 | Orthoptera | Gryllidae | | | | |
| 782 | Orthoptera | Pyrgomorphidae | | | | |
| 524 | Orthoptera | Stenopelmatidae | | | | |
| 1008 | Orthoptera | Stenopelmatidae | | | | |
| 1043 | Orthoptera | Stenopelmatidae | | | | |
| 1557 | Orthoptera | Stenopelmatidae | | | | |
| 1582 | Orthoptera | Stenopelmatidae | | | | |
| 526 | Orthoptera | Stenopelmatidae | | *Onosandrus* | | K |
| 881 | Orthoptera | Tetrigidae | | | | |
| 713 | Orthoptera | Tetrigidae | | | | |
| 873 | Orthoptera | Tettigoniidae | | | | |
| 882 | Orthoptera | Tettigoniidae | | | | |
| 897 | Orthoptera | Tettigoniidae | | | | |
| 902 | Orthoptera | Tettigoniidae | | | | |
| 903 | Orthoptera | Tettigoniidae | | | | K |
| 931 | Orthoptera | Tettigoniidae | | | | |
| 980 | Orthoptera | Tettigoniidae | | | | |
| 988 | Orthoptera | Tettigoniidae | | | | |
| 994 | Orthoptera | Tettigoniidae | | | | |
| 1009 | Orthoptera | Tettigoniidae | | | | |
| 1013 | Orthoptera | Tettigoniidae | | | | |
| 1026 | Orthoptera | Tettigoniidae | | | | |
| 1039 | Orthoptera | Tettigoniidae | | | | |
| 1052 | Orthoptera | Tettigoniidae | | | | |
| 1326 | Orthoptera | Tettigoniidae | | | | |
| 1327 | Orthoptera | Tettigoniidae | | | | |
| 1332 | Orthoptera | Tettigoniidae | | | | |
| 1342 | Orthoptera | Tettigoniidae | | | | |
| 1346 | Orthoptera | Tettigoniidae | | | | |
| 1386 | Orthoptera | Tettigoniidae | | | | |
| 1483 | Orthoptera | Tettigoniidae | | | | |
| 1485 | Orthoptera | Tettigoniidae | | | | |
| 1487 | Orthoptera | Tettigoniidae | | | | |
| 1539 | Orthoptera | Tettigoniidae | | | | |
| 1622 | Orthoptera | Tettigoniidae | | | | |
| 1644 | Orthoptera | Tettigoniidae | | | | |

| Spec # | Order | Family | Tax 3 | Genus | Species | GR/K |
|---|---|---|---|---|---|---|
| 1675 | Orthoptera | Tettigoniidae | | | | |
| 1695 | Orthoptera | Tettigoniidae | | | | |
| 1736 | Orthoptera | Tettigoniidae | | | | |
| 1739 | Orthoptera | Tettigoniidae | | | | |
| 1749 | Orthoptera | Tettigoniidae | | | | |
| 1750 | Orthoptera | Tettigoniidae | | | | |
| 1779 | Orthoptera | Tettigoniidae | | | | |
| 106 | Orthoptera | Tettigoniidae | | | | K |
| 118 | Orthoptera | Tettigoniidae | | | | |
| 149 | Orthoptera | Tettigoniidae | | | | K |
| 167 | Orthoptera | Tettigoniidae | | | | |
| 202 | Orthoptera | Tettigoniidae | | | | |
| 218 | Orthoptera | Tettigoniidae | | | | K |
| 246 | Orthoptera | Tettigoniidae | | | | K |
| 268 | Orthoptera | Tettigoniidae | | | | |
| 1754 | Orthoptera | Tettigoniidae | Phasmatidinae | | | |
| 1207 | Orthoptera | Tettigoniidae | Phasmodinae | | | |
| 973 | Phasmatodea | | | | | |
| 1080 | Phasmatodea | | | | | |
| 1220 | Phasmatodea | | | | | |
| 1223 | Phasmatodea | | | | | |
| 1314 | Phasmatodea | | | | | |
| 1520 | Phasmatodea | | | | | |
| 1705 | Phasmatodea | | | | | |
| 1715 | Phasmatodea | | | | | |
| 1733 | Phasmatodea | | | | | |
| 785 | Phasmatodea | | | | | |
| 303 | Phasmatodea | | | | | |
| 458 | Phasmatodea | | | | | |
| 1385 | Platyhelminthes | | | | | |
| 1404 | Platyhelminthes | | | | | |
| 1568 | Platyhelminthes | | | | | |
| 521 | Platyhelminthes | | | | | |
| 879 | Scorpionida | | | | | |
| 880 | Scorpionida | | | | | |
| 965 | Scorpionida | | | | | |
| 1451 | Scorpionida | | | | | |
| 1592 | Scorpionida | | | | | |
| 1600 | Scorpionida | | | | | |
| 1796 | Scorpionida | | | | | |
| 568 | Scorpionida | | | | Scorpion sp1 | K |
| 469 | Scorpionida | | | | Scorpion sp2 | K |
| 629 | Scorpionida | | | | Scorpion sp3 | K |
| 1042 | Trichoptera | | | | | GA |
| 69 | Trichoptera | | | | | GA |
| 144 | Trichoptera | | | | | GA |
| 145 | Trichoptera | | | | | GA |
| 151 | Trichoptera | | | | | GA |

# BIRDS

Graeme Liddelow and Chris Vellios

## Introduction

The object of recording birds in FORESTCHECK is to monitor the impacts of logging and associated burning on bird species composition and abundance. This is achieved by:

- Recording species richness and abundance within each treatment (coupe buffer, shelterwood and gap release) and uncut controls.
- Comparing species richness and abundance between each treatment
- Analysing trends within species between treatments

## Monitoring

All Wellington East FORESTCHECK grids were monitored for diurnal birds in the spring of 2004. Science Division personnel were able to undertake all the bird census work in 2004. Both sight and sound were used to identify the birds, and the census method is described in the FORESTCHECK Operating Plan.

## Preliminary Results and Discussion

### Diurnal Birds

A total of 29 species of birds, comprising 487 individuals, were recorded in the ten grids. Ten or more individuals were recorded in 14 species (Table 1). For each of the 3 treatment grids, there were 25 species and 155 individuals in the controls, 21 species and 178 individuals in the shelterwood treatment and 20 species and 118 individuals in the gap release treatment. The single coupe buffer had 14 species and 36 individuals.

The overall density of birds in this year's census was 9.7 birds/ha. In previous years it was 5.3 at Donnelly (2001), 15.4 at Wellington (2002) and 9.7 at Perth Hills (2003). The 9.7 birds/ha at Wellington East is similar to the ongoing Kingston Study in an "average" year with 10.4 birds/ha.

Seven species of birds occurred in only one treatment (either control, coupe buffer, shelterwood or gap release, see Table 1), however, none of these would be expected to be restricted to that treatment.

**Table 1.** Bird species and number of individuals recorded by treatment in the Wellington East FORESTCHECK grids.

| RAOU No. | Common Name | Scientific Name | Total | Ext Control | Coupe Buffer | Shelter-wood | Gap Release |
|---|---|---|---|---|---|---|---|
| 264 | Forest Red-tailed Black Cockatoo | *Calyptorhynchus banksii naso* | 3 | 3 | | | |
| 290 | Red-capped Parrot | *Platycerus spurius* | 13 | | | 13 | |
| 294 | Australian Ringneck | *Platycerus zonarius* | 10 | 5 | | 5 | |
| 322 | Laughing Kookaburra | *Dacelo novaeguineae* | 1 | | 1 | | |
| 337 | Pallid Cuckoo | *Cuculus pallidus* | 3 | 1 | | 1 | 1 |
| 344 | Shining Bronze-Cuckoo | *Chrysococcyx lucidus* | 9 | 3 | | 4 | 2 |
| 361 | Grey Fantail | *Rhipidura fuliginosa* | 21 | 11 | 2 | 6 | 2 |
| 380 | Scarlet Robin | *Petroica multicolor* | 30 | 9 | 2 | 6 | 13 |
| 394 | Western Yellow Robin | *Eopsaltria griseogularis* | 11 | 2 | 1 | 5 | 3 |
| 398 | Golden Whistler | *Pachycephala pectoralis* | 26 | 7 | 7 | 8 | 4 |
| 408 | Grey Shrike-thrush | *Colluricincla harmonica* | 11 | 3 | 1 | 6 | 1 |
| 424 | Black-faced Cuckoo-shrike | *Coracina novaehollandiae* | 4 | 2 | | 1 | 1 |
| 463 | Western Gerygone | *Gerygone fusca* | 61 | 20 | 4 | 21 | 16 |
| 465 | Weebill | *Smicornis brevirostris* | 1 | | 1 | | |
| 472 | Western Thornbill | *Acanthiza inornata* | 32 | 7 | | 6 | 19 |
| 476 | Broad-tailed (Inland) Thornbill | *Acanthiza apicalis* | 94 | 28 | 6 | 41 | 19 |
| 488 | White-browed Scrubwren | *Sericornis frontalis* | 1 | 1 | | | |
| 549 | Varied Sitella | *Daphoenositta chrysoptera* | 25 | 7 | | 12 | 6 |
| 556 | Rufous Treecreeper | *Climacteris rufa* | 10 | 2 | 2 | 6 | |
| 565 | Spotted Pardalote | *Pardalotus punctatus* | 5 | 1 | | 3 | 1 |
| 574 | Silvereye | *Zosterops lateralis* | 7 | 1 | | 4 | 2 |
| 578 | Western White-naped Honeyeater | *Melithreptus chloropsis* | 5 | 1 | 1 | 2 | 1 |
| 592 | Western Spinebill | *Acanthorhynchus superciliosus* | 17 | 4 | | 6 | 7 |
| 608 | Singing Honeyeater | *Lichenostomus virescens* | 1 | 1 | | | |
| 638 | Red Wattlebird | *Anthochaera carunculata* | 1 | | | | 1 |
| 697 | Grey Currawong | *Sterpera versicolor* | 6 | 1 | 2 | 2 | 1 |
| 710 | Western Little Wattlerbird | *Anthochaera lunulata* | 6 | 4 | | | 2 |
| 930 | Australian Raven | *Corvus coronoides* | 2 | 1 | 1 | | |
| 976 | Striated Pardalote | *Pardolotus striatus* | 71 | 30 | 5 | 20 | 16 |
| | | **Total Individuals** | **487** | **155** | **36** | **178** | **118** |
| | | **Total Species** | **29** | **25** | **14** | **21** | **20** |

**Table 2.** Bird species and number of individuals recorded by forest block in the Wellington East FORESTCHECK grids.

| RAOU No. | Common Name | Scientific Name | Total | Nalyerin | Godfrey | Stockyard | Bell |
|---|---|---|---|---|---|---|---|
| 264 | Forest Red-tailed Black Cockatoo | *Calyptorhynchus banksii naso* | 3 | | | | 3 |
| 290 | Red-capped Parrot | *Platycerus spurius* | 13 | | | | 13 |
| 294 | Port Lincoln Ringneck | *Platycerus zonarius* | 10 | | 2 | 4 | 4 |
| 322 | Laughing Kookaburra | *Dacelo novaeguineae* | 1 | | 1 | | |
| 337 | Pallid Cuckoo | *Cuculus pallidus* | 3 | 1 | | 2 | |
| 344 | Shining Bronze-Cuckoo | *Chrysococcyx lucidus* | 9 | 2 | 3 | 2 | 2 |
| 361 | Grey Fantail | *Rhipidura fuliginosa* | 21 | 4 | 2 | 5 | 10 |
| 380 | Scarlet Robin | *Petroica multicolor* | 30 | 2 | 10 | 8 | 10 |
| 394 | Western Yellow Robin | *Eopsaltria griseogularis* | 11 | | 5 | 2 | 4 |
| 398 | Golden Whistler | *Pachycephala pectoralis* | 26 | 4 | 11 | 4 | 7 |
| 408 | Grey Shrike-thrush | *Colluricincla harmonica* | 11 | 1 | 3 | 3 | 4 |
| 424 | Black-faced Cuckoo-shrike | *Coracina novaehollandiae* | 4 | | | | 4 |
| 463 | Western Gerygone | *Gerygone fusca* | 61 | 7 | 16 | 18 | 20 |
| 465 | Weebill | *Smicornis brevirostris* | 1 | | 1 | | |
| 472 | Western Thornbill | *Acanthiza inornata* | 32 | 2 | 4 | 15 | 11 |
| 476 | Broad-tailed (Inland) Thornbill | *Acanthiza apicalis* | 94 | 13 | 37 | 24 | 20 |
| 488 | White-browed Scrubwren | *Sericrornis frontalis* | 1 | | | 1 | |
| 549 | Varied Sitella | *Daphoenositta chrysoptera* | 25 | | 4 | 1 | 20 |
| 556 | Rufous Treecreeper | *Climacteris rufa* | 10 | | 2 | 2 | 6 |
| 565 | Spotted Pardalote | *Pardalotus punctatus* | 5 | | 2 | | 3 |
| 574 | Silvereye | *Zosterops lateralis* | 7 | 1 | 2 | 2 | 2 |
| 578 | Western White-naped Honeyeater | *Melithreptus chloropsis* | 5 | | 1 | 1 | 3 |
| 592 | Western Spinebill | *Acanthorhynchus superciliosus* | 17 | 2 | | 6 | 9 |
| 608 | Singing Honeyeater | *Lichenostomus virescens* | 1 | 1 | | | |
| 638 | Red Wattlebird | *Anthochaera carunculata* | 1 | | | | 1 |
| 697 | Grey Currawong | *Sterpera versicolor* | 6 | 1 | 3 | 1 | 1 |
| 710 | Western Little Wattlerbird | *Anthochaera lunulata* | 6 | 1 | | | 5 |
| 930 | Australian Raven | *Corvus coronoides* | 2 | | 1 | | 1 |
| 976 | Striated Pardalote | *Pardolotus striatus* | 71 | 8 | 18 | 23 | 22 |
| | | **Total Species** | **29** | **15** | **20** | **19** | **24** |
| | | **Total Individuals** | **487** | **50** | **128** | **124** | **185** |

All 13 records of the Red-capped Parrot (*Platycerus spurius*) were recorded in the shelterwood at Bell forest block, but there appears to be no obvious reason as to why. Of the small scrub birds only one individual, a White-browed Scrubwren (*Sericornis frontalis*), was recorded in Stockyard external control. There were no other small species, such as Fairy-wrens, recorded. This is to be expected, as the majority of the scrub in the grids is only about 20 cm or lower.

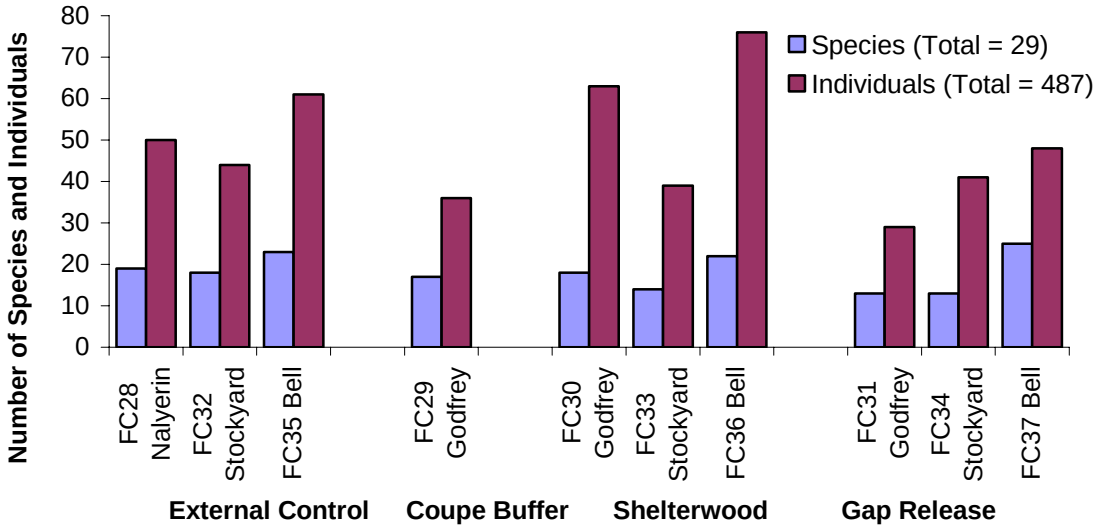



**Figure 1.** The number of bird species and individuals recorded in each FORESTCHECK grid in Wellington East.

In previous years we have stated the importance of the Kingston jarrah bird study for monitoring the annual changes that occur following logging and regeneration. In 2005, The Kingston study will have been going for 10 years, and as the FORESTCHECK sites are monitored on a 5-6 year rotation it will be important to keep the Kingston study going to document any changes that could occur, especially after crown separation occurs.

### Nocturnal Birds

Systematic survey of the nocturnal birds was not carried in this round of monitoring due to unsuitable weather, and unavailability of personnel. However, one night's survey was conducted (Fig. 2) and opportunistic records were kept. A past survey of owls in the southwest by Liddelow *et.al* (2002) suggests that most owls are common in this area.

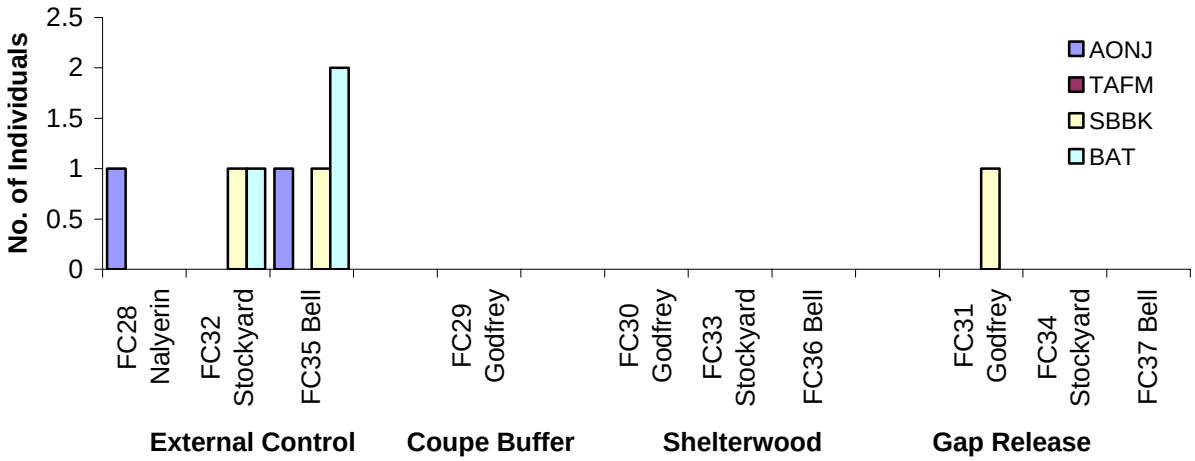



**Figure 2.** Results of a single night's survey for nocturnal birds and bats in Wellington East.

During the course of other monitoring, such as the mammal spotlighting, owls were heard calling or were seen. Southern Boobook Owls (*Ninox novaeseelandiae*) were heard at all sites. One Masked Owl (*Tyto novaehollandiae*) was heard calling in Bell forest block in jarrah-wandoo semi-woodland between the shelterwood and external control sites. A number of Masked Owls were seen on Boundary Rd. One individual was seen twice, 1km south of Alamo Road, along the private property boundary (which is a preferred hunting zone for Masked owls) and another was heard in a wandoo gully 1 km north of Mistley Road. Australian Owlet-nightjars (*Aegotheles cristatus*) were commonly seen on the roads between sites at night when travelling for the spotlight surveys and Tawny Frogmouths (*Podargus strigoides*) were also seen at all sites. These species all appear to be common in this forest habitat.

## Reference

Liddelow, G.L., Wheeler, I.B. and Kavanagh, R.P. 2002. Owls in the southwest forest of Western Australia. Pp. 233-241 In, Newton, I., Kavanagh, R., Olsen, J., Tayler, I. (eds). *Ecology and Conservation of Owls.* CSIRO, Collingwood.

## MAMMALS AND HERPETOFAUNA

Graeme Liddelow

### Introduction

The object of recording mammals and herpetofauna in FORESTCHECK is to monitor the impacts of logging and associated burning on species status and abundance. This is achieved by:

- Trapping and recording the suite of medium and small sized mammals, reptiles and amphibians on each FORESTCHECK grid
- Recording the presence of small mammals in nest boxes placed within each grid
- Comparing species richness, abundance, sex ratios and trap percentages between treatments within and between FORESTCHECK sites
- Recording the presence of the larger mammals along set transects that cover all treatments of the FORESTCHECK sites on a landscape basis
- Recording the presence of nocturnal mammals by spotlighting along set transects that cover all the treatments of the FORESTCHECK sites

The species and abundance of feral animals is also recorded with the use of sand pads placed at regular intervals along pre-determined tracks and roads within each FORESTCHECK site.

### Monitoring

Trapping and spotlighting was carried out on all grids in spring 2004 and autumn 2005. Spring monitoring went according to plan, with only one day of rain that disrupted the road and spotlight surveys on that day but had little impact on the following day's trapping. However, autumn monitoring was disrupted by constant rain, which resulted in the pit traps being opened for only 2 of the 4 nights. The sand pad survey had to be abandoned in autumn as the pads were hard and wet and could not be interpreted.

### Voucher Specimens

Thirty individual specimens were lodged with the WA Museum. This number would have been higher if there was not the inclement weather in autumn.

The specimens included 24 skinks with 7 species, 1 snake, 1 dragon and 4 species of amphibian (Table 1).

### Results

#### Trapping

A total of 173 individuals were trapped in the spring and autumn sessions (Table 2) with 107 individuals trapped in spring and 66 in autumn.

There were 28 mammals, 71 reptiles and 8 amphibians trapped in spring and 63 mammals, 2 reptiles and 1 amphibian trapped in autumn (Table 2 and Fig. 1). The results clearly show the lack of reptile and amphibian captures due to the inclement weather conditions in autumn.

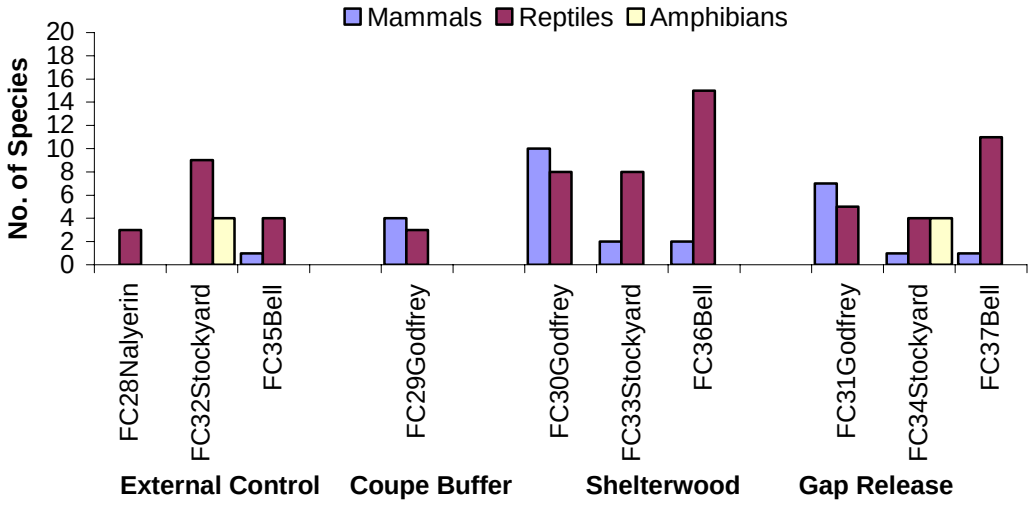
**Table 1.** Specimens from the Wellington East FORESTCHECK grids that were lodged with the W.A. Museum.

| Field # | Museum # | Museum Name |
|---|---|---|
| FC145 | 156646 | *Lerista distinguenda* |
| FC146 | Discard | *Morethia obscura* |
| FC147 | 156647 | *Lerista distinguenda* |
| FC148 | 156651 | *Morethia obscura* |
| FC149 | 156650 | *Lerista distinguenda* |
| FC150 | 156649 | *Egernia napoleonis* |
| FC151 | 156648 | *Ctenotus labillardieri* |
| FC152 | Discard | *Lerista distinguenda* |
| FC153 | 156652 | *Morethia obscura* |
| FC154 | 156653 | *Morethia obscura* |
| FC155 | 156654 | *Morethia obscura* |
| FC156 | 156659 | *Limnodynastes dorsalis* |
| FC157 | 156658 | *Pseudophryne guentheri* |
| FC158 | 156656 | *Hemiergis initialis initialis* |
| FC159 | 156655 | *Morethia obscura* |
| FC160 | 156657 | *Crinia georgiana* |
| FC161 | 156661 | *Pogona minor minor* |
| FC162 | Discard | *Hemiergis initialis initialis* |
| FC163 | 156660 | *Morethia obscura* |
| FC164 | 156662 | *Lerista distinguenda* |
| FC165 | 156644 | *Egernia napoleonis* |
| FC166 | 156645 | *Morethia obscura* |
| FC167 | 156643 | *Ctenotus delli* |
| FC168 | 156642 | *Heleioporus barycragus* |
| FC169 | 156663 | *Morethia obscura* |
| FC170 | 156664 | *Menetia greyii* |
| FC171 | 156665 | *Ramphotyphlops australis* |
| FC172 | Discard | *Hemiergis initialis initialis* |
| FC173 | 156666 | *Lerista distinguenda* |
| FC174 | 156667 | *Lerista distinguenda* |

**Table 2.** The species and abundance of mammals, reptiles and amphibians recorded in traps within treatments in Wellington East.

| Species | External Control | | | | Coupe Buffer | | | | Shelterwood | | | | Gap release | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Spring | | Autumn | | Spring | | Autumn | | Spring | | Autumn | | Spring | | Autumn | |
| | Pit | Wire | Pit | Wire | Pit | Wire | Pit | Wire | Pit | Wire | Pit | Wire | Pit | Wire | Pit | Wire |
| **MAMMALS** | | | | | | | | | | | | | | | | |
| *Antechinus flavipes* | | | | 3 | | | | | | | | 1 | | 1 | | 2 |
| *Bettongia penicillata ogilbyi* | | | | | | 3 | | 4 | | 8 | | 12 | | 7 | | 12 |
| *Cercartetus concinnus* | | | | | | | | | | | 1 | | | | | |
| *Dasyurus geoffroii* | | | | | | | | 4 | | 1 | | 4 | | | | 4 |
| *Sminthopsis gilbertii* | 1 | | | | | | | | 3 | | | | 1 | | | |
| *Tachyglossus aculeatus* | | | | | | | | | | | | 1 | | | | 1 |
| *Trichosurus vulpecula* | | | | | | 1 | | 8 | | 2 | | 6 | | | | |
| **REPTILES** | | | | | | | | | | | | | | | | |
| *Ctenotus catenifer* | | | | | | | | | | | | | 1 | | | |
| *Ctenotus labillardieri* | | | | | | | | | 1 | | | | | | | |
| *Egernia napoleonis* | | | | | | | | | 3 | | | | 2 | | | |
| *Hemiergis initialis* | 1 | | | | | | | | 3 | | | | | | | |
| *Hemiergis peroni* | | | | | | | | | | | 2 | | | | | |
| *Lerista distinguenda* | 6 | | | | 2 | | | | 12 | | | | 11 | | | |
| *Menetia greyii* | 1 | | | | | | | | 1 | | | | 2 | | | |
| *Morethia linocellata* | 3 | | | | | | | | 1 | | | | 3 | | | |
| *Morethia obscura* | 5 | | | | | | | | 6 | | | | 1 | | | |
| *Pogona minima* | | | | | 1 | | | | 1 | | | | | | | |
| *Ramphotyphlops australis* | | | | | | | | | 1 | | | | | | | |
| *Tiliqua rugosa* | | | | | | | | | | 2 | | | | 1 | | |
| **AMPHIBIANS** | | | | | | | | | | | | | | | | |
| *Crinia georgiana* | 1 | | | | | | | | | | | | | | | |
| *Heleioporus eyrei* | | | | | | | | | | | | | 4 | | 1 | |
| *Limnodynastes dorsalis* | 2 | | | | | | | | | | | | | | | |
| *Pseudophryne guentheri* | 1 | | | | | | | | | | | | | | | |
| **TOTAL (173)** | **21** | **0** | **0** | **3** | **3** | **4** | **0** | **16** | **32** | **13** | **3** | **24** | **25** | **9** | **1** | **19** |
| **TREATMENT TOTALS** | **24** | | | | **23** | | | | **72** | | | | **54** | | | |

(a) Spring – all traps




(b) Autumn – all traps

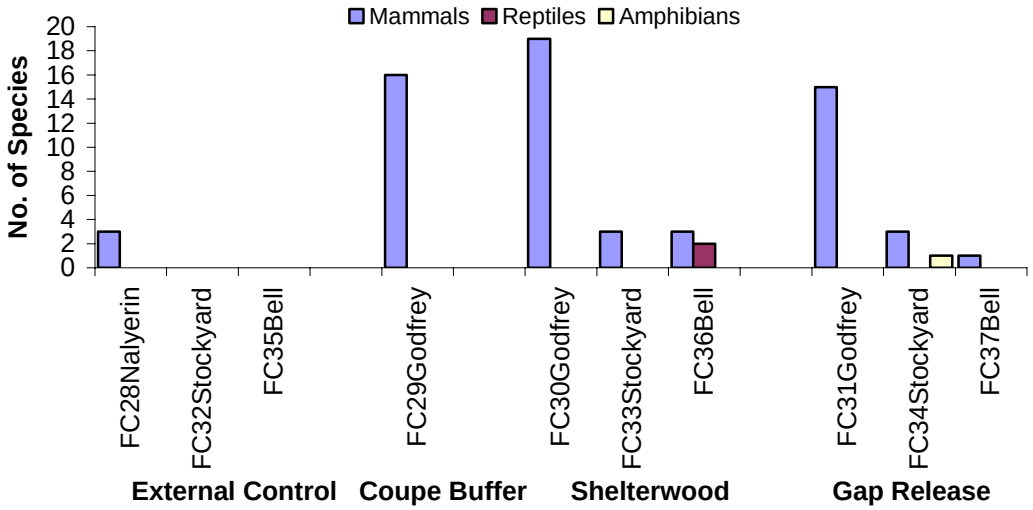



**Figure 1.** The number of individual animals, reptiles and amphibians recorded in traps in spring (a) and autumn (b) in the Wellington East FORESTCHECK grids.

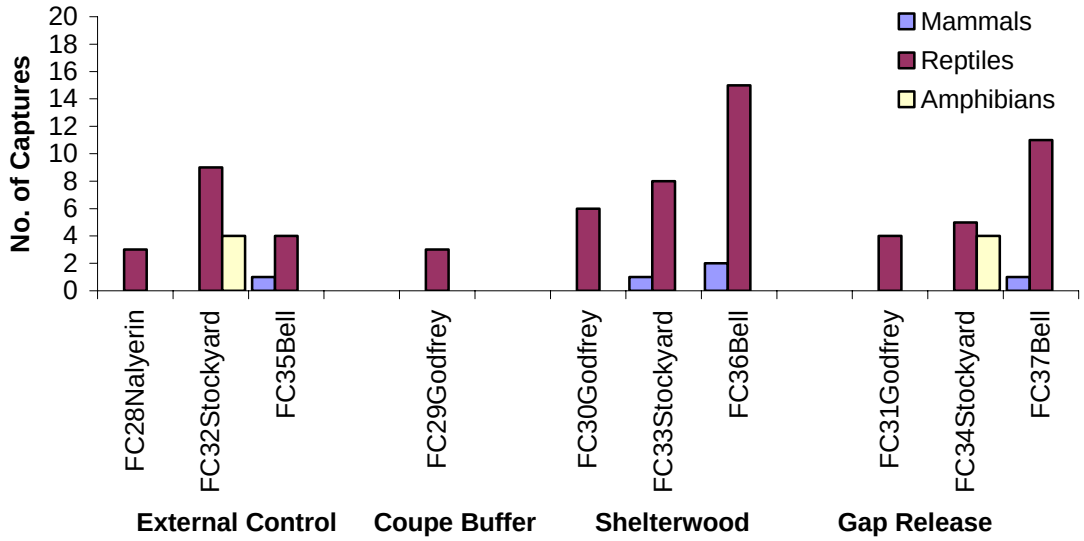
The highest total numbers of captures occurred in the shelterwood treatment followed by the gap release treatment and the lowest numbers occurred in the external controls (Table 3). There was only one coupe buffer treatment (compared to 3 each for the other treatments) therefore no comparisons are made to this treatment.

**Table 3.** The species and abundance of mammals, reptiles and amphibians recorded in traps by block on the Wellington East FORESTCHECK grids in 2004-05. NB. The shaded area highlights the higher number of mammals recorded in the Godfrey forest block, which is baited for foxes in the Western Shield program.

| | Nalyerin/Godfrey | | | | Stockyard | | | Bell | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Species** | **Ext. Control** | **Coupe Buffer** | **Shelterwood** | **Gap Release** | **Ext. Control** | **Shelterwood** | **Gap Release** | **Ext. Control** | **Shelterwood** | **Gap Release** | **TOTAL** |
| **MAMMALS** | | | | | | | | | | | |
| *Antechinus flavipes* | 3 | | | | | 1 | 3 | | | | **7** |
| *Bettongia penicillata* | | 7 | 18 | 18 | | 2 | 1 | | | | **46** |
| *Cercartetus concinnus* | | | | | | 1 | | | | | **1** |
| *Dasyurus geoffroii* | | 4 | 3 | 3 | | | | | 2 | 1 | **13** |
| *Sminthopsis gilbertii* | | | | | | 1 | | 1 | 2 | 1 | **5** |
| *Tachyglossus aculeatus* | | | | 1 | | | | | 1 | | **2** |
| *Trichosurus vulpecula* | | 9 | 8 | | | | | | | | **17** |
| **REPTILES** | | | | | | | | | | | |
| *Ctenotus catenifer* | | | | | | | 1 | | | | **1** |
| *Ctenotus labillardieri* | | | 1 | | | | | | | | **1** |
| *Egernia napoleonis* | | | 2 | | | 1 | 2 | | | | **5** |
| *Hemiergis initialis* | | | | | 1 | 3 | | | | | **4** |
| *Hemiergis peroni* | | | | | | | | | 2 | | **2** |
| *Lerista distinguenda* | 2 | 2 | 2 | 3 | 3 | 1 | | 1 | 9 | 8 | **31** |
| *Menetia greyii* | | | | | | | 2 | 1 | 1 | | **4** |
| *Morethia linocellata* | | | | | 2 | | | 1 | 1 | 3 | **7** |
| *Morethia obscura* | 1 | | 1 | 1 | 3 | 2 | | 1 | 3 | | **12** |
| *Pogona minima* | | 1 | | | | 1 | | | | | **2** |
| *Ramphotyphlops australis* | | | | | | | | | 1 | | **1** |
| *Tiliqua rugosa* | | | 2 | 1 | | | | | | | **3** |
| **AMPHIBIANS** | | | | | | | | | | | |
| *Crinia georgiana* | | | | | 1 | | | | | | **1** |
| *Heleioporus eyrei* | | | | | | | 5 | | | | **5** |
| *Limnodynastes dorsalis* | | | | | 2 | | | | | | **2** |
| *Pseudophryne guentheri* | | | | | 1 | | | | | | **1** |
| **Total** | **6** | **23** | **37** | **27** | **13** | **13** | **14** | **5** | **22** | **13** | **173** |

Pit trapping was very successful in the spring, but was interrupted by inclement weather in autumn. A total of 81 individuals were trapped in spring and only 3 in the autumn. The shelterwood treatment had the highest numbers followed by the gap release then the external controls (Fig. 2). All the reptiles, except the bobtailed lizard (*Tiliqua rugosa*), and all the amphibians were caught in pit traps.

(a) Spring – pit traps




(b) Autumn – pit traps

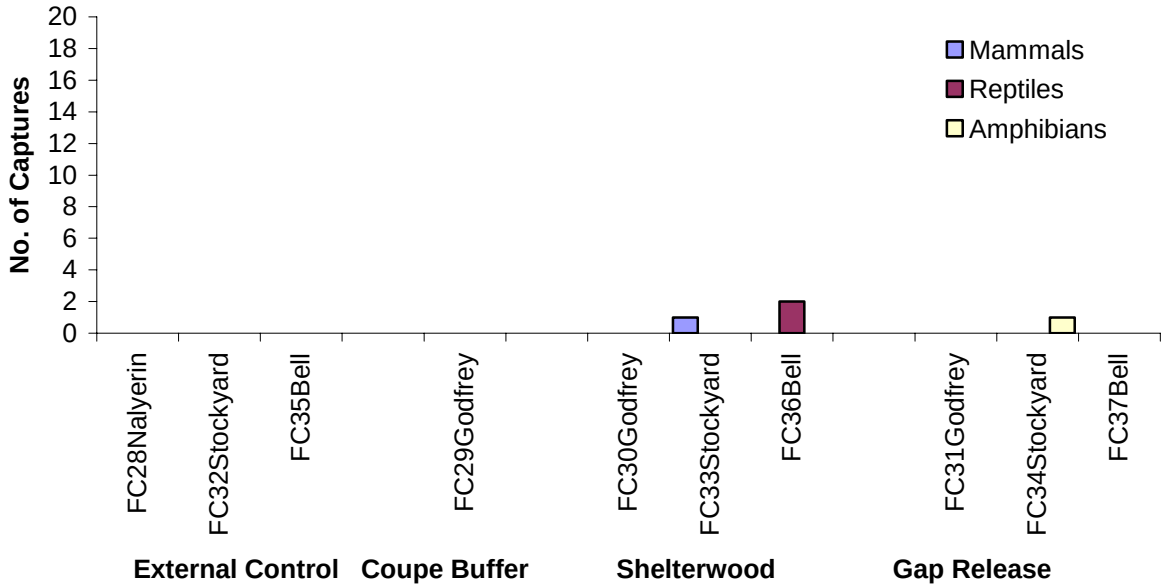
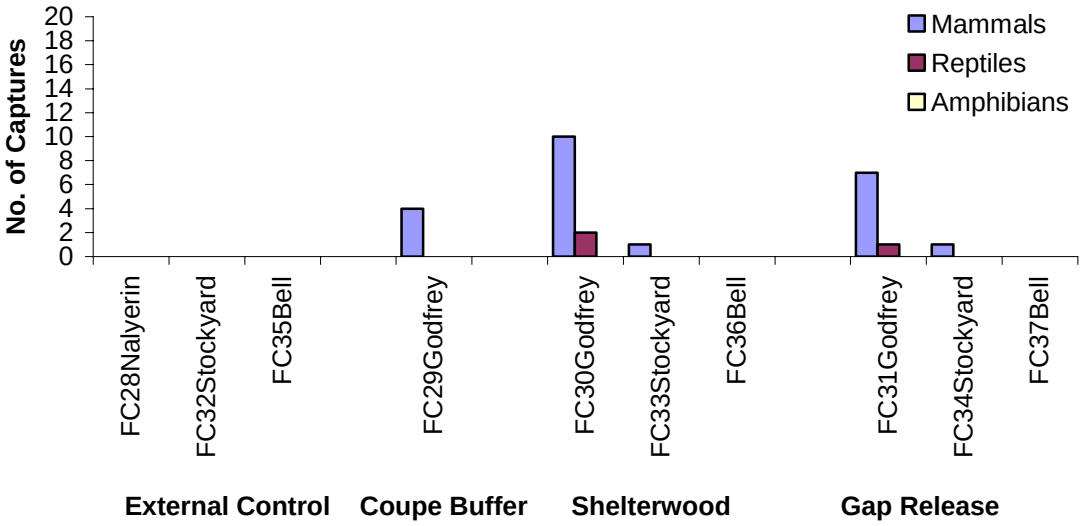



**Figure 2.** The number of individual mammals, reptiles and amphibians recorded in pit traps in the spring (a) and autumn (b) on the Wellington East FORESTCHECK grids.

Wire traps were very successful, especially in the Godfrey forest block treatments where excellent captures of Woylies (*Bettongia penicillata*), Brush-tailed Possums (*Trichosurus vulpecula)* and a Chuditch (*Dasyurus geoffroii*) were recorded. The autumn trapping session was more successful than spring (Fig. 3). The woylie captures at Stockyard forest block resulted from one individual being caught 3 times. This was a survivor from a woylie release in Stene forest block, to the east of Stockyard, some years before. The results support the success of the Western Shield fox-baiting program. Godfrey forest block is baited under the Western Shield program, but the sites north of the Williams-Collie Rd in Nalyerin, Stockyard and Bell forest blocks are not.

(a) Spring – wire traps




(b) Autumn – wire traps


**Figure 3.** The number of individual mammals, reptiles and amphibians recorded in wire traps in the spring (a) and autumn (b) on the Wellington East FORESTCHECK grids.

### Sandpads

Sand pads are installed and monitored on a landscape scale with pads at 1 km intervals over a distance of 50 km. Monitoring was carried out in spring 2004 but was not able to be undertaken in autumn 2005 due to inclement weather.

Recording the presence of feral animals is the main objective when monitoring sand pads, so it was gratifying not to record any fox activity. Native mammals, including kangaroos, wallabies, woylies and chuditch, accounted for 62% of the animals recorded on the sand pads. The other mammals were 2 rabbits and one pig (8%). Birds accounted for 18% of the records and the remaining 2% were reptiles (Fig. 4).

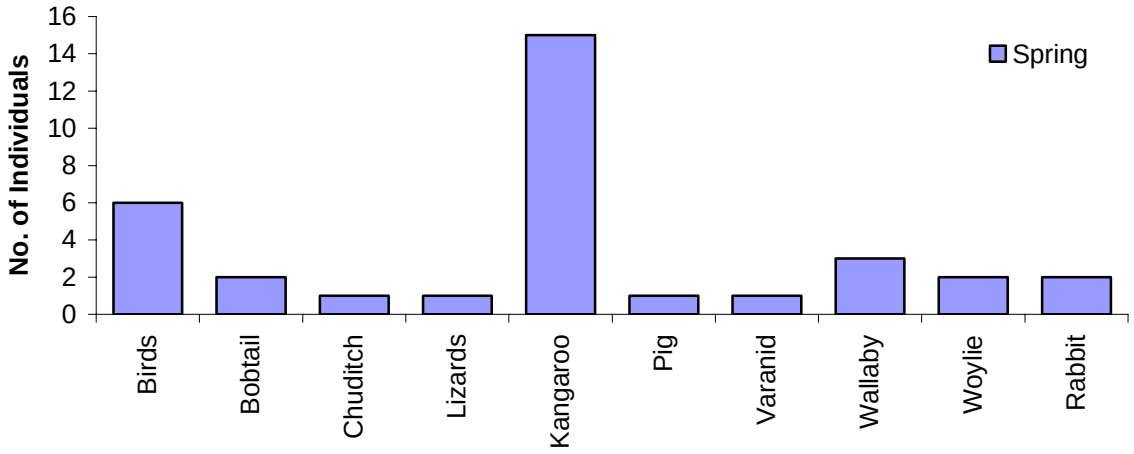



**Figure 4.** The number of species recording contacts on sand pads in the spring at the Wellington East FORESTCHECK location.

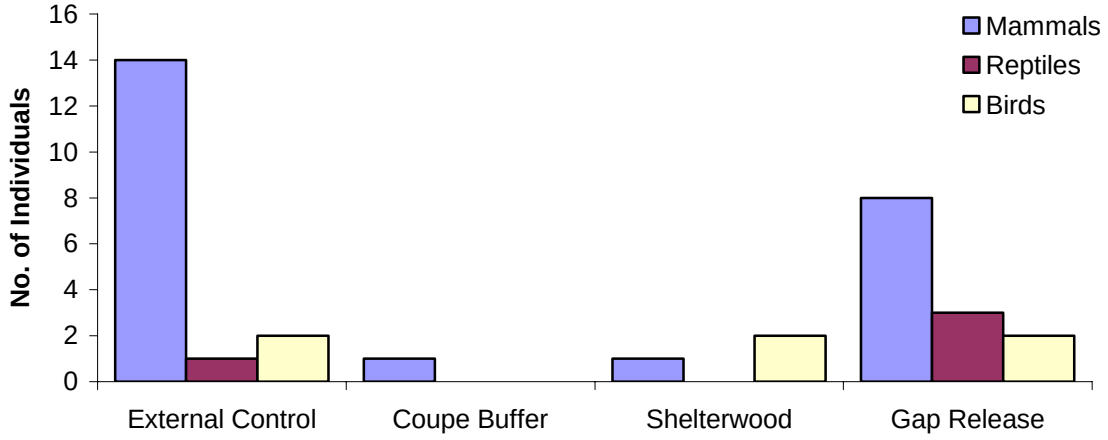



**Figure 5.** The number of individual animals recorded by treatment on sand pads in the spring at the Wellington East FORESTCHECK location.

Most activity was recorded in the vicinity of external controls followed by the gap release treatments and then the shelterwoods (Fig. 5).

**Road Survey**

Road surveys were conducted in spring 2004 and autumn 2005, and are also undertaken on a landscape basis, with the emphasis on differences between blocks as the treatments within the blocks are close together. The distance travelled this year was 42 km.

Only 2 species were recorded on these surveys, the Western Grey Kangaroo (*Macropus fuliginosus*) and the Western Brush Wallaby (*Macropus irma*) with the kangaroo dominating the counts (Fig. 6). The higher numbers of kangaroos in Stockyard forest block in spring is unexplained, as it was assumed they would be higher in the Nalyerin/Godfrey area with a younger fire successional stage and with more succulent regrowth and understorey plants for food.

No Western Brush Wallabies were recorded in Bell forest block on either spring or autumn surveys however one was seen during the spotlighting surveys (Fig. 7b). The country is similar to both Stockyard and Nalyerin/Godfrey forest blocks and it would be expected to see more of them there. The numbers of brush wallabies are similar to the eastern Donnelly FORESTCHECK sites (which were monitored in 2001-02).

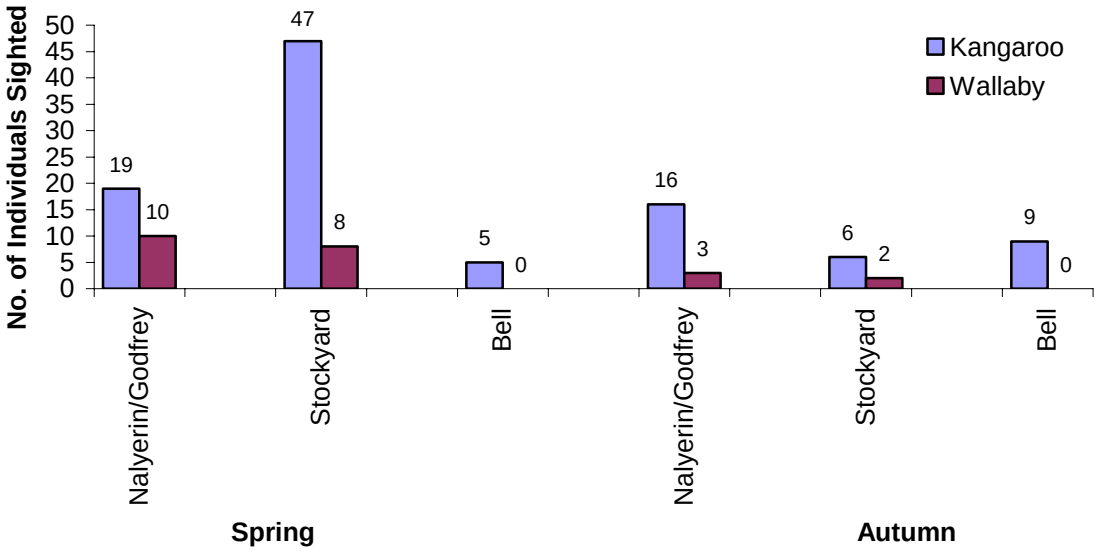
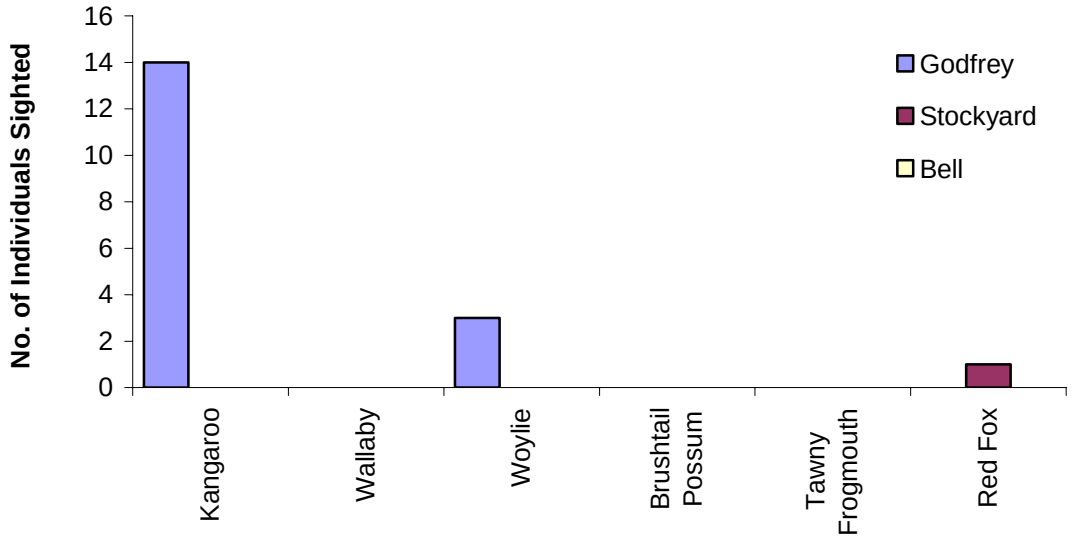



**Figure 6.** The number of individual animals recorded by block during road surveys in the spring and autumn within the Wellington East FORESTCHECK location.

**Spotlighting**

A total of 19 kangaroos, 10 wallabies, 4 woylies, 1 brushtailed possum, 2 Tawny Frogmouths and 1 red fox were recorded during spotlighting (fig 7). All the animals except 1 kangaroo and 2 brush wallabies and the fox were recorded in Godfrey forest block. The red fox was recorded in Stockyard forest block.

(a) Spring - Spotlighting




(b) Autumn - Spotlighting

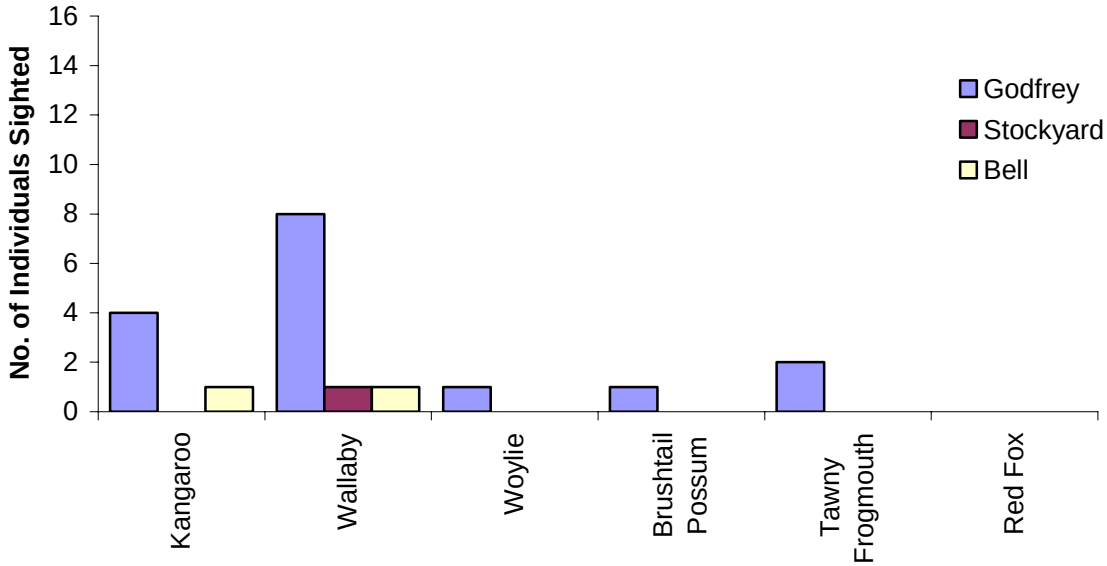



**Figure 7.** The number of individual animals recorded during spotlighting in the spring (a) and autumn (b) within the Wellington East FORESTCHECK location.

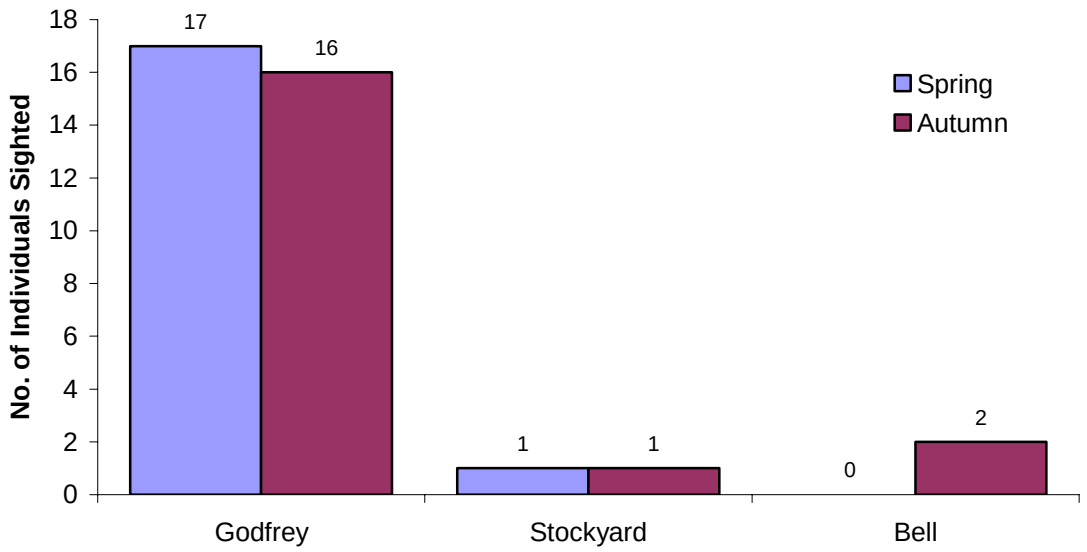



**Figure 8.** The number of animals recorded by block during spotlighting in the spring and autumn within the Wellington East FORESTCHECK location.

## Conclusions

- The results support those from elsewhere (e.g. Perup, Kingston and Batalling) that fox baiting has a significant impact on the number of native animals recorded.
- The wet weather had a significant impact on small mammal and reptile trapping in the autumn.
- High numbers of animals were trapped on the logged treatments (shelterwood and gap release).

# DATA MANAGEMENT AND STORAGE

Amanda Mellican and Verna Tunsell

## Introduction

This group is responsible for entering the collected data into electronic format for Macro Vertebrates, Dirurnal Birds, Nocturnals, Mammals and Herpetofauna, Vascular Plants, Macrofungi and Cryptogams, and the collected voucher specimens (Flora, Cryptogams and Macrofungi), and obtaining the electronic data from the remaining groups.

## Data Entry

An excel program applying Visual Basic was developed for each of the survey sheets. There are 2 parts in the program: Data entry and Data correction. The aim is to save time and to reduce typing errors during the data entry process.

As an example, in the Trapping Field Data Sheet, there are 12 fields for the data entry (Location, Treatment, Personnel, Date, Trap point, Species, Weight, Tag #1, Tag #2, Sex, Breeding Condition and Comments). Places of location, names of treatment, names of personnel and gender are known and they are created as drop-down lists. As for the species, common species name was pre-listed in the program. Date as in Day, Month and Year (from 2001 to 2010) was also created as drop down lists. Thus, location, treatment and personnel are only entered once for all the records for a particular data sheet. If there was nothing to comment on, then the program will automatically record in the Comments section as "No comment". If any one of the fields is missing or left as blank, an error message is given and the data would not be inserted into data file until all the fields are selected or filled. Species code, scientific name and common name are also automatically recorded into the data file depending upon the selected common species. Record number is automatically written into the data file.

To date, all the survey sheets have been completed by Verna Tunsell. A metadata form as shown in Appendix A is also completed.

## Data Validation

Amanda Mellican validates the data for all the groups that we are responsible for. The validation date will be recorded in the metadata form. Then a DESCRIPTIONS file (which indicates the lists of an individual field, and codes and descriptions of an individual field), and the validated DATA file will be sent to the leader of the individual group.

## Data Storage

All the individual sampling data will be saved and backed up as individual files on the network drive. The data are saved and secured since the network drive is backed up at COB everyday. The final version of the validated data will be printed and kept in a filing cabinet and eventually archived with the library at the completion of the project.

**Collected Specimens**

The 166 Vascular Plants and 413 Cryptogam specimens collected during the period, have been identified (as far as possible), prepared, and lodged at the WA Herbarium. The fungi season was late this year due to the weather and the 138 collected voucher specimens are almost ready to be processed. The fungi collection is housed at the Tony Annels Herbarium in Manjimup to enable further work to be carried out.

Each specimen is allocated its own unique barcode so that each specimen is readily located by electronic means or by physical means as required.

Vascular plant specimens are pressed and dried, then mounted, with specialised herbarium tape, on card, and placed in separate folders.

Cryptogams are dried (friable specimens are stabilised with emulsion), placed on a card with adhesive to keep the specimen together (Mosses are washed prior to drying to remove debris). The specimens are then secured in cardboard boxes to prevent damage.

Fungi specimens are also dried and placed into greaseproof paper, then into ziplock bags, those small enough then go into similar boxes to cryptogams, the larger remain unboxed.

The specimens that have been lodged at the WA Herbarium have also been databased on the Max system and submitted electronically. Max was developed by Simon Woodman and Paul Gioia and is used as the primary means of submitting specimen information to the Herbarium. There are many facets to Max, the sections used for FORESTCHECK are the collecting book, specimen tables and reporting facilities. (Examples attached).

**Appendix A.** Example of Metadata Form.

Group Name →

Leader →

Contact Officer →

| No | File Name | File Size (KB) | File Type | Date (completed) | Name of Data Entry Person | Validated Date |
|---|---|---|---|---|---|---|
| | | | | | | |
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**Appendix B.** Example of Flora Labels generated in Max.

**WESTERN AUSTRALIAN HERBARIUM, PERTH**
**Flora of Western Australia**

***Stackhousia monogyna*** Labill.

Stackhousiaceae

Identified by:

Erect open perennial shrub, height to 40 cm, width to 40 cm; flowers white. Population flowering 30%. State forest; hill slope; gravelly brown sany clay. frequent. Forest with associated vegetation of Eucalyptus marginata, Allocasuarina fraseriana, Macrozamia riedlei, Hakea lissocarpa, Hibbertia commutata and a few Corymbia calophylla.

**Loc.:** Forest monitoring plot FC30, Godfrey forest block, 2.1 km along Steed Road from Ernie Road then left on shunt,

**Lat.** 33° 16' 2"S **Long.** 116° 25' 25"E (WGS84)

**Coll.** B.G. Ward FC670 **Date:** 05/10/2004

**Voucher:** Forestcheck Monitoring Program.

PERTH 6643337

**WESTERN AUSTRALIAN HERBARIUM, PERTH**
**Flora of Western Australia**

***Trymalium ledifolium*** Fenzl

Rhamnaceae

Identified by:

Erect compact perennial shrub, height to 1 m, width to 90 cm. Population flowering 100%. State forest; hill slope; gravelly brown clayey sand. occasional. Forest with associated vegetation of Eucalyptus marginata, Allocasuarina fraseriana, Macrozamia riedlei, Hakea lissocarpa, Hibbertia commutata and a few Corymbia calophylla.

**Loc.:** Forest monitoring plot FC30, Godfrey forest block, 2.1 km along Steed Road from Ernie Road, then left along shunt,

**Lat.** 33° 16' 2"S **Long.** 116° 25' 25"E (WGS84)

**Coll.** B.G. Ward FC671 **Date:** 05/10/2004

**Voucher:** Forestcheck Monitoring Program.

PERTH 6643329

**WESTERN AUSTRALIAN HERBARIUM, PERTH**
**Flora of Western Australia**

***Trymalium ledifolium*** Fenzl

Rhamnaceae

Identified by:

Erect compact perennial shrub, height to 1 m, width to 90 cm. Population flowering 100%. State forest; hill slope; gravelly brown clayey sand. occasional. Forest with associated vegetation of Eucalyptus marginata, Allocasuarina fraseriana, Macrozamia riedlei, Hakea lissocarpa, Hibbertia commutata and a few Corymbia calophylla.

**Loc.:** Forest monitoring plot FC30, Godfrey forest block, 2.1 km along Steed Road from Ernie Road, then left along shunt,

**Lat.** 33° 16' 2"S **Long.** 116° 25' 25"E (WGS84)

**Coll.** B.G. Ward FC671 **Date:** 05/10/2004

**Voucher:** Forestcheck Monitoring Program.

PERTH 6643329

**WESTERN AUSTRALIAN HERBARIUM, PERTH**
**Flora of Western Australia**

***Acacia pulchella*** R.Br.

Mimosaceae

Identified by:

Erect compact pungent perennial shrub, height to 70 cm, width to 40 cm; flowers yellow. Population flowering 10%. State forest; hill slope; gravelly brown clayey sand. frequent. Forest with associated vegetation of Eucalyptus marginata, Allocasuarina fraseriana, Macrozamia riedlei, Hakea lissocarpa, Hibbertia commutata and a few Corymbia calophylla.

**Loc.:** Forest monitoring plot FC30, Godfrey forest block, 2.1 km along Steed Road from Ernie Road, then left along shunt,

**Lat.** 33° 16' 2"S **Long.** 116° 25' 25"E (WGS84)

**Coll.** B.G. Ward FC672 **Date:** 05/10/2004

**Voucher:** Forestcheck Monitoring Program.

PERTH 6643310

**Appendix C.** Example of Cryptogam Label generated in Max.

**WESTERN AUSTRALIAN HERBARIUM, PERTH**
**Flora of Western Australia**

***Rhyncochostegium tenuifolium*** var. ***tenuifolium***

Brachytheciaceae

Identified by: R.J. Cranfield 25/02/2005

Moss: growing in sheltered wet positions on stone in ground layer Littered brown gravelly clay soil with 5% or less outcropping of laterite, pH7. Occasional on isolated sites. Forest with associated vegetation of Eucalyptus marginata, Corymbia calophylla, Allocasuarina fraseriana, Trymalium ledifolium, Hakea lissocapha.

**Loc.:** Forest monitoring plot 36, 800 m on shunt of Belmont Road, 1km S of intersection with Alamo Road, Bell Forest Block

**Lat.** 32° 59' 53.2"S **Long.** 116° 21' 18.3"E (WGS84)

**Coll.** R.J. Cranfield 20970 **Date:** 12/10/2004

**Voucher:** Forest monitoring program.

**WESTERN AUSTRALIAN HERBARIUM, PERTH**
**Flora of Western Australia**

***Cladonia rigida***

Cladoniaceae

Identified by: R.J. Cranfield 23/02/2005

Lichen: active growth phase; fruticose; growing in sheltered wet positions on organic material in ground layer. Chemistry: cortex K+ yellow. Littered brown gravelly clay soil with 5% or less outcropping of laterite, pH7. Frequent on occasional sites. Forest with associated vegetation of Eucalyptus marginata, Corymbia calophylla, Allocasuarina fraseriana, Trymalium ledifolium, Hakea lissocapha.

**Loc.:** Forest monitoring plot 36, 800 m on shunt of Belmont Road, 1km S of intersection with Alamo Road, Bell Forest Block

**Lat.** 32° 59' 53.2"S **Long.** 116° 21' 18.3"E (WGS84)

**Coll.** R.J. Cranfield 20971 **Date:** 12/10/2004

**Voucher:** Forest monitoring program.

**WESTERN AUSTRALIAN HERBARIUM, PERTH**
**Flora of Western Australia**

***Campylopus introflexus***

Dicranaceae

Identified by: R.J. Cranfield 28/02/2005

Lichen: active growth phase; growing in sheltered wet positions on soil in ground layer. Littered brown gravelly clay soil with 5% or less outcropping of laterite, pH7. Frequent on frequent sites. Forest with associated vegetation of Eucalyptus marginata, Corymbia calophylla, Allocasuarina fraseriana, Trymalium ledifolium, Hakea lissocapha.

**Loc.:** Forest monitoring plot 36, 800 m on shunt of Belmont Road, 1km S of intersection with Alamo Road, Bell Forest Block

**Lat.** 32° 59' 53.2"S **Long.** 116° 21' 18.3"E (WGS84)

**Coll.** R.J. Cranfield 20972 **Date:** 12/10/2004

**Voucher:** Forest monitoring program.

**WESTERN AUSTRALIAN HERBARIUM, PERTH**
**Flora of Western Australia**

***Usnea subeciliata***

Usneaceae

Identified by: R.J. Cranfield 25/02/2005

Lichen: active growth phase; filamentose; growing in sheltered wet positions on live and dead bark in tree layer. Littered brown gravelly clay soil with 5% or less outcropping of laterite, pH7. Occasional on occasional sites. Forest with associated vegetation of Eucalyptus marginata, Corymbia calophylla, Allocasuarina fraseriana, Trymalium ledifolium, Hakea lissocapha.

**Loc.:** Forest monitoring plot 36, 800 m on shunt of Belmont Road, 1km S of intersection with Alamo Road, Bell Forest Block

**Lat.** 32° 59' 53.2"S **Long.** 116° 21' 18.3"E (WGS84)

**Coll.** R.J. Cranfield 20973 **Date:** 12/10/2004

**Voucher:** Forest monitoring program.

**Appendix D.** Example of File Report generated in Max showing unique bar code allocated to each specimen**.**

10/08/2005 **Example of Max Report showing unique barcode number** 1

| COLLECT | SHEETNO | FAMILY | GENUS | SPECIES | INFSP_TYP | INFSP_NAME |
|---|---|---|---|---|---|---|
| FC670 | 6643337 | Stackhousiaceae | Stackhousia | monogyna | | |
| FC671 | 6643329 | Rhamnaceae | Trymalium | ledifolium | | |
| FC671 | 6643329 | Rhamnaceae | Trymalium | ledifolium | | |
| FC672 | 6643310 | Mimosaceae | Acacia | pulchella | | |
| FC674 | 6643299 | Proteaceae | Dryandra | lindleyana | | |
| FC675 | 6643280 | Droseraceae | Drosera | huegelii | | |
| FC676 | 6643272 | Droseraceae | Drosera | menziesii | subsp. | menziesii |
| FC677 | 6643264 | Proteaceae | Conospermum | caeruleum | | |
| FC678 | 6643434 | Casuarinaceae | Allocasuarina | fraseriana | | |
| FC679 | 6643426 | Papilionaceae | Daviesia | preissii | | |
| FC680 | 6643418 | Goodeniaceae | Lechenaultia | biloba | | |
| FC682 | 6643388 | Epacridaceae | Leucopogon | capitellatus | | |
| FC684 | 6643353 | Dilleniaceae | Hibbertia | amplexicaulis | | |
| FC685 | 6643345 | Proteaceae | Dryandra | bipinnatifida | | |
| FC686 | 6643515 | Tremandraceae | Tetratheca | hirsuta | | |
| FC687 | 6643507 | Epacridaceae | Astroloma | pallidum | | |
| FC688 | 6643493 | Thymelaeaceae | Pimelea | suaveolens | subsp. | suaveolens |
| FC689 | 6643485 | Dasypogonaceae | Lomandra | caespitosa | | |
| FC690 | 6643477 | Epacridaceae | Styphelia | tenuiflora | | |
| FC691 | 6643469 | Proteaceae | Petrophile | striata | | |
| FC692 | 6643450 | Loganiaceae | Logania | serpyllifolia | | |
| FC693 | 6643442 | Mimosaceae | Acacia | browniana | | |
| FC694 | 6643604 | Proteaceae | Synaphea | petiolaris | | |
| FC695 | 6643590 | Asteraceae | Senecio | hispidulus | | |
| FC696 | 6643582 | Orchidaceae | Cyanicula | sericea | | |
| FC697 | 6643574 | Orchidaceae | Caladenia | flava | | |
| FC698 | 6643566 | Orchidaceae | Elythranthera | brunonis | | |
| FC699 | 6643558 | Goodeniaceae | Dampiera | linearis | | |
| FC700 | 6643531 | Iridaceae | Patersonia | babianoides | | |
| FC701 | 6643523 | Anthericaceae | Chamaescilla | corymbosa | | |
| FC702 | 6643698 | Iridaceae | Patersonia | juncea | | |
| FC703 | 6643671 | Dilleniaceae | Hibbertia | commutata | | |
| FC704 | 6643663 | Asteraceae | Rhodanthe | citrina | | |
| FC705 | 6643655 | Goodeniaceae | Velleia | trinervis | | |
| FC706 | 6643647 | Anthericaceae | Sowerbaea | laxiflora | | |
| FC707 | 6643639 | Euphorbiaceae | Phyllanthus | calycinus | | |
| FC708 | 6643620 | Papilionaceae | Bossiaea | ornata | | |
| FC709 | 6643612 | Apiaceae | Xanthosia | huegelii | | |
| FC710 | 6643787 | Rutaceae | Boronia | crenulata | | |
| FC711 | 6643779 | Restionaceae | Desmocladus | fasciculatus | | |
| FC712 | 6643760 | Droseraceae | Drosera | stolonifera | | |
| FC712A | 6643752 | Dilleniaceae | Hibbertia | spicata | | |
| FC713 | 6643744 | Olacaceae | Olax | benthamiana | | |
| FC714 | 6643736 | Asteraceae | Craspedia | variabilis | | |
| FC715 | 6643728 | Asteraceae | Hyalosperma | cotula | | |
| FC716 | 6643701 | Haemodoraceae | Conostylis | setigera | | |
| FC717 | 6643876 | Haemodoraceae | Conostylis | aculeata | | |
| FC718 | 6643868 | Haemodoraceae | Conostylis | serrulata | | |
| FC719 | 6643841 | Zamiaceae | Macrozamia | riedlei | | |

* = Alien species

**Appendix E.** Example of Specimen Table generated in Max.

11/08/2005

| Taxon Name | NameID | SpeciesCode | Lifeform | Lifestyle | Fire Resp |
|---|---|---|---|---|---|
| *Acacia alata* | 3207 | ACAALA | S | P | A1 |
| *Acacia browniana* | 3247 | ACABRO | S | P | A1 |
| *Acacia celastrifolia* | 3254 | ACACEL | S | P | A1 |
| *Acacia drummondii* | 3311 | ACADRU | S | P | A1 |
| *Acacia drummondii* subsp. *drummondii* | 11661 | ACADRUDR | S | P | A1 |
| *Acaena echinata* | 3184 | ACAECH | DS | P | A1 |
| *Acacia extensa* | 3331 | ACAEXT | S | P | A1 |
| *Acacia myrtifolia* | 3453 | ACAMYR | S | P | A1 |
| *Acacia preissiana* | 3496 | ACAPRE | DS | P | A1 |
| *Acacia pulchella* | 3502 | ACAPUL | S | P | A1 |
| *Acacia saligna* | 3527 | ACASAL | S | P | A1 |
| *Actinotus glomeratus* | 6203 | ACTGLO | DS | P | A1 |
| *Agrostocrinum scabrum* | 1261 | AGRSCA | G | P | B3 |
| *Aira cupaniana* | 185 | AIRCUP | GR | A | A1 |
| *Allocasuarina fraseriana* | 1728 | ALLFRA | T | P | B1 |
| *Anigozanthos manglesii* | 1411 | ANIMAN | S | P | B3 |
| *Arctotheca calendula* | 7838 | ARCCAL | H | A | A1 |
| *Astroloma ciliatum* | 6323 | ASTCIL | DS | P | B2 |
| *Astroloma drummondii* | 6325 | ASTDRU | DS | P | B2 |
| *Astroloma pallidum* | 6334 | ASTPAL | DS | P | B2 |
| *Austrodanthonia caespitosa* | 17950 | AUSCAE | GR | P | B3 |
| *Austrostipa campylachne* | 17233 | AUSCAM | GR | P | B3 |
| *Banksia grandis* | 1819 | BANGRA | T | P | A2 |
| *Banksia sphaerocarpa* | 1851 | BANSPH | S | P | A2 |
| *Billardiera variifolia* | 3165 | BILVAR | V | P | A1 |
| *Boronia crenulata* | 4413 | BORCRE | DS | P | A1 |
| *Boronia gracilipes* | 4422 | BORGRA | DS | P | A1 |
| *Boronia ramosa* | 4438 | BORRAM | S | P | A1 |
| *Boronia spathulata* | 4441 | BORSPA | S | P | B2 |
| *Bossiaea eriocarpa* | 3710 | BOSERI | S | P | A1 |
| *Bossiaea ornata* | 3714 | BOSORN | S | P | A1 |
| *Briza minor* | 245 | BRIMIN | GR | A | A1 |
| *Burchardia umbellata* | 1387 | BURUMB | G | P | B3 |
| *Caesia micrantha* | 1276 | CAEMIC | G | P | B3 |
| *Caladenia flava* | 1592 | CALFLA | G | P | B3 |
| *Caladenia macrostylis* | 1604 | CALMAC | G | P | B3 |
| *Caladenia reptans* | 1613 | CALREP | G | P | B3 |
| *Caladenia splendens* | 15380 | CALSPL | G | P | B3 |
| *Cassytha racemosa* | 2957 | CASRAC | P | P | A1 |
| *Centaurium erythraea* | 6539 | CENERY | H | A | A1 |
| *Centrolepis polygyna* | 1134 | CENPOL | H | A | A1 |
| *Chamaescilla corymbosa* | 1280 | CHACOR | G | P | B3 |
| *Clematis pubescens* | 2929 | CLEPUB | V | P | A1 |
| *Comesperma calymega* | 4550 | COMCAL | DS | P | B2 |
| *Conostylis aculeata* | 1418 | CONACU | DS | P | B3 |
| *Conospermum caeruleum* | 1862 | CONCAE | S | P | A1 |
| *Conostylis serrulata* | 1453 | CONSER | DS | P | B2 |
| *Conostylis setigera* | 1454 | CONSET | DS | P | B3 |
| *Corymbia calophylla* | 17104 | CORCAL | T | P | A2 |
| *Craspedia variabilis* | 13354 | CRAVAR | G | P | B3 |