# REPORT OF PROGRESS 2007-08

FOREST CHECK

Department of Environment and Conservation

*Our environment, our future*

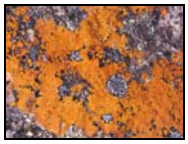
## Science Division
## March 2009

Balga at Kingston external control (main photo), the forest red-tailed black cockatoo (above right) and collecting coarse woody debris data (right).


Reptiles


Fungi


Invertebrates


Lichens


Mammals


Birds


Flora

**Produced by the Department of Environment and Conservation, Kensington, Western Australia, March 2009**



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This report highlights preliminary results for FORESTCHECK monitoring, determined by basic analysis and field observation, for the year 2007-08. This and previous FORESTCHECK Annual Reports should not be quoted or used as final results for the FORESTCHECK program. Publications based on detailed analyses using comprehensive statistical methods are published on a 5-year basis. All FORESTCHECK publications and reports are available on the DEC NatureBase web site at www.naturebase.net

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# EXECUTIVE SUMMARY

FORESTCHECK is a unique monitoring program, which is unparalleled for its integration and the range of ecological attributes and biodiversity monitored. Fieldwork on the FORESTCHECK monitoring program was suspended in 2006-07 to allow a comprehensive analysis and write-up of the first five years of data to be undertaken. The results from five years of data collected from 2001-2006 will be submitted in 2009 to a peer reviewed journal for publication.

This document reports the results of FORESTCHECK monitoring on ten grids in the Donnelly District in 2007-08. The Donnelly grids were previously monitored in 2001-02. This report, and previous reports, can be viewed on and downloaded from the Department of Environment and Conservation NatureBase website at www.naturebase.net .

The monitoring grids at Donnelly are located within a variety of vegetation complexes in the jarrah south forest ecosystem. The external reference grids are situated in uncut forest located in state forest and national park. Coupe buffer grids are situated in uncut state forest included in the temporary area exclusion system (TEAS). The remaining shelterwood and gap release grids are in forest that was harvested during the period of 1991 to 1996.

The results in this report represent observations from preliminary analysis only. However, some interesting points which have emerged from the 2007-08 results and from comparisons with data from the same grids in 2001-02 are:

- Stand growth at Donnelly reflected treatments, with harvested grids having higher basal area increments than external controls and coupe buffers, and gap release grids having the highest overall increment of 1.0-1.5 $m^2$ $ha^{-1}$ $year^{-1}$.
- Litter loads increased since the initial measurement in 2001 and reflected time since fire.
- Assessment of coarse woody debris was expanded to include decay stage, and logs ≥ 20 cm diameter were tagged to allow more precise measurement of change over time.
- Significant additions to the macrofungal flora and invertebrate fauna records were achieved in 2007-08. Species accumulation continues to rise steadily for both groups with no signs of slowing.
- Helena gum moth was very abundant on the Donnelly grids in 2007-08.
- The second phase of monitoring has increased knowledge on the disturbance ecology and successional trends for a number of lichens.
- Comparison of vascular plant data collected in 2001 and 2007 shows no difference in the plant community structure and composition.
- The density of diurnal birds was similar in each treatment with an overall density of 13.3 birds per hectare. Nocturnal birds were not monitored in 2007-08.
- Woylie numbers decreased by 62% in 2007-08 compared to captures recorded in 2001-02. This is consistent with regional declines in woylie populations.

- Brush tail possum numbers increased from 3% of total mammal captures in 2001-02 to be 11% in 2007-08. This coincides with the expansion of Western Shield baiting to the eastern side of the South Western Hwy.

The commitment and professionalism of the FORESTCHECK team is to be commended, and I look forward to reviewing the next round of results from the Wellington District in 2008-09.

Dr Neil Burrows
Director, Science Division
March 2009.

# 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 jarrah forest in the Donnelly District during the 2007-08 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 intention is to extend the scale of monitoring over time to include 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[1] and is included as an operational program in the current Forest Management Plan 2004-2013[2]. 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 and adaptive management is recognized as an appropriate strategy for managing under conditions of uncertainty and change.

The Science Division of the Department of Environment and Conservation has primary responsibility for the implementation of FORESTCHECK. The development of the program took place over 2 yrs and included input from scientists and managers within the Department of Environment and Conservation, 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 www.naturebase.net

[1] Codd, M. 1999. Forest management Plans 1994-2003: Mid-Term EPA Report on Compliance

[2] Conservation Commission of Western Australia.2004. Forest management plan 2004-2013. Conservation Commission of Western Australia. 144p + maps.

**Monitoring strategy**

Between 1995 and 2004 timber harvesting in jarrah forests was undertaken according to Silvicultural Guideline 1/95, which recognizes three 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.

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[3]).

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 have been established at a number of locations throughout the jarrah forest, stratified according to recognized ecological gradients of rainfall, evapo-transpiration and soil fertility. Forest ecosystem mapping (Mattiske and Havel 1998[4], 2000[5]) 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 four sampling grids. Grids have been established in forest subject to the following treatments:

(1) gap release,
(2) shelterwood (or selective cut),
(3) coupe buffer or internal reference forest i.e. temporary exclusion areas (TEAS) between adjacent gaps or shelterwood forest,

[3] CALM 2004. Silvicultural practice in the jarrah forest. Dept. CALM, SFM guideline No. 1.
[4] 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.
[5] Mattiske, E.M. and Havel, J.J 2000. Vegetation Mapping in the South West of Western Australia. CALM, Perth.

(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.

At each location, grids are 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 are always present in the one locality and occasionally, external reference forest has been located some distance from their harvested counterparts. Also, 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**

Monitoring of biodiversity is based on a sampling grid (see Fig. 1). The main grid is 200 m x 100 m, with a central area of 100 m x 100 m. Four 30 m x 30 m vegetation sample plots are located external to and adjacent each corner of the central area.

A range of ecosystem attributes are monitored on each grid 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)

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 at Donnelly 2007-08**

Ten FORESTCHECK monitoring grids were established in the Donnelly District in 2001 (Table 1). Four grids are situated in Kingsotn block (FC1, FC2, FC3 & FC4), one in Yornup (FC5), two in Thornton (FC6 & FC7), two in Carter (FC8 & FC9) and one in Easter (FC10) (Figs 2-5). They were initially monitored in spring 2001 and autumn 2002 and a second round of monitoring was conducted in 2007-08. The grids are located within several Mattiske and Havel (1998) vegetation complexes. External reference grids and coupe buffers (TEAS) are situated in uncut forest. The Kingston (FC1) and Easter

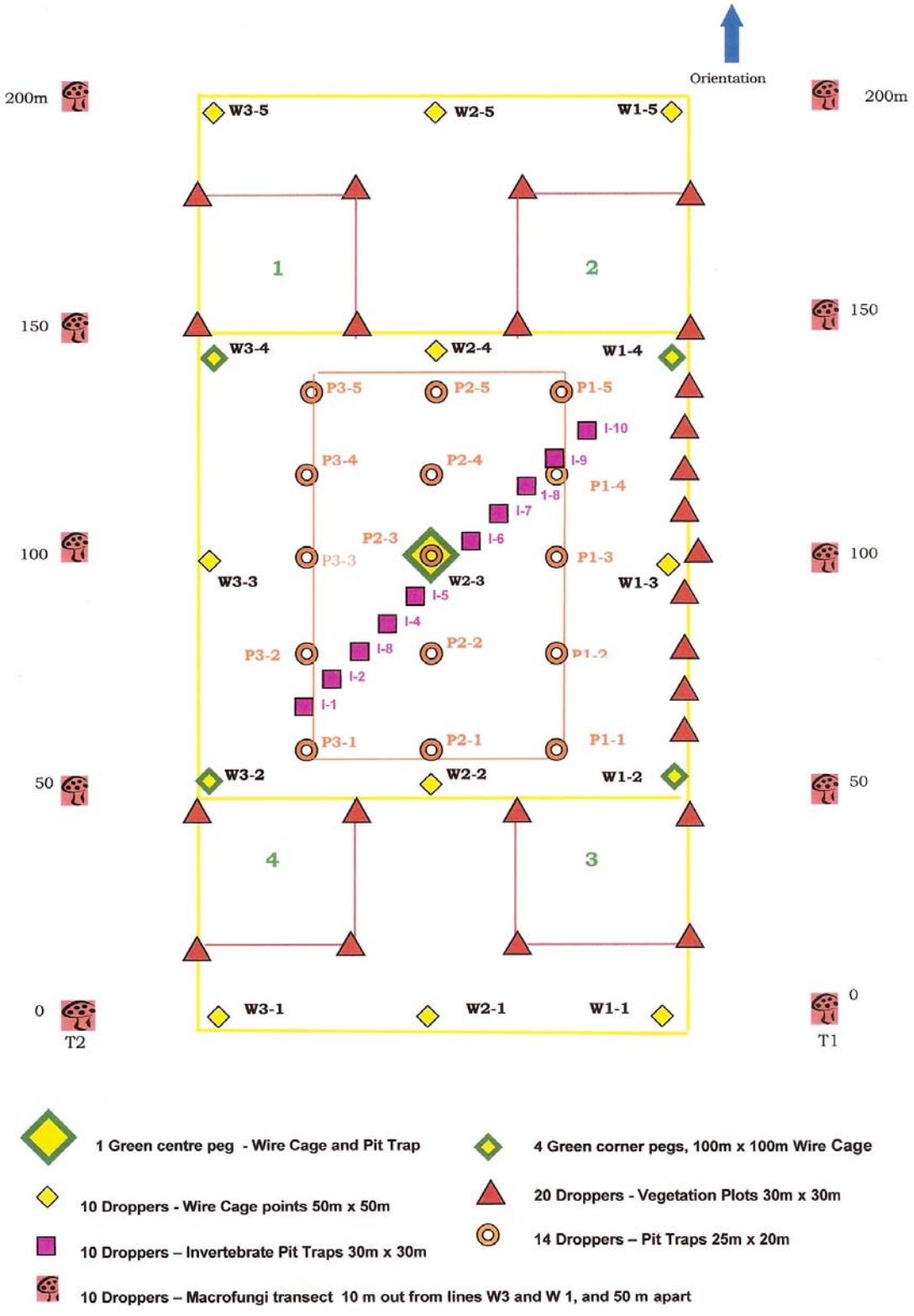



**Figure 1**. FORESTCHECK grid layout

(FC10) external reference grids are situated in national park, but the Yornup external reference (FC5) is in State forest. The range of time since the last fire was 4-21 years, and the only grid that has been burnt since the initial monitoring in 2001-02 is the Yornup external reference which was prescribe burnt in spring 2003. The remaining grids are in forest that was harvested during the period of 1991 to 1996 (Table 1).

**Table 1**. Forest block location, and management history of each FORESTCHECK grid at Donnelly in 2007.

| Treatment/ Grid | Forest block | Burnt | | Logged | | Site Type | Site description |
|---|---|---|---|---|---|---|---|
| | | Year[1] | Years since | Current cutting cycle | Years since | | |
| **External control** | | | | | | | |
| FC1 | Kingston | 1986 Au | 21 | Uncut | | Corbalup 2 | Depressions- humid & subhumid |
| FC5 | Yornup | 2003 Sp* | 4 | Uncut | | Mattaband 1 | Lowlands – perhimid & humid |
| FC10 | Easter | 1999 Sp | 18 | Uncut | | Bevan 1 | Uplands - perhumid |
| **Coupe buffer** | | | | | | | |
| FC4 | Kingston | 1996 Sp | 11 | Uncut | | Corbalup 2 | Depressions- humid & subhumid |
| FC7 | Thornton | 1996 Sp | 11 | Uncut | | Corbalup 1 | Depressions – perhumid & humid |
| FC9 | Carter | 1999 Sp | 8 | Uncut | | Collis1/ Yanmar 2 | Lowlands – perhumid & humid, valley floor humid |
| **Shelterwood** | | | | | | | |
| FC3 | Kingston | 1995 Sp | 12 | 1996 | 11 | Corbalup 2 | Depressions- humid & subhumid |
| **Gap release** | | | | | | | |
| FC3 | Kingston | 1995 Sp | 12 | 1996 | 11 | Corbalup 2 | Depressions- humid & subhumid |
| FC6 | Thornton | 1992 Sp | 15 | 1991 | 16 | Corbalup 1 | Depressions – perhumid & humid |
| FC8 | Carter | 1999 Sp | 8 | 1995 | 12 | Collis 1 | Lowlands – perhumid & humid |

[1] Au & Sp refer to the silvicultural burn being carried out in autumn or spring.
* Yornup FC5 was the only grid burnt since the initial monitoring in 2001 (previously burnt in 1996 Sp.)

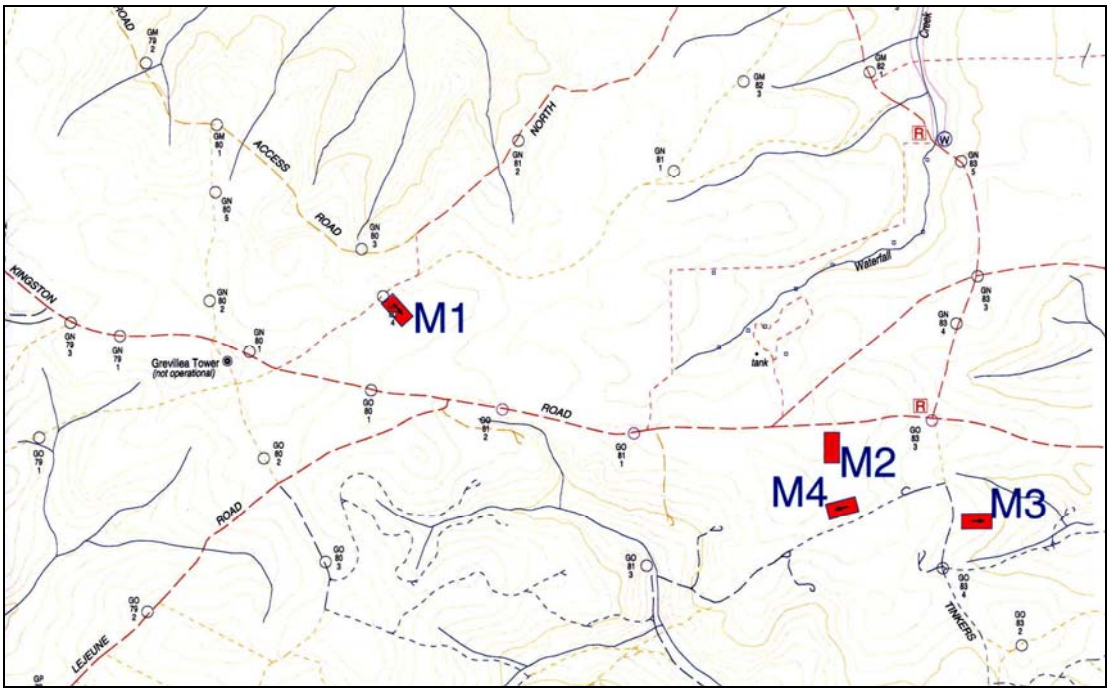



**Figure 2.** Location of FC1, FC2, FC3 and FC4 in Kingston forest block.

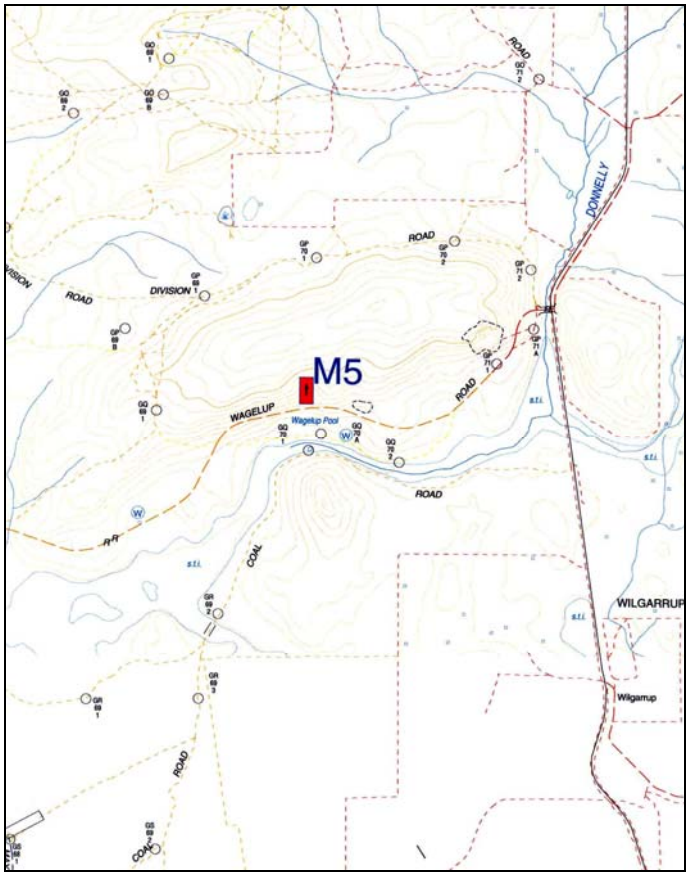



**Figure 3.** Location of FC5 in Yornup forest block.

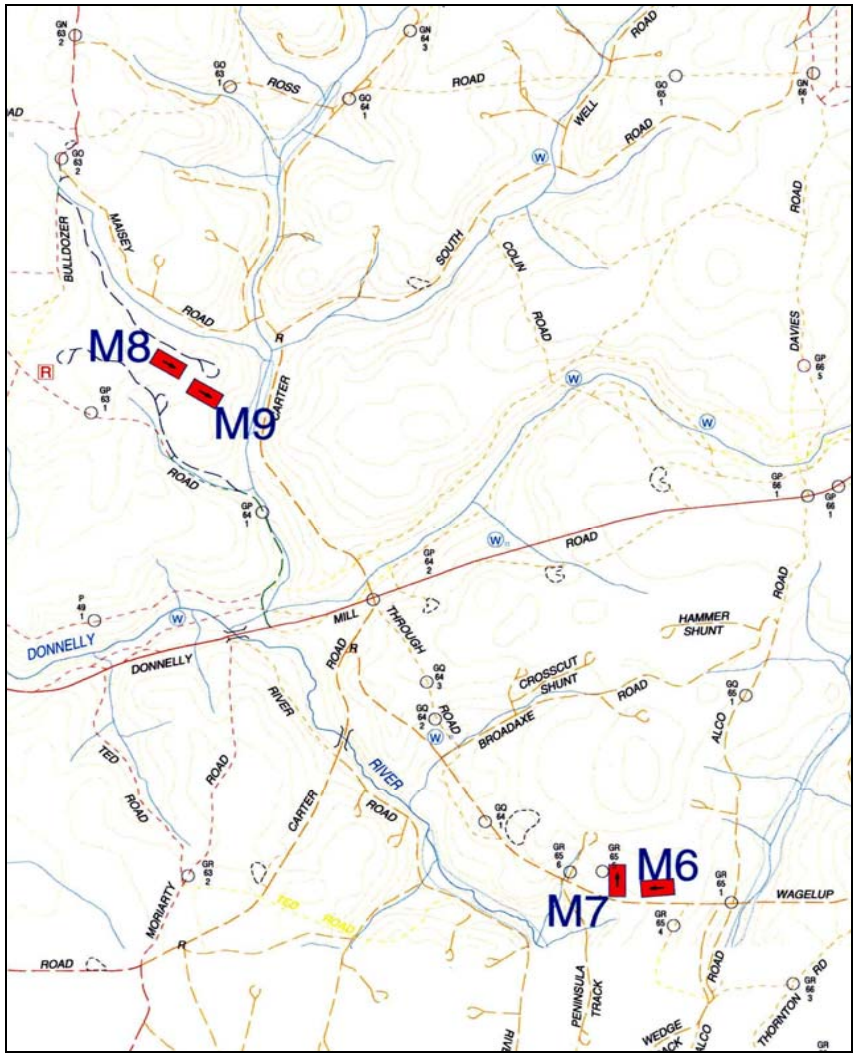



**Figure 4.** Location of FC6, FC7, FC8 and FC9 in Thornton and Carter forest block.

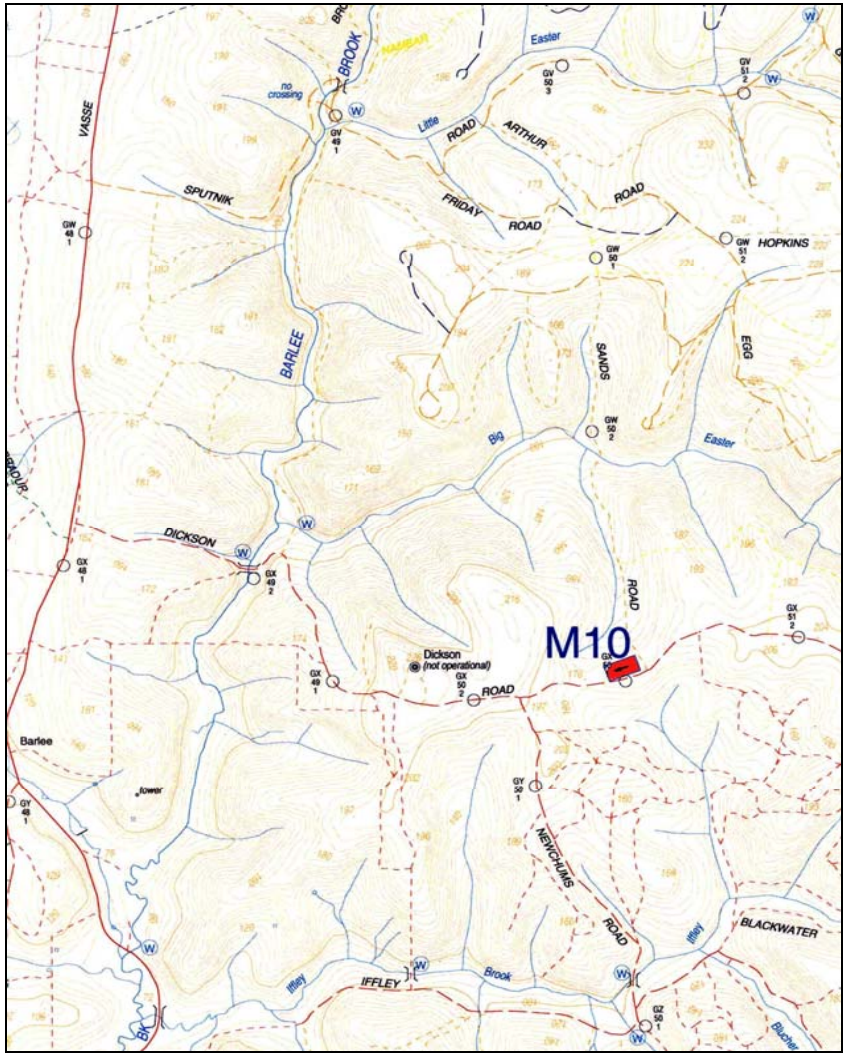



**Figure 5.** Location of FC10 in Easter forest block.

Reference photographs of each grid were initially taken in 2001 and presented in the FORESTCHECK Report of Progress 2002-2002 (available at www.naturebase.net). In 2007, reference photos were again taken for each monitoring grid and are presented in Figs. 5-14. All photos were taken from peg W2-1 looking towards the centre peg (W2-3) (see Fig. 1), and allow changes in vegetation structure and condition to be observed in each subsequent photograph (compare to photos in 2001-02 report, but note that in 2001 photos were not taken from a standard reference point on each grid).

**Figure 5**. FC1 Kingston external reference.

**Figure 6**. FC2 Kingston gap release.

**Figure 7**. FC3 Kingston shelterwood.

**Figure 8**. FC4 Kingston coupe buffer (TEAS).

**Figure 9**. FC5 Yornup external reference.

**Figure 10**. F6 Thornton gap release.

**Figure 11**. FC7 Thornton coupe buffer (TEAS).

**Figure 12**. FC8 Carter gap release.

**Figure 13**. FC10 Easter external reference.

**Figure 14**. FC9 Carter coupe buffer (TEAS).

The budget and expenditure for the 2007-08 FORESTCHECK program is detailed in Table 2. Funding for the program is provided by the Sustainable Forest Management Division of DEC via a works agreement with the Forest Products Commission for $225,000.

**Table 2.** Budget for maintenance and monitoring of FORESTCHECK sites at Donnelly for 2007-08

| Task/Activity | OIC | Total Operating |
|---|---|---|
| **OPERATIONAL** | | |
| Grid maintenance | McCaw | 18 000 |
| Forest structure and regeneration | McCaw | 6 000 |
| Soil and foliar nutrients | McCaw | 5 000 |
| Soils disturbance | Whitford | Nil |
| Macrofungi / Litter & CWD | Robinson | 15 000 |
| Vascular flora | Ward | 10 000 |
| Cryptogams | Cranfield | 10 000 |
| Invertebrates | Farr | 15 000 |
| Birds (diurnal) | Liddelow | 3 000 |
| Fauna (grid trapping) | Liddelow | 10 000 |
| | | |
| **OTHER** | | |
| Administration and overheads | McCaw | 51 550 |
| Data base management | McCaw | 52 473 |
| Data analysis and publications | McCaw | 16 241 |
| Directorate | | 12 736 |
| | | |
| **SUB TOTAL** | | **225 000** |
| **SALARY** | | 191 000 |
| **TOTAL** | | **416 000** |

**2008-09 Activities**

In 2008-09 monitoring will be undertaken in the Wellington District. Nine FORESTCHECK grids (FC11 to FC19) were established in Wellington in 2002, and initially monitored in 2002-03. The grids are located north-east of Collie between the 900 mm and 1000 mm annual isohyets in State forest and the Lane Poole Reserve.

## FOREST STRUCTURE AND REGENERATION STOCKING

Lachlan McCaw, Grant Phelan and Lydia Guja

### 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 recognised as a Category A indicator (Commonwealth of Australia 1998) 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 stands, there is a need to consider existing stand structure and whether there is sufficient sapling and advance growth present for re-establishment 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 (CALM 2004).

Forest managers also require information about growth rate and species composition 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.

A total of 48 FORESTCHECK monitoring grids were established between 2001-02 and 2005-06 across the geographic range of the jarrah forest. The distribution of grids stratified according to DEC administrative boundaries and forest ecosystems mapped for the Regional Forest Agreement (Mattiske and Havel 2000) and is as follows:

- Donnelly District (jarrah south), 10 grids;
- Wellington District (jarrah north west - central), 9 grids;
- Perth Hills District (jarrah north west - north), 8 grids;
- Wellington District (jarrah north east), 10 grids; and
- Blackwood District (jarrah Blackwood), 11 grids.

Ten monitoring grids established in Donnelly District in 2002 were re-assessed in 2008 with the objective of describing changes in stand structure, species composition and developmental stage of tree species present over the previous six years.

### Monitoring

Sampling techniques were the same as in May 2002, except that cut stumps were not re-measured and triangular tessellation assessment of regeneration stocking was not repeated. All trees taller than 2 m were measured in transects 100 m long by 4 m wide located between marker pegs 1-2 to 1-4 and 3-2 to 3-4. To improve the reliability of long

term measurements of tree growth, mortality and tree fall all stems ≥20 cm diameter at breast height were identified with a numbered tag. The height and species of regeneration was assessed at four locations on each grid to indicate the rate of regrowth.

Canopy cover was recorded in spring 2007 as part of the vegetation cover assessment during vascular plant surveys. Intercepts with foliage above 2 m in height were recorded at 240 points around the perimeter of the four 30 m x 30 m vegetation quadrats using a vertical periscope fitted with a fine crosshair. Canopy intercepts were recorded as presence/absence.

**Data management**

Stem diameter measurements from 2008 were entered into the FORESTCHECK stand database and used to calculate current basal area and basal area increment for the period 2002-2008. A small number of errors in the 2002 data were detected and corrected. These resulted from:

- incorrect recording of species for one large tree on grid FC4 during the 2002 assessment;
- inclusion of additional jarrah trees on FC5, FC9 and FC10 in 2008 assessment which had not been measured in 2002.

In these three plots the basal areas in 2002 were adjusted to account for the additional trees recorded in 2008 but these additional trees were not allocated any increment for the period 2002-2008.

Permanent tagging of trees >20 cm diameter will minimize potential for errors of this kind during subsequent measurements.

**Preliminary results**

**Stand structure and species composition**

Basal area and basal area increment of jarrah and marri are summarised in Table 1 and stem diameter distribution by 10 cm classes is presented for each grid in Figures 1, 2 & 3.

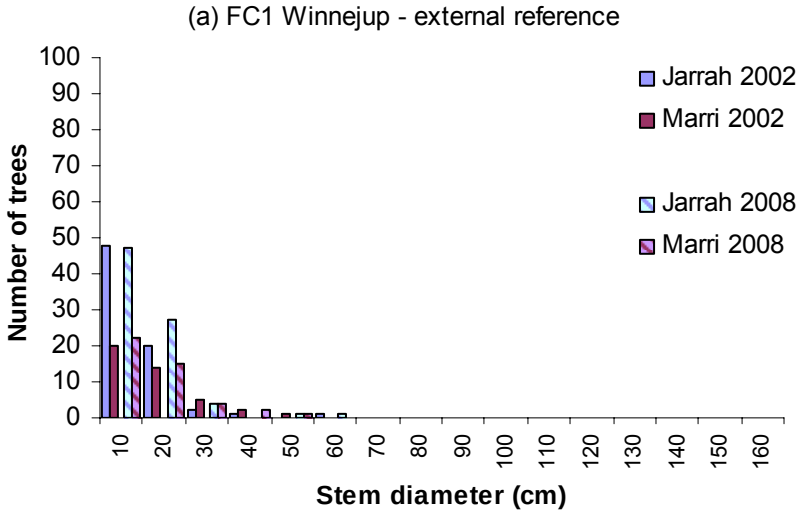
External reference and coupe buffer grids exhibited modest basal area increments (0.09-0.56 $m^2$ $ha^{-1}$ $year^{-1}$). Grid FC10 experienced strong growth of saplings following a low intensity prescribed fire in 1999 (Fig. 1 & 2).

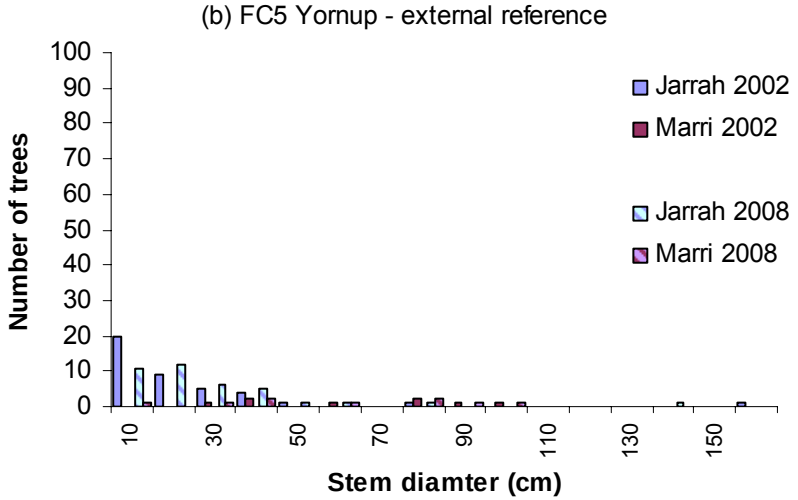
Grid FC3 which was cut to shelterwood had an increment of 0.39 $m^2$ $ha^{-1}$ $year^{-1}$ comprised predominantly of jarrah, although marri was more numerous than jarrah in the sapling size class (Fig. 2).

Grids cut to gap release had increments in the range 1.0-1.5 $m^2$ $ha^{-1}$ $year^{-1}$ with jarrah contributing more than half of the increment. The stand structure of gap release grids changed as a result of saplings growing into the 10-20 cm diameter size classes, and there was some mortality of smaller saplings (Fig. 3).

**Table 1.** Basal area in 2008 and basal area increment of live eucalypts >2 m tall over the period 2002-2008 for ten FORESTCHECK grids in Donnelly District.

| Treatment | Grid | Basal area 2008 ($m^2$ $ha^{-1}$) | | | Basal area increment ($m^2$ $ha^{-1}$) | | Mean annual increment ($m^2$ $ha^{-1}$ $year^{-1}$) |
|---|---|---|---|---|---|---|---|
| | | jarrah | marri | total | jarrah | marri | |
| **External control** | FC1 | 13.30 | 10.95 | 24.25 | 2.16 | 1.21 | 0.56 |
| | FC5 | 39.30 | 33.01 | 73.20 | 1.47 | 0.29 | 0.29 |
| | FC10 | 33.13 | 39.26 | 72.39 | -0.10 | 1.68 | 0.26 |
| **Coupe buffer** | FC4 | 50.74 | 27.56 | 78.30 | 1.95 | -1.44 | 0.09 |
| | FC7 | 11.96 | 23.79 | 35.75 | 1.97 | 0.13 | 0.35 |
| | FC9 | 32.55 | 13.44 | 45.99 | 1.48 | 1.04 | 0.42 |
| **Shelterwood** | FC3 | 12.00 | 8.40 | 20.40 | 2.24 | 0.12 | 0.39 |
| **Gap release** | FC2 | 20.73 | 20.55 | 41.28 | 5.29 | 1.02 | 1.05 |
| | FC6 | 10.05 | 16.43 | 26.48 | 5.01 | 4.13 | 1.52 |
| | FC8 | 14.09 | 5.36 | 19.45 | 5.35 | 3.76 | 1.52 |


(a) FC1 Winnejup - external reference
Number of trees
Stem diameter (cm)
Jarrah 2002
Marri 2002
Jarrah 2008
Marri 2008


(b) FC5 Yornup - external reference
Number of trees
Stem diamter (cm)
Jarrah 2002
Marri 2002
Jarrah 2008
Marri 2008

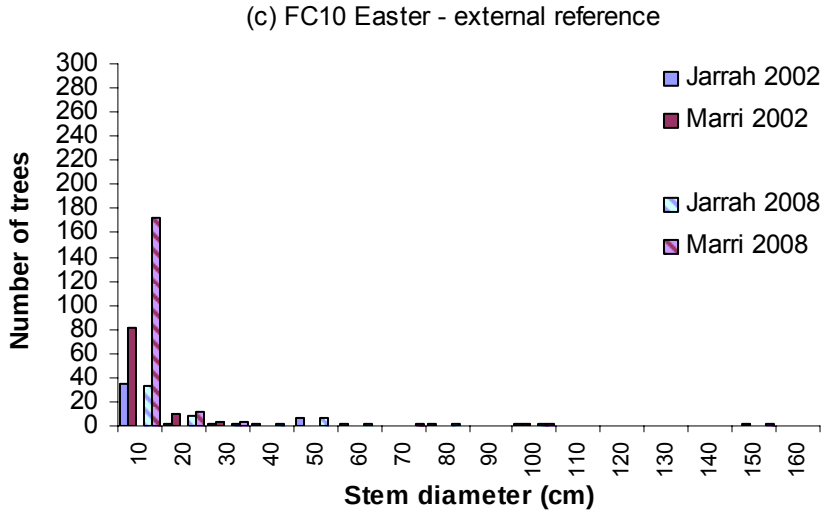

(c) FC10 Easter - external reference
Number of trees
Stem diameter (cm)
Jarrah 2002
Marri 2002
Jarrah 2008
Marri 2008

**Figure 1.** Stem diameter distribution by 10 cm classes for each external control grid in classes 0-9 cm, 10-19 cm etc.

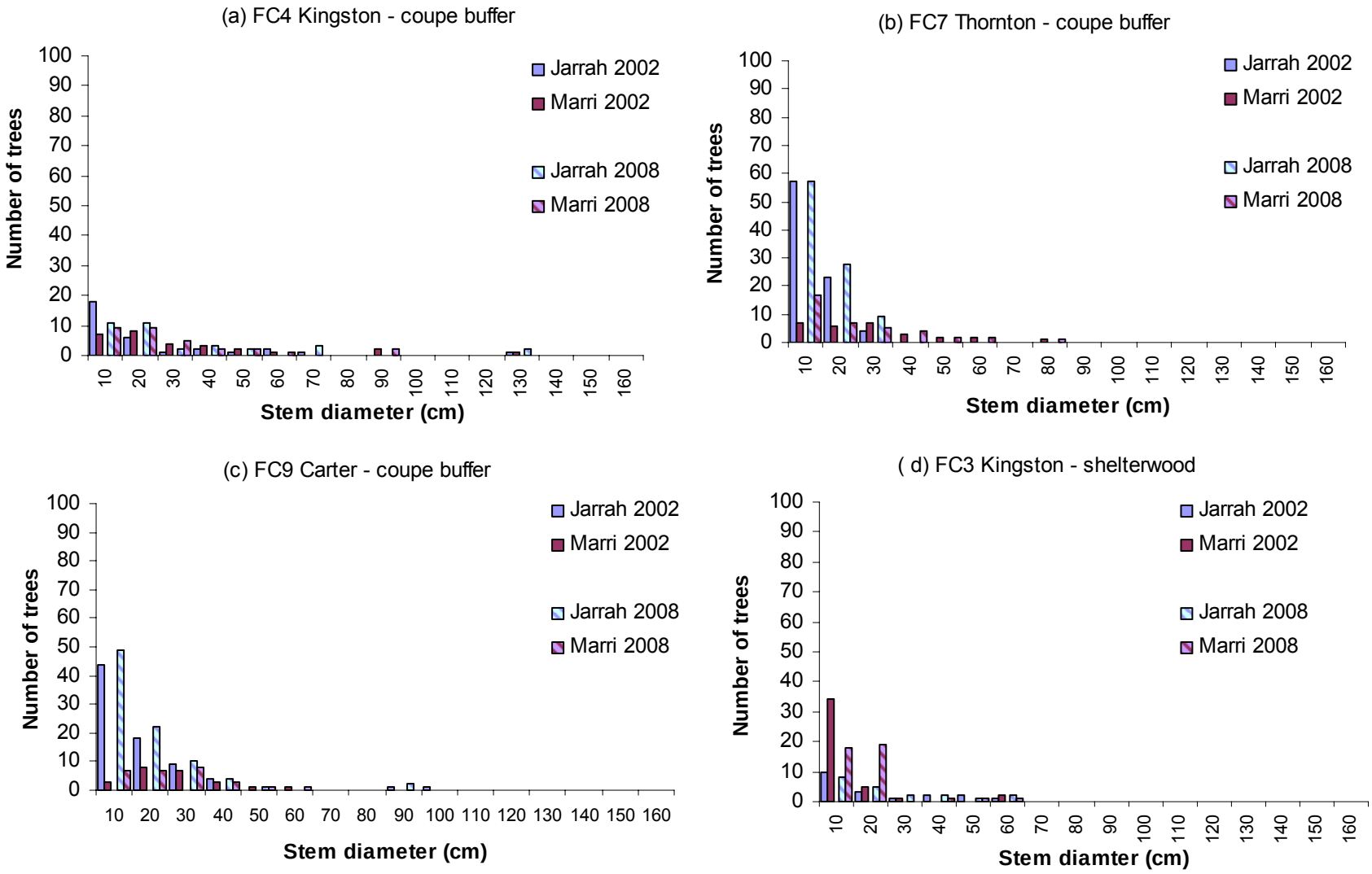



**Figure 2.** Stem diameter distribution by 10 cm classes for each coupe buiffer and shelterwood grid in classes 0-9 cm, 10-19 cm etc.

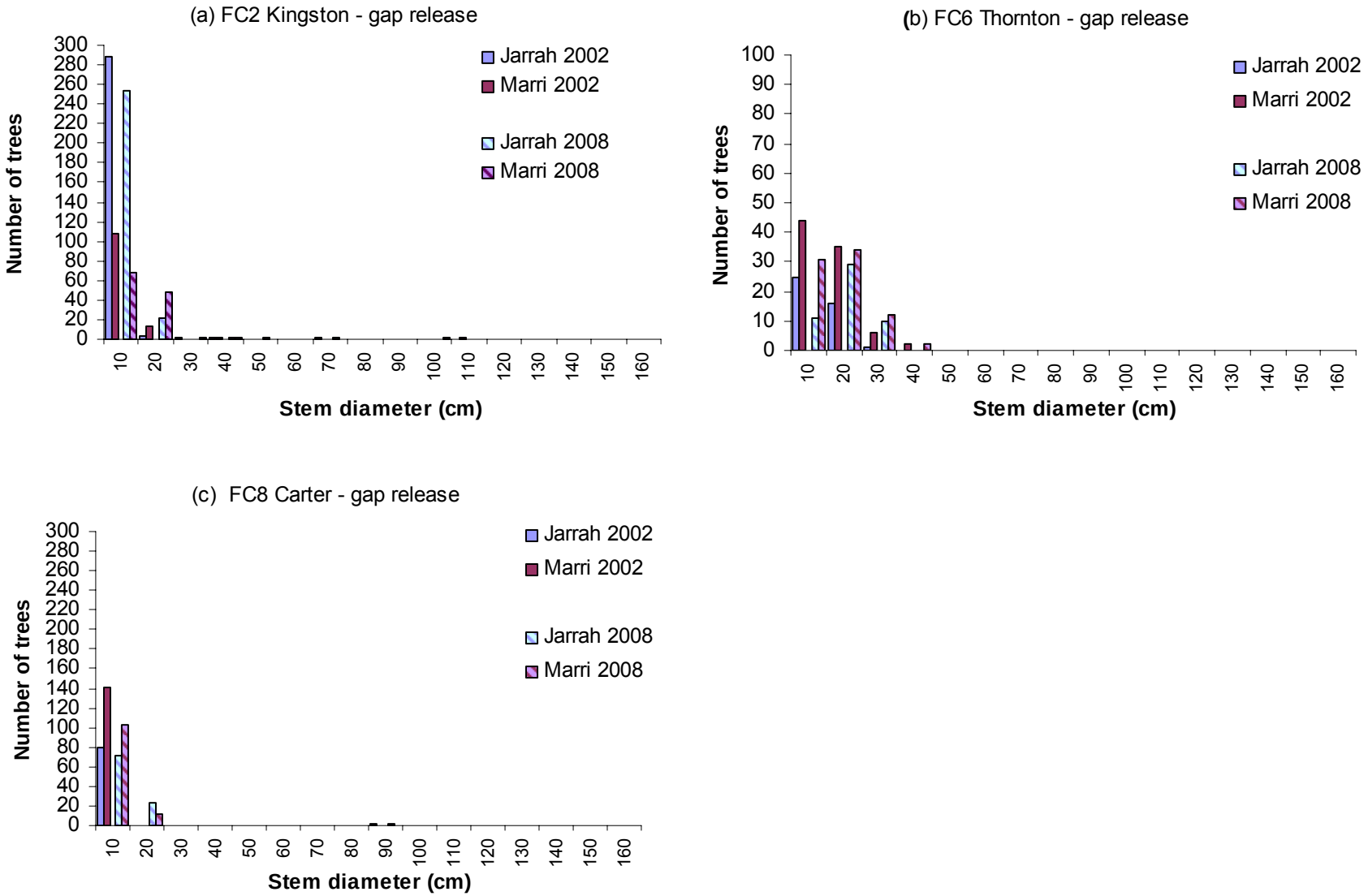



**Figure 3.** Stem diameter distribution by 10 cm classes for each gap release grid in classes 0-9 cm, 10-19 cm etc.

Measured canopy cover increased most markedly in the Carter gap release grid (FC8) which only had a very low cover in 2001 following post-harvest burning in 1999 (Fig. 4). Cover also increased, but to a lesser extent, in the Kingston shelterwood grid (FC3), external reference grids at Winnejup (FC1) and Yornup (FC5), coupe buffer grids at Kingston (FC4) and Carter (FC9), and the gap release grid at Thornton (FC6). Measured cover decreased between 2001 and 2007 at the Easter external reference (FC10), Thornton coupe buffer (FC7), and Kingston gap release (FC2) grids.

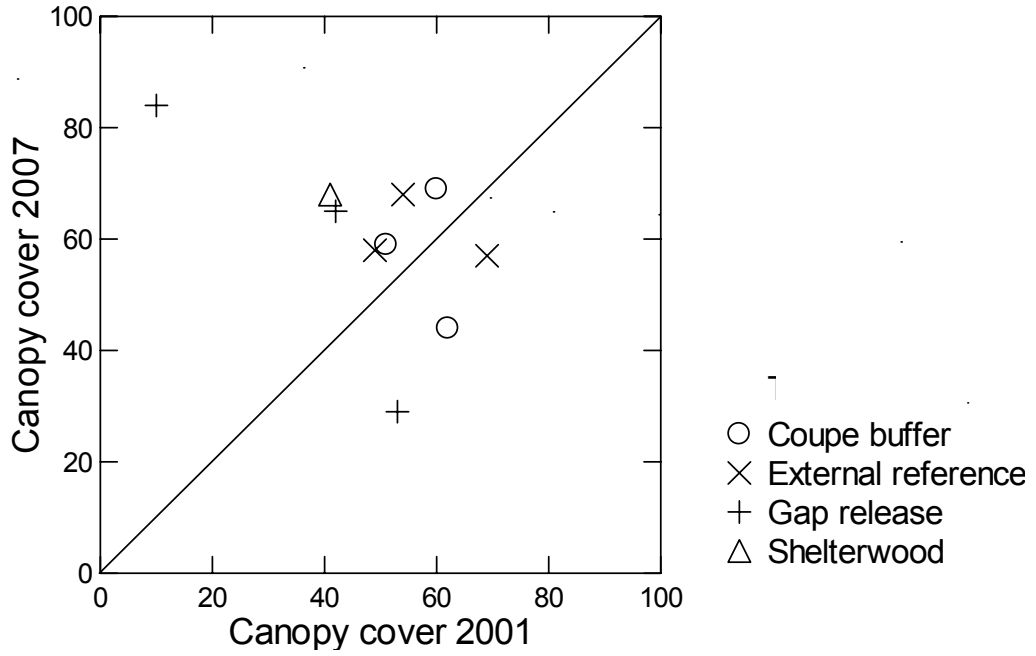



**Figure 4.** Scatter plot of canopy cover measurements made on each grid in 2001 and 2007. The line indicates 1:1 agreement between measurements in different years.

## Discussion

Basal area increments for external reference and coupe buffer grids are consistent with or slightly greater than the mean value of 0.19 $m^2$ $ha^{-1}$ $year^{-1}$ reported for high quality jarrah forest by Abbott and Loneragan (1983) based on analysis of data from 47 plots in the forest between Collie and Mundaring. Stand growth in the shelterwood and gap release harvested grids was above to very much above this mean value and reflected recruitment of a vigorous cohort of saplings.

For some grids the crown cover measurements made in 2007 varied considerably from measurements made in 2001. In the case of the Carter gap release grid (FC8) this is readily explained by re-establishment of a sapling canopy following regeneration. Some variation may also have resulted from changes in the vertical arrangement of foliage caused by height growth and differentiation of the canopy, particularly in the Kingston gap release grid (FC2) which had become noticeably more open by 2007 as the sapling cohort increased in height and became separated from the understorey shrub layer. More sophisticated techniques such as leaf area index (LAI) assessment from remote sensing and vertical photography may have to be employed if precise quantification of canopy condition is required to monitor the impacts of frost, drought or insect defoliation.

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

Kim Whitford and Richard Robinson

### Introduction

Wood and leaf debris on the forest floor provides habitat for many fungi, small reptiles, mammals and invertebrates. The litter layer also affects soil moisture and in conjunction with micro-organisms influences soil structure. Consequently coarse woody debris (CWD), small wood and twigs (SWT) and litter are important structural and biological components of forest ecosystems. Disturbance such as logging and burning influence the volumes and types of debris that occur in forests. The aims of this component of the FORESTCHECK monitoring program are to:

- Measure and record the amount of litter, small wood and twigs and coarse woody debris 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.
- Provide data for analysis of distribution patterns of other organisms such as invertebrates, small mammals, fungi and cryptogams.

The 2007-08 CWD assessment was used to collect additional data on 22 of the existing 48 monitoring grids. The additional field work and data collection:

- Increased the length of the two transects used for CWD assessment on each grid from 100 m to 200 m to improve the precision of the estimate of CWD debris.
- Provided data on the decay status of the CWD as this had not previously been collected and is known to greatly influence the habitat value and combustibility of CWD.
- Provided additional assessments of log attributes related to the combustibility of individual CWD pieces.
- Provided assessments of attributes related to the rates of decay of individual CWD pieces.
- Provided assessments of attributes related to the habitat quality of individual CWD pieces.
- Recorded the location of each piece of CWD and tagged each piece with a diameter greater than 20 cm at the point that it was intersected by the transect. This will facilitate the identification and remeasurement of CWD after fires.

These additional assessments and the revised procedure now used to assess CWD are detailed in Whitford *et al*. (2008).

### Field and Laboratory Monitoring

For these assessments, SWT is defined as woody material that is 1 cm to 2.5 cm in diameter, CWD is defined as material that is larger than 2.5 cm in diameter and litter is dead leaves and other dead fine vegetative material less than 1 cm in diameter. Assessment of CWD, SWT and litter in 2007-08 was carried out from May 8 to December 18, 2008. The litter and SWT samples were oven dried, weighed in grams and then converted to tonnes $ha^{-1}$. The volume of CWD was determined using the line intersect method (Van Wagner 1968) and calculated to cubic metres per hectare.

## Results and Discussion

### Litter weights

Litter weights on the treatment grids generally reflected the time since the last burn (Fig. 1), but will also be influenced by stand structure and density. All grids except The Yornup (FC5) and Easter (FC10) references had an increase in loading. The Easter external reference recorded a lighter litter load in 2008 than in 2002, despite it being burnt only 2 years previously in 2002. The Yornup external reference had low loading, but both measurements coincided with only 5 years since fire. The heaviest litter loads were measured on the coup buffer grids and the Easter external reference. Within the gap release treatment, the Carter grid (FC8) had a lighter litter load than both the Kingston (FC2) and Thornton grids (FC6) but has had 5 years less time for litter to accumulate.

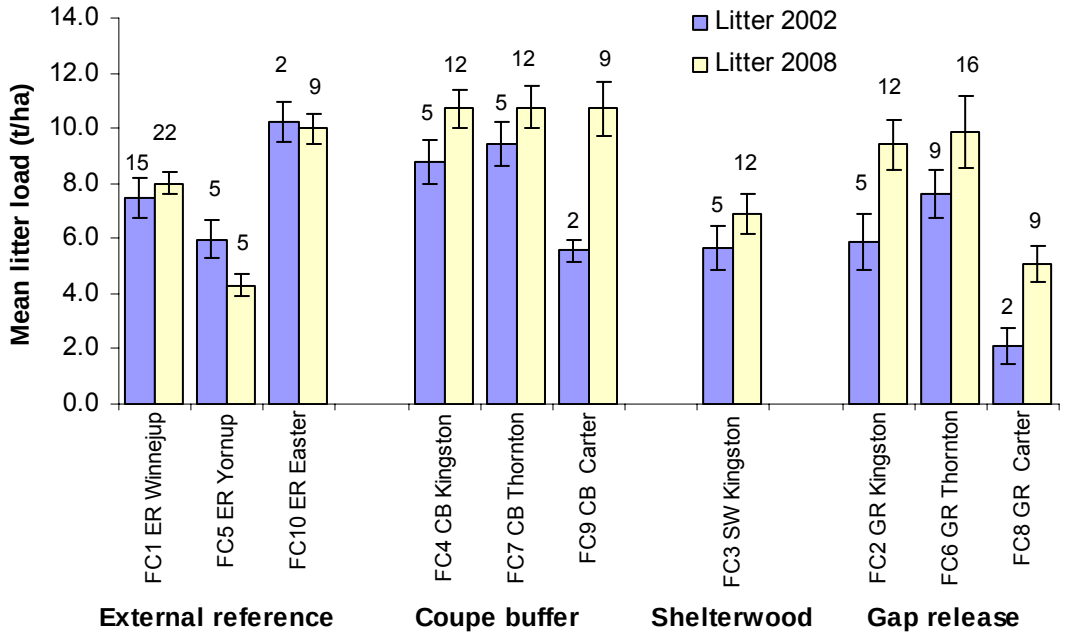


**Figure 1:** Mean litter loads (t ha$^{-1}$ ± se) calculated at each FORESTCHECK grid at Donnelly in 2008. Numbers above columns indicate years since burnt.

### Small wood and twigs

The amount of SWT carried on all sites was light (Fig. 2) compared to that of the litter (Fig. 1). The increase in loading since 2002 was variable, ranging from gains of 0.7 tha$^{-1}$ on the Winnejup external reference (FC1), the Kingston coupe buffer (FC4) and the Thornton gap release (FC6), to losses of 0.1 tha$^{-1}$ on the Thornton coupe buffer (FC7) and the Easter external reference (FC10). Generally the loads reflected time since fire, but the Kingston external reference (FC1) carried a low load considering it was 22 years without fire. The Yornup external reference (FC5) was burnt following the 2002 measurement, resulting in two measurements 5-years post-fire and this was reflected in the twig loads being the same in both 2002 and 2008, 0.7 tha$^{-1}$.

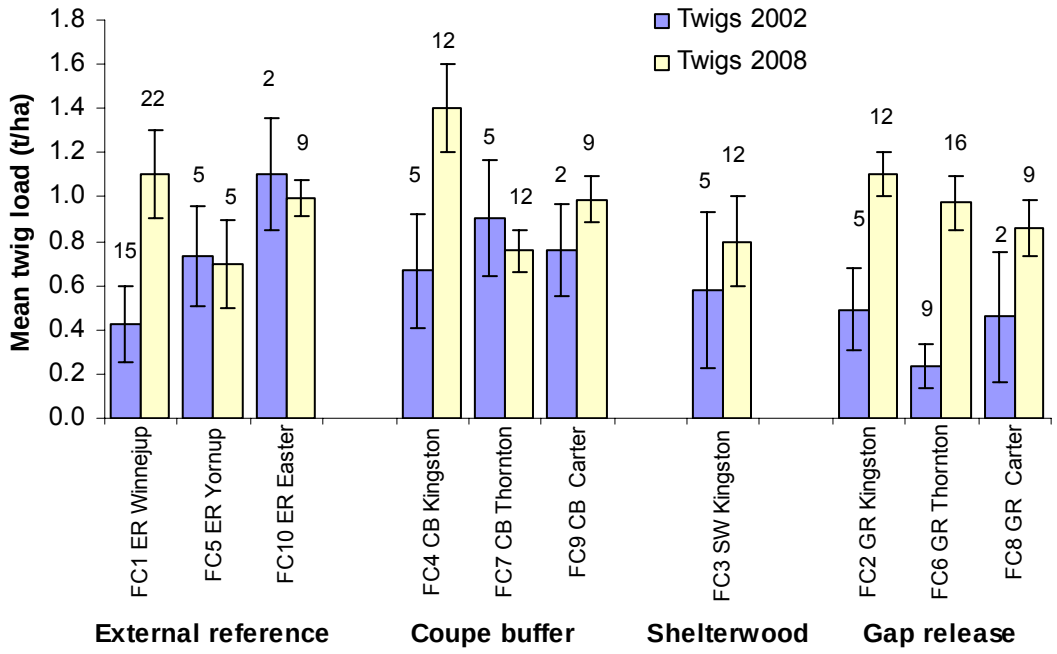


**Figure 2:** The average weights (t ha$^{-1}$) of small wood and twigs measured at each FORESTCHECK grid at Donnelly in 2008. The numbers above the columns indicate years since burnt.

## Coarse woody debris

Using the revised procedure (Whitford *et al*. 2008), 22 FORESTCHECK grids were reassessed for CWD volume and condition. The CWD volumes determined for these grids are given in Table 1. CWD volume was highly variable across these 22 grids and no consistent trends were obvious across the treatment groupings (Fig. 3), though volumes on external reference treatments were relatively low compared to more recently harvested treatments. CWD can persist on the forest floor for periods up to 100 years; consequently the volume of CWD on a site will be affected by the long term fire and logging history, as well as the stand density and structure on the site. These factors will affect CWD volume as much, or more so than the most recent harvesting treatment. Accordingly we expect variability between sites could hide any effects of the most recent harvesting treatments.

**Table 1**. The 22 FORESTCHECK grids reassessed in 2008 for coarse wood debris (CWD) volume and condition.

| Grid | Location | Treatment | Year of grid establishment | Year of most recent harvest | Mean CWD volume ($m^3$ $ha^{-1}$ ± se) |
|---|---|---|---|---|---|
| FC1 | Winnejup | External reference | 2001 | Uncut | 124 ± 35 |
| FC5 | Yornup | External reference | 2001 | Uncut | 99 ± 7 |
| FC10 | Easter | External reference | 2001 | Uncut | 219 ± 37 |
| FC4 | Kingston | Coupe buffer | 2001 | 1975 | 168 ± 89 |
| FC7 | Thornton | Coupe buffer | 2001 | 1945 | 154 ± 13 |
| FC9 | Carter | Coupe buffer | 2001 | 1945 | 172 ± 42 |
| FC3 | Kingston | Shelterwood | 2001 | 1996 | 86 ± 13 |
| FC2 | Kingston | Gap release | 2001 | 1996 | 254 ± 127 |
| FC6 | Thornton | Gap release | 2001 | 1991 | 549 ± 98 |
| FC8 | Carter | Gap release | 2001 | 1995 | 218 ± 53 |
| FC17 | Surface | External reference | 2002 | Uncut | 55 ± 24 |
| FC19 | Tumlo | External reference | 2002 | Uncut | 146 ± 37 |
| FC13 | Ross | Shelterwood | 2002 | 1992 | 157 ± 65 |
| FC15 | Surface | Shelterwood | 2002 | 1997 | 138 ± 30 |
| FC18 | Chalk | Shelterwood | 2002 | 1992 | 210 ± 49 |
| FC11 | Edward | Gap release | 2002 | 1994 | 118 ± 23 |
| FC12 | Ross | Gap release | 2002 | 1992 | 120 ± 57 |
| FC14 | Surface | Gap release | 2002 | 1997 | 100 ± 3 |
| FC21 | Holyoake | External reference | 2003 | Uncut | 38 ± 5 |
| FC24 | Kennedy | External reference | 2003 | 1935 | 98 ± 4 |
| FC20 | Holyoake | Shelterwood | 2003 | 1995 | 119 ± 53 |
| FC23 | Cameron | Shelterwood | 2003 | 1989 | 137 ± 0 |

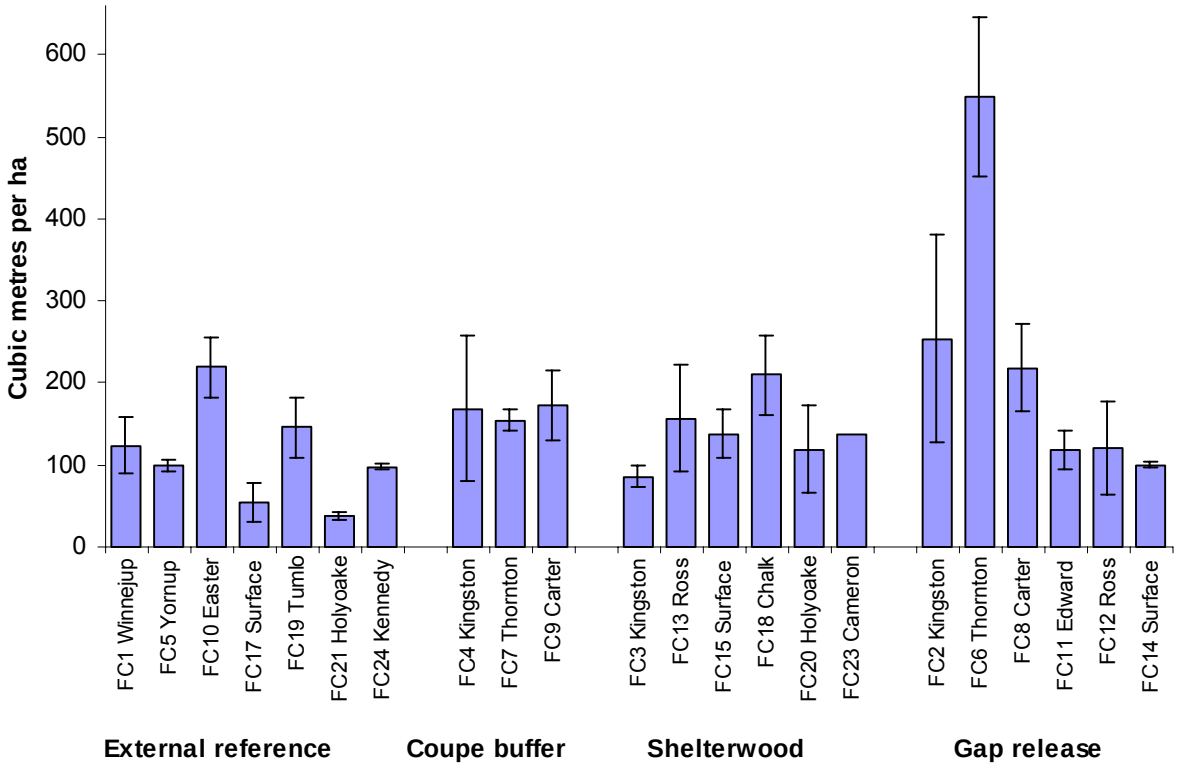


**Figure 3:** The volume ($m^3$ $ha^{-1}$ ± se) of coarse woody debris measured at 22 FORESTCHECK grids in 2008 using two 200 m transects on each site.

Figure 4 shows results from the original assessment of CWD on Donnellyy grids in 2002, Wellington grids in 2003 athe the southern grids from Perth Hills in 2004 and the most recent assessment in 2008 using the Van Wagner (1968) procedure along the same two 100 m transects used in the original assessments. Of the 22 grids that were remeasured, one grid was unchanged, 17 grids showed a decrease in the CWD volume and five showed and increase in the volume of CWD. Large changes were calculated for some grids. The significance of these changes has not been tested. Some of these changes may relate to the line intersect sampling method that was used. Though an efficient method of estimating CWD volumes, the value derived from this sampling method can be strongly influenced by a single large tree which may fall across the transect line, substantially increasing the estimated volume of CWD. Closer investigation of the causes and significance of these changes and the effects of transect length is required.

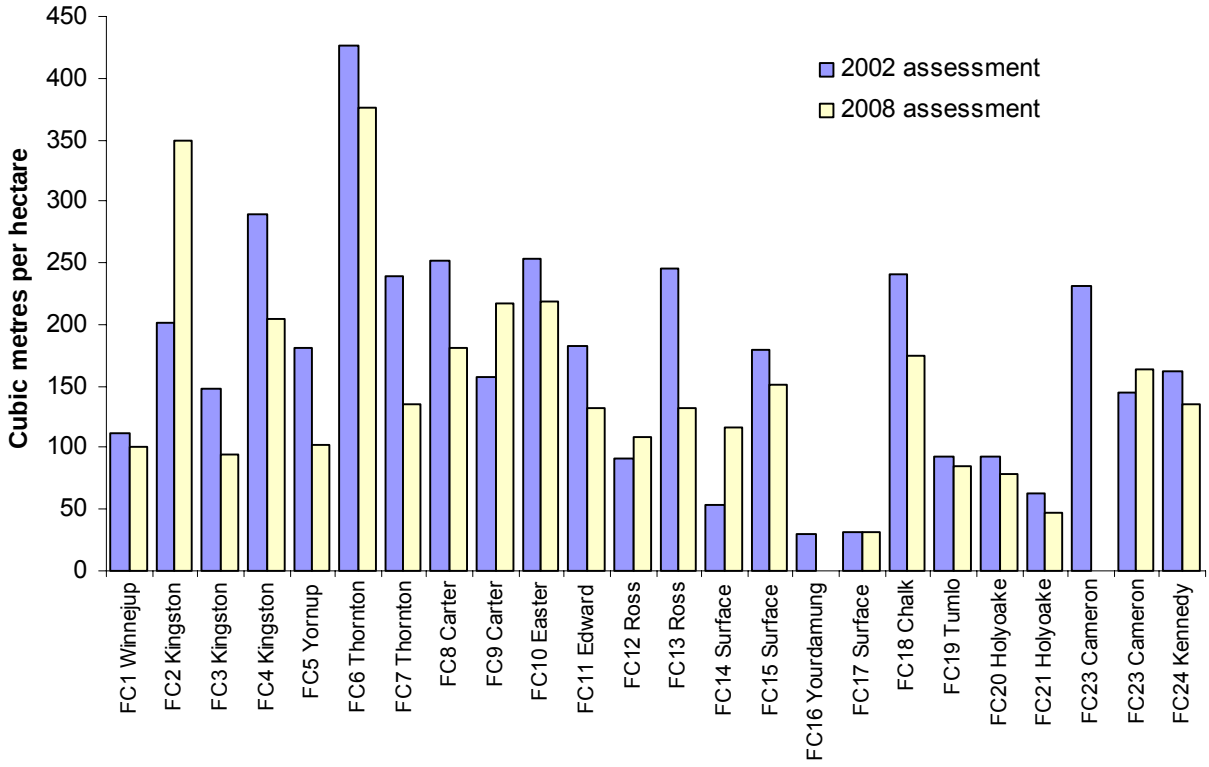


**Figure 4:** The volumes ($m^3$ $ha^{-1}$) of coarse woody debris measured at 24 FORESTCHECK sites in the first assessment and in the second assessment in 2008. Both values are derived from the same two 100 m transects used on each site. Grids 16 and 22 were not reassessed in 2008.

The increase in the transect length introduced for this reassessment of CWD was intended to increase the precision of the estimates of CWD. The two 200m transects were chosen as they achieved a substantial increase in the sampling intensity over sampling in previous years, were relatively long compared to similar surveys in other Australian eucalypt forests (Woldendorp *et al*. 2004) and could be achieved at reasonable cost within a single day at the majority of FORESTCHECK locations. To consider the utility of this transect length for examining changes in CWD volume over time and differences between treatments and grids we created a synthetic transect for resampling by combining all of the data collected on eleven grids which carried similar volumes of CWD (mean 129 $m^3$ $ha^{-1}$). We then resampled this synthetic transect at 100, 200, 400, 600, 800 and 1000 metre lengths and examined the coefficient of variation (CV) from this resampling. The results from this exercise (Fig. 4) show the sharp decline in the coefficient of variation as transect length increases from 100 m to 400 m. Transect length in excess of 400 m will consist of data from more than one FORESTCHECK grid; consequently the CV calculated for transects longer than 400 m in Figure 4 will be over estimated (we estimate by approximately 6 to 12%).

This exercise indicates that the current transect lengths (two 200 m transects) are probably insufficient to detect differences between individual FORESTCHECK grids unless these differences are large. However these transects, which when repeated, cover exactly the same path and include tagging of individual logs, should be adequate to detect changes over time on individual sites. The utility of this transect

length for detecting differences between treatments will be further examined before the remaining grids are surveyed in the coming year.

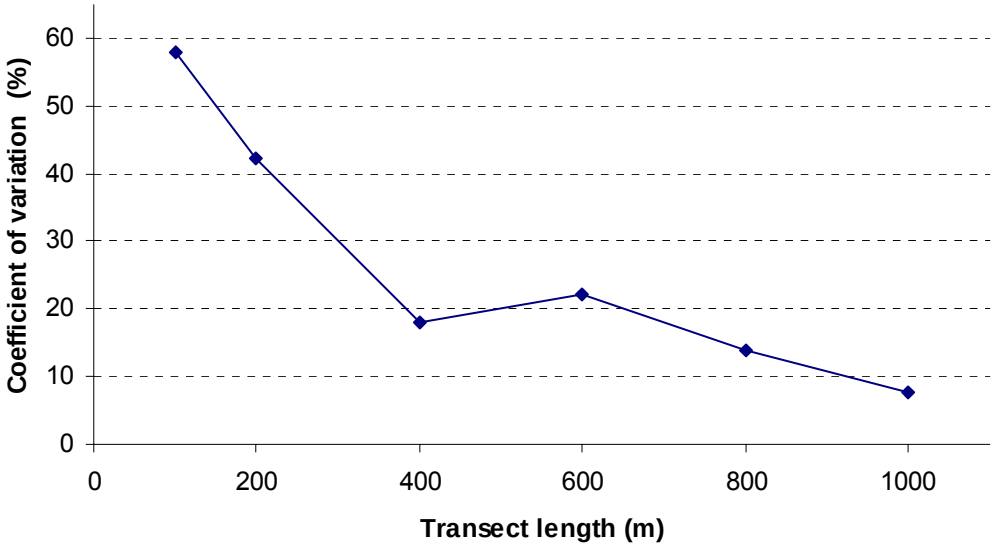


**Figure 4:** The coefficient of variation for estimates of CWD ($m^3$ $ha^{-1}$) determined from resampling a synthetic transect compiled from twenty-one 200 m transects collected on eleven sites with a mean coarse woody debris volume of 129 $m^3$ $ha^{-1}$.

## Conclusions

- Litter and twig loads generally increased from 2002-08 and the trend between grids reflected time since fire.
- CWD volumes were varied greatly across the 22 grids that were reassessed in 2008, ranging from 38 to 549 $m^3$ $ha^{-1}$. The mean across these 22 grids was 153 $m^3$ $ha^{-1}$. Thornton gap release carried the greatest volume of CWD.
- No consistent trends were obvious across the harvest treatment though grids with little or no history of harvesting generally carried lower volumes of CWD. The size distribution and the decay state of this CWD needs to be considered to identify any effects of timber harvesting.
- Of the 22 grids that were remeasured in 2008, one was unchanged, 17 grids showed a decrease in the CWD volume and five showed an increase in the volume of CWD. The significance of these changes has not been tested.
- Site factors appear to have a major effect on CWD volumes and our sampling may be insufficient to test differences from recent treatments due to the large effect of site factors and long term site treatment history.
- The adequacy of the length of the CWD transects will be further examined before the remaining grids are surveyed in the coming year.
- Analysis of the size class distribution, the decay state and the rate of decay and combustion of the CWD will be undertaken once data collection is completed for all 48 grids.

**Acknowledgements**
We thank Lydia Guja, Grant Phelan and Lachie McCaw for their contribution to the development of the revised CWD assessment procedure and Julie Fielder and Laura Henningson for their assistance in the field.

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Woldendorp, G., Keenan R. J., Barry, S., Spencer, R. D. 2004. Analysis of sampling methods for coarse woody debris. Forest Ecology and Management 198: 133-148.

## MACROFUNGI

Richard Robinson, Julie Fielder, Katie Syme

### Introduction

Fungi are considered one of the most important forest organisms in terms of both biodiversity and forest 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.

Recent research on fungi in Western Australia's southern forests has shown that fungal communities respond to fire and forest management activities. 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 (shelterwood, selective cut and gap release) and in uncut forest.
- Analyse trends in species composition, richness and abundance and substrate utilization over time.
- To generate detailed descriptions of unknown or unnamed species.

### Field Survey

Ten FORESTCHECK grids, including six reference grids (3 external reference and 3 coup buffer), one shelterwood and three gap release treatments, were installed in the jarrah south forest ecosystem in the Donnelly District in 2001. These plots were initially monitored for macrofungi in autumn 2002, and subsequently at yearly intervals from 2003 to 2006. Only the initial monitoring for 2002 was included in the 5-year analysis of FORESTCHECK data undertaken in 2006-07.

In 2007-08, a second round of FORESTCHECK monitoring was conducted on the Donnelly grids. Macrofungal monitoring was undertaken from 23-30 May and again from 13-19 June 2008. Consistent rain events throughout May (Fig. 1) resulted in the soil dryness index, which indicates the amount of rain needed to bring the soil back to field capacity, fell to almost zero during the first survey and returned to almost zero following a 53 mm rain event during the second survey (Fig. 1). Thus providing good conditions for macrofungal fruiting.

On each occasion, all ten grids were monitored. All macrofungal species and their abundance were recorded along 2 x 200 m transects on each grid. All new or previously unrecorded taxa were photographed *in situ* and vouchers collected.

### Laboratory – voucher specimen examination and processing

In the laboratory, voucher specimens were kept in a refrigerator at 5ºC. Processing of each voucher was completed on the day of collection or the next day. Detailed

descriptions of the macroscopic characters of the fresh specimens were compiled for each voucher collection that represented a putative new species or represented noticeable variation in species concepts already determined. All collections were then air dried at 35º C. At the completion of the field surveys, dried specimens were examined microscopically and detailed measurements of basidia, spore and hyphal structure were undertaken to aid in verifying the identity of a number of species and to confirm a number of unnamed species. A species list has been compiled. In total, 214 voucher collections, representing 156 species, were made. A total of 113 taxa were determined to be new records for FORESTCHECK. Voucher specimens are currently being entered onto the PERTH (WA Herbarium) database and are housed in the Tony Annells Herbarium at the Manjimup Research Centre.

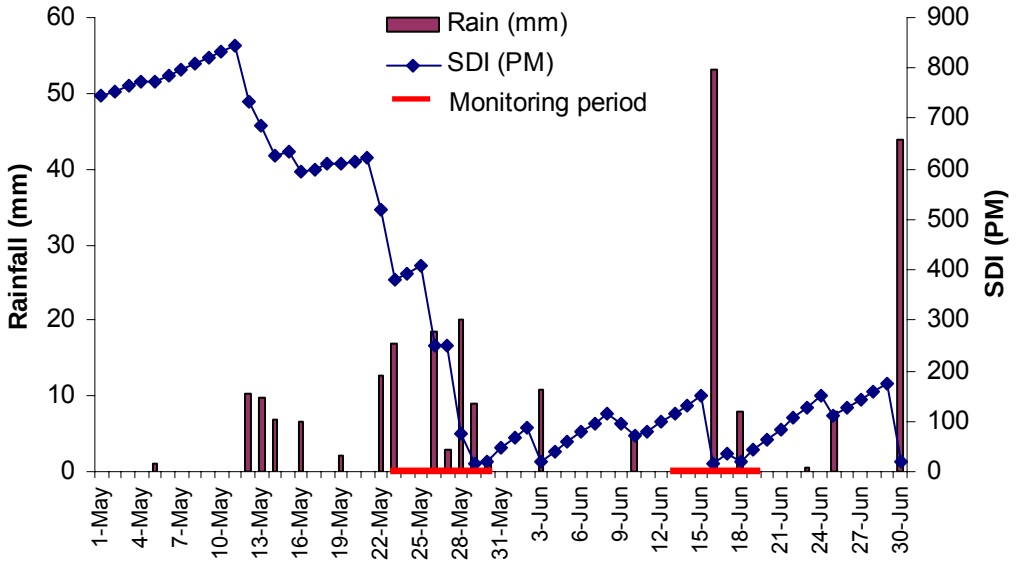



**Figure 1**. Daily soil dryness index (SDI = mm rain x 10 needed to bring soil to field capacity) for Donnelly District during May and June 2008. Each FORESTCHECK macrofungi monitoring period is indicated by the red sections on the x-axis.

## Preliminary Results and Discussion

A total of 371 species of fungi and 25,236 fruit bodies were recorded on the Donnelly monitoring grids (Appendix 1). Of these, 113 species (30.5%) were recorded for the first time in FORESTCHECK. In the May survey, 256 species were recorded and in the June survey 288 were recorded. One hundred and seventy six species were recorded in both surveys, with 85 and 110 restricted to the May and June surveys respectively (Fig. 2).

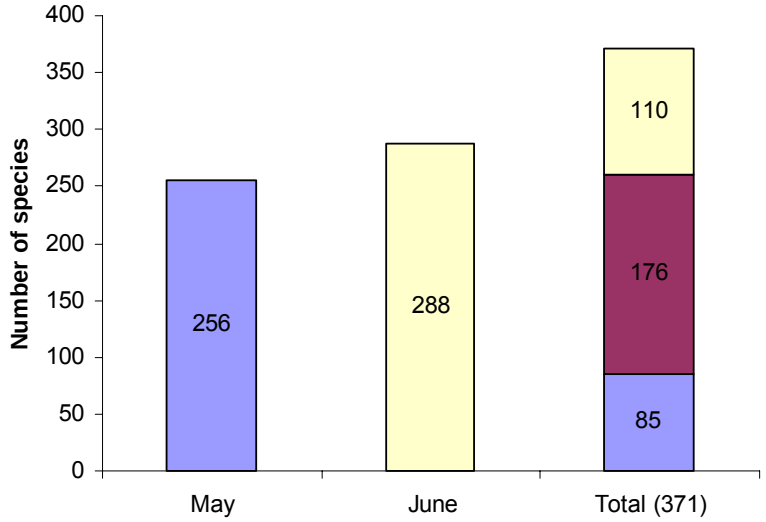



**Figure 2**. The total number of species recorded in May and June surveys on the Donnelly FORESTCHECK monitoring grids in 2008.

Overall the Yornup and Easter external reference grids (FC10 & FC5) were the most species rich, followed by the Thornton and Carter gap release grids (FC8 & FC6) (Fig. 3). Although the mean number of species and the mean abundance per grid were both lower in coupe buffer and shelterwood treatments the difference was not large (Fig. 4). The total species richness in the shelterwood treatment, however, was less than one-half of that recorded for other treatments but is likely due to there being only one shelterwood grid in the Donnelly region.

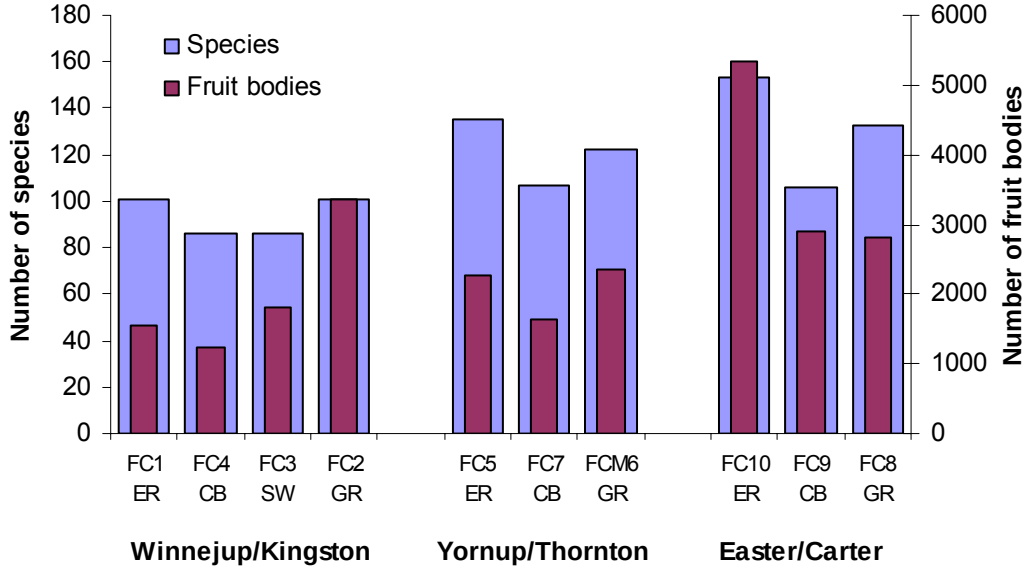



**Figure 3**. The total number of species recorded on each FORESTCHECK monitoring grid at Donnelly in 2008 (ER = external reference, CB = coupe buffer, SW = shelterwood, GR = gap release).

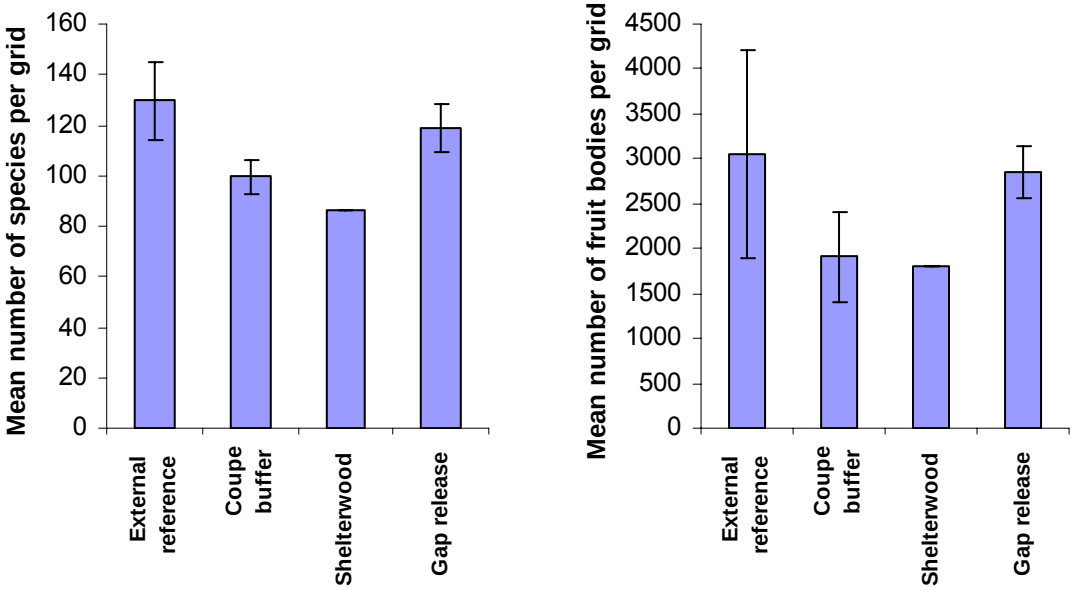



**Figure 4**. The mean number of species (*left*) and the mean number of fruit bodies (*right*) recorded in each treatment on Donnelly FORESTCHECK grids in 2008.

The three major habitats for fungi are soil, litter and wood. In each treatment the majority of species were recorded fruiting on soil (Fig. 5). For both soil and wood, similar and higher mean values were recorded in the external reference and gap release treatments. Litter was the least species rich substrate with no difference between treatments. Although the Kingston shelterwood grid had only about one-half and one-fourth respectively of the amount of coarse woody debris measured in external reference and gap release treatments, the amount of coarse woody debris in the coupe buffer treatment was higher than that measured in the external reference treatment (see Table 1 in chapter on Coarse Woody Debris and Litter). The reason for the low number of species in the coupe buffer treatments requires further investigation.

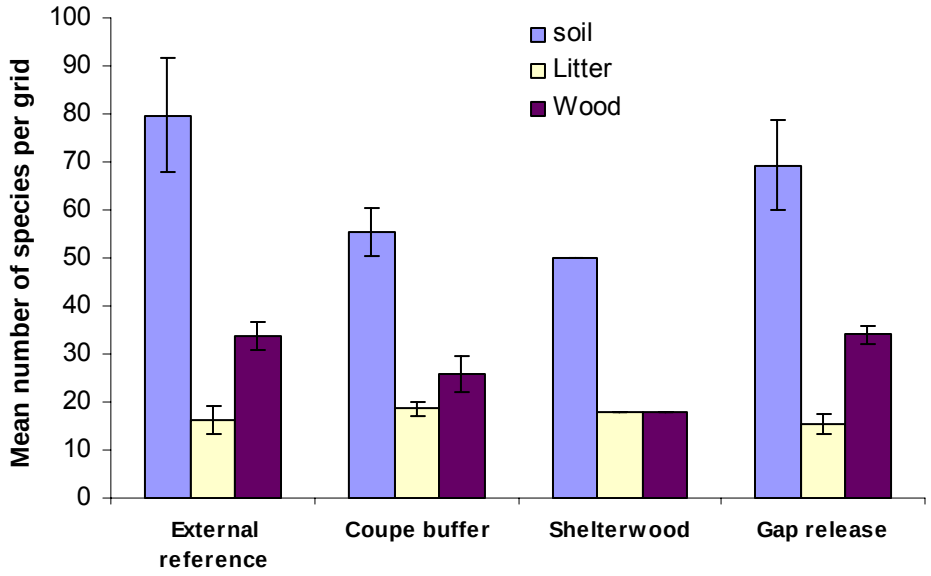



**Figure 5**. The mean number of species per grid recorded fruiting on soil, litter and wood on the Donnelly FORESTCHECK grids in 2008.

## Comparison with previous monitoring at Donnelly and other regions

The Donnelly sites were established in 2002. In the initial FORESTCHECK monitoring at Donnelly (2002) the grids were only visited once. From 2003 onwards, FORESTCHECK monitoring for macrofungi has included two surveys per grid, about 2-3 weeks apart.

In addition, the Donnelly grids were also surveyed once each year from 2002-2006. Here the annual results from monitoring at Donnelly are compared and the results from 2008 are compared to those from 2002 and the 2003-06 results from other regions (Wellington 2003, Perth Hills 2004, Wellington East 2005 and Balckwood plateau 2006) where FORESTCHECK grids are established.

### Species richness and abundance

From 2003 to 2006, the total number of species recorded at the Donnelly grids ranged from160 in 2002 to 242 in 2006. In 2008, this increased markedly to 371 (Fig. 6). The increase is likely attributed to two surveys being conducted in 2008, against only one each year from 2002-06. However, both surveys in 2008 resulted in a higher number of species being recorded than in previous years (256 in May and 288 in June). The 2008 monitoring at Donnelly resulted in the highest number of species and abundance recorded for any year of FORESTCHECK monitoring, an increase of 118 species over the Blackwood grids in 2006 and 6847 individual fruit bodies more than recorded at Wellington in 2003. The total number of species of macrofungi recorded in FORESTCHECK from 2002-08 is 563. The southern jarrah in the Donnelly district appears to have a very rich and diverse mycoflora, as single surveys at Donnelly result in equal or greater species richness than two surveys in other jarrah forest regions.

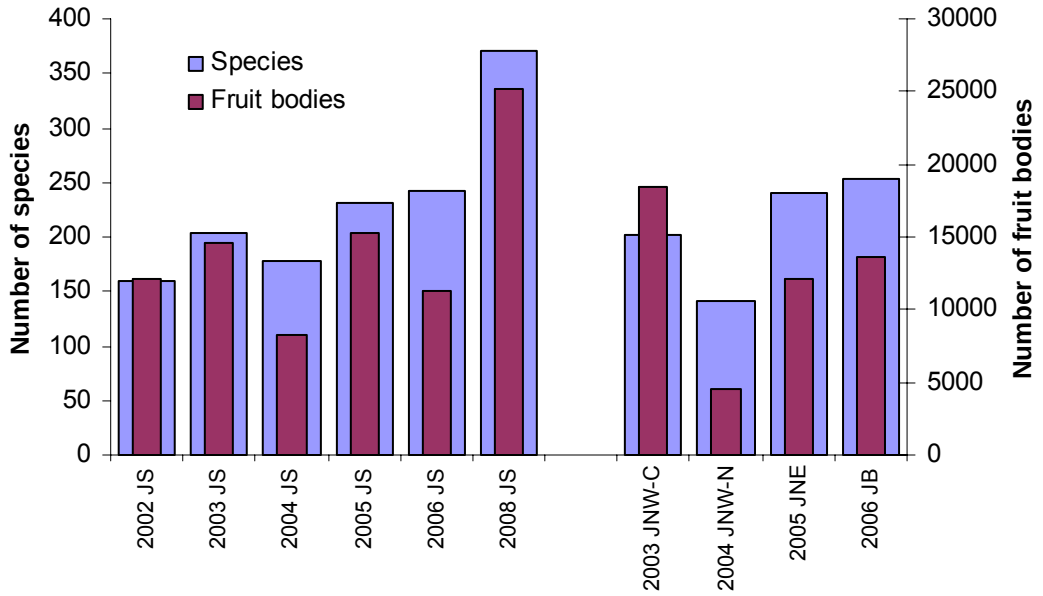



**Figure 6**. The number of species of macrofungi and fruit bodies recorded in Forestcheck monitoring from 2002-08

### Species accumulation at Donnelly

The number of species recorded at Donnelly has steadily increased from 160 in 2002 to be 518 in 2008 (Fig. 7).

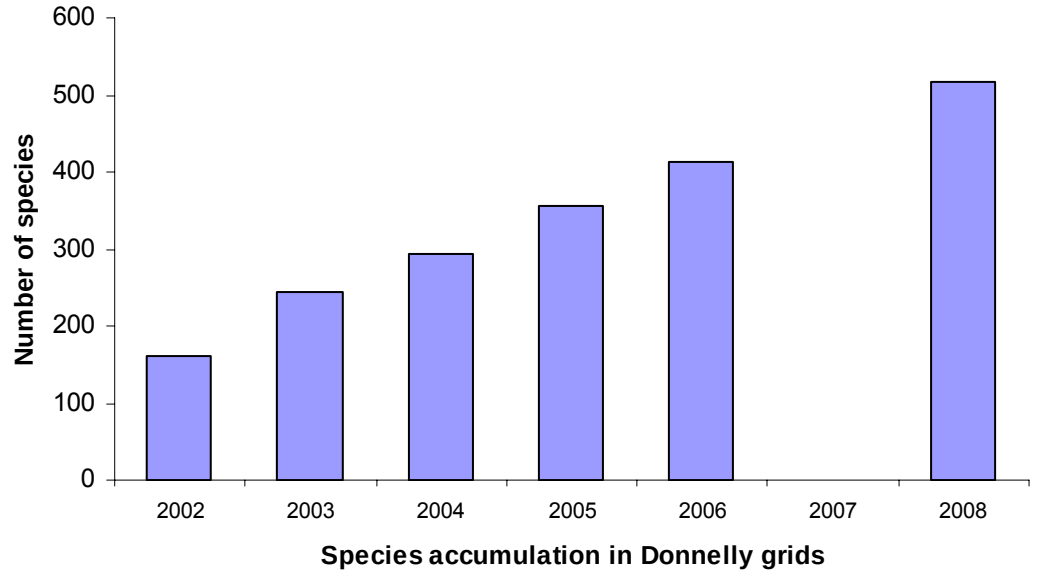



**Figure 7**. Species accumulation for macrofungi recorded on Donnelly FORESTCHECK grids 2002-2008.

At the individual grid level, species accumulation on the external reference grid at Easter block (FC10) is also still rising steadily (Fig. 8). FC10 is in mature forest that has never been logged and has not been burnt since 1999. A total of 231 species have

been recorded on this grid alone and it demonstrates clearly the need for regular monitoring over many years, even on sites that are relatively stable in their development, in order to identify the majority of macrofungi present on large sites, within local areas or across regions.

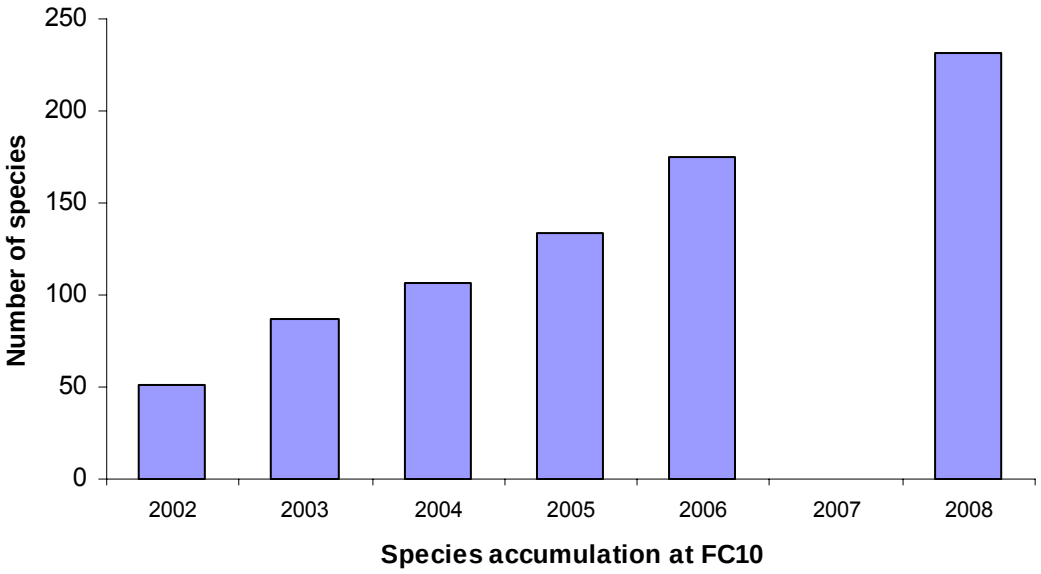



**Figure 8**. Species accumulation for macrofungi recorded on the Easter external reference grid (FC10) from 2002-2008.

## Conclusions

The main observations made following monitoring of macrofungi in the southern jarrah at Donnelly were:

- A total of 563 species of macrofungi have so far been recorded in FORESTCHECK.
- 371 species were recorded at Donnelly in 2008. Of these 113 species were recorded for the first time in FORESTCHECK.
- The majority of macrofungi recorded in 2008 fruited on soil.
- Species richness and fruit body abundance was similar in external reference and gap release treatments.
- Species richness and abundance was exceptionally high on the external reference grid in Easter block, with 231 species recorded.
- Species accumulation is still steadily rising on the Donnelly grids after 6 years of monitoring.

## Acknowledgements

We wish to express our appreciation to Verna Tunsell for her assistance with data input and entering voucher specimen details into the Perth Herbarium database and to Francesco (Paco) Tovar and Roy Whittkuhn for assistance with field surveys.

**APPENDIX 1.** List of macrofungi recorded in Forestcheck 2002-08, and the species and abundance recorded on the Donnelly monitoring grids in 2008. The species in the shaded cells are those additional species recorded in Donnelly from 2003-06.

| Sp # | Species | Life Mode[1] | Substrate[2] | Treatments[3] | | | | TOTAL |
|---|---|---|---|---|---|---|---|---|
| | | | | ER | CB | SW | GR | |
| 550 | Agaric 'blue grey' | S? | S | | | | | |
| 642 | Agaric 'khaki-yellow, moist' | S | W | 8 | 6 | | | 14 |
| 0 | Agaric unidentified | | | 3 | | | 3 | 6 |
| 240 | *Agaricus* sp. "small with red brown fibrils" | S | S | 2 | 1 | | | 3 |
| 38 | *Agaricus* sp. "small" | S | S | | | | | |
| 71 | *Agaricus* sp. "small, flat- red stain" | S | S | | | | | |
| 33 | *Agaricus* sp. "yellow stainer" | S | S | 2 | 1 | | | 3 |
| 39 | *Agaricus* sp."large cap, purplish scales" | S | S | 1 | 6 | | 5 | 12 |
| 120 | *Aleuria rhenana* | S | S | 14 | 5 | 4 | 62 | 85 |
| 126 | *Aleurina ferruginea* | S | S/Moss | 1 | | 16 | 14 | 31 |
| 536 | *Aleurodiscus* sp. 'apricot on *B. grandis* cone' | S | Fruits | | | | | |
| 206 | *Amanita ananiceps* | M | S | 3 | 1 | | | 4 |
| 395 | *Amanita basirubra* | M | S | | | | | |
| 186 | *Amanita brunneibulbosa* "grey-brown" | M | S | 1 | 1 | 5 | | 7 |
| 283 | *Amanita eucalypti* | M | S | | | | | |
| 448 | *Amanita flaviphylla* | M | S | | 1 | | | 1 |
| 269 | *Amanita ochrophylloides* | M | S | | | | | |
| 114 | *Amanita* sp. "apricot-pink margin" | M | S | | | | | |
| 518 | *Amanita* sp. "beige with saccate base" | M | S | | | | | |
| 520 | *Amanita* sp. "creamy yellow, sticky cap" | M | S | | | | | |
| 493 | *Amanita* sp. "grey brown robust" | M | S | | | | | |
| 497 | *Amanita* sp. "grey brown with orange yellow veil" | M | S | | | | | |
| 496 | *Amanita* sp. "grey veil" | M | S | | | | | |
| 360 | *Amanita* sp. "large grey-white, robust" | M | S | | | | | |
| 526 | *Amanita* sp. "small creamy white, membranous ring" | M | S | | | | | |
| 320 | *Amanita* sp. "small robust, yellow-buff, bulbous base | M | S | | | | | |
| 368 | *Amanita* sp. "white with mealy stem" | M | S | | | | | |
| 371 | *Amanita* sp. "white with saccate volva" | M | S | | | | | |
| 45 | *Amanita* sp. "white, deeply rooted" | M | S | | | 1 | | 1 |
| 525 | *Amanita* sp. "white, grey scales, silvery stem" | M | S | | | | | |
| 28 | *Amanita* sp. "white, stout" | M | S | | | | | |
| 519 | *Amanita* sp. "yellow brown, long stem, constricted bulb" | M | S | | | | | |
| 588 | *Amanita* sp. 'salmon pink margin and stem' | M | S | | 1 | 2 | | 3 |
| 218 | *Amanita* sp."powdery - long tapering base" | M | S | | | | | |
| 531 | Amanita spp. unidentified | M | S | | 3 | 1 | | 4 |
| 196 | *Amanita umbrinella* | M | S | | 1 | | 11 | 12 |
| 6 | *Amanita xanthocephala* | M | S | 15 | 7 | 18 | 33 | 73 |
| 35 | *Amanita xanthocephala* forma *macalpiniana* | M | S | | | 1 | | 1 |
| 577 | *Amanitra* sp. 'grey brown with white warts' | M | S | 1 | | | | 1 |
| 338 | *Anthracobia muelleri* | S | S | | | | | |
| 338 | *Anthracobia muelleri* "small yellow" | S | S | | | | | |
| 509 | *Anthracophyllum archeri* | S | T | | 1 | | | 1 |
| 313 | *Antrodiella citrea* | S | W/T | 2 | 5 | 1 | | 8 |
| 180 | *Armillaria luteobubalina* | P/S | W | 110 | 11 | | 113 | 234 |
| 657 | *Ascocoryne sarcoides* | S | W | | 2 | | | 2 |
| 275 | *Auriscalpium* sp. "fleshy funnel" | ? | S/L | | | | | |
| 188 | *Austroboletus laccunosa* | S | S | 2 | 2 | | | 4 |
| 200 | *Austroboletus occidentale* | S | S | | 1 | | 3 | 4 |
| 291 | *Austropaxillus* sp."orange-brown" | M | S | | | 1 | | 1 |
| 392 | *Banksiamyces toomansis* "quercifolia" | S | Fruits | | | | | |

| Sp # | Species | Life Mode[1] | Substrate[2] | Treatments[3] | | | | TOTAL |
|---|---|---|---|---|---|---|---|---|
| | | | | ER | CB | SW | GR | |
| 392 | *Banksiamyces toomansis* "sphaerocarpa" | S | Fruits | | | | | |
| 436 | *Beauvaria bassiana* | P | Insect | 8 | | | | 8 |
| 653 | *Bjerkandera* sp. | S | W | 60 | 50 | | 2 | 112 |
| 93 | *Boletellus ananiceps* | S | S | 12 | | | | 12 |
| 103 | *Boletellus obscurecoccineus* | S | S | 2 | 4 | | 5 | 11 |
| 740 | *Boletellus*sp. 'brown obscurecoccineus' | S | S | | 1 | | | 1 |
| 225 | *Boletus* sp. "creamy pale yellow | M | S | | | | | |
| 29 | *Boletus* sp. "dull maroon" | M | S | | | | | |
| 345 | *Boletus* sp. "light yellow" | M | S | | | | 1 | 1 |
| 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 | | 3 | | | 3 |
| 628 | *Boletus* sp. "slippery dark brown - stains pinkish brown" | M | S | | | | | |
| 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 | | | | 1 |
| 695 | *Boletus* sp. | M | S | | | | | |
| 607 | *Boletus* sp. 'yellow brown, stains blue' | M | S | | | | | |
| 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 | | | | | |
| 503 | *Botryobasidium* sp. "creamy-grey crust on charcoal and leaves" | S | L/W | | 1 | | 2 | 3 |
| 504 | *Botryobasidium* sp. "creamy-orange mycelium under well rotted litter" | S | L/W | | | | | |
| 304 | *Byssomerulius corium*. | S | W/T | | 1 | | | 1 |
| 9 | *Calocera guepinioides* | S | W | 262 | 420 | 520 | 1442 | 2644 |
| 465 | *Calostoma fuscum* | S | S | | | | | |
| 187 | *Campanella gragaria* | S | W | | | | 200 | 200 |
| 463 | *Cantharellus concinnus* | M | S | 7 | | | | 7 |
| 265 | *Cheilymenia* sp. "eyelash on roo poo" | C | Dung | | | | 8 | 8 |
| 243 | *Cheilymenia* sp. "orange disks on marri nuts" | S | FruitsS | | 15 | 109 | 4 | 128 |
| 364 | *Chlorociboria aeruginascens* ssp. *australis* | S | W | 2 | 37 | 3 | | 42 |
| 319 | *Clavaria* (*Clavulinopsis*) sp. "grey-brown with black tips" | M? | S | | 6 | | 12 | 18 |
| 693 | *Clavaria alboglobispora* | S | S | 9 | | | | 9 |
| 620 | *Clavaria* sp. "yellow orange forks" | S | S | | | | 1 | 1 |
| 694 | *Clavicorona piperata* | S | W | 8 | | | | 8 |
| 561 | *Clavilinopsis* sp. 'simple white clubs' | S | S | | | | | |
| 665 | *Clavulicium sp.* yellow glue | S | T | | | | 1 | 1 |
| 81 | *Clavulina* cf. *cinerea* "grey-brown" | S | S | 27 | 66 | | 42 | 135 |
| 344 | *Clavulina* sp. "cream, fluffy tips" | M? | S | 5 | 15 | 4 | 18 | 42 |
| 140 | *Clavulina* sp. "pink-buff coral" | S | S | | 5 | 1 | 5 | 11 |
| 458 | *Clavulina* sp. "pinkish brown, red-brown tips" | S | S | 3 | 7 | 95 | 43 | 148 |
| 700 | *Clavulina* sp. 'fuzzy creamy white' | S | S | 9 | | | 30 | 39 |
| 562 | *Clavulina* sp. 'grey brown forks' | S | S | | | | | |
| 362 | *Clavulinopsis* "grey brown, black tips" | M? | S | 5 | | | | 5 |
| 316 | *Clavulinopsis amoena* | M? | S | 87 | 6 | | 1 | 94 |
| 739 | *Clavulinopsis miniata* | S | S | | 12 | | | 12 |
| 472 | *Clavulinopsis* sp. "coral pink" | S | S | | | | | |
| 261 | *Clavulinopsis* sp. "cream" | S | S | 23 | 2 | | 1 | 26 |
| 143 | *Clitocybe* aff. *clitocyboides* "buff funnel" | S | S | | 1 | 11 | 16 | 28 |

| Sp # | Species | Life Mode[1] | Substrate[2] | Treatments[3] | | | | TOTAL |
|---|---|---|---|---|---|---|---|---|
| | | | | ER | CB | SW | GR | |
| 197 | *Clitocybe semi oculta* | S | W | 51 | 3 | | 1 | 55 |
| 197 | *Clitocybe semi-occulta* "large" | S | W | | | | 7 | 7 |
| 23 | *Clitocybe* sp. | S | S | | | | | |
| 370 | *Clitocybe* sp. "creamy beige" | S | S/L | | | | | |
| 46 | *Clitocybe* sp. "creamy white" | S | S | | | | | |
| 324 | *Clitocybe* sp. "grey robust" | S | S | | | | 1 | 1 |
| 170 | *Clitocybe/Clitocybula* sp. "yellow brown-moist" | S | S/L | | | | | |
| 181 | *Collybia* aff. *butracea* | S | S | | | | | |
| 633 | *Collybia dryophila* | S | S | | | | | |
| 489 | *Collybia* sp. "large brown, tan gills" | S | S | | | | | |
| 151 | *Collybia* sp. "large" | S | S | | | | | |
| 15 | *Coltricia oblectans* | S | S | 17 | 24 | 76 | 48 | 165 |
| 532 | *Coltriciella dependens* | S | W | | | | | |
| 32 | *Coprinus* sp. | S | S/L | | | | | |
| 128 | *Coprinus* sp. "basal hairs" | S | S | 1 | | | 8 | 9 |
| 224 | *Coprinus* sp. "micacus" | S | S | | | | | |
| 662 | *Coprinus* sp. 'mealy scaled cap (on burnt soil)' | S | S | | | | | |
| 460 | *Cordyceps* sp. "brown club" | P | Insect | | | | | |
| 467 | *Cordyceps* sp. "orange-brown club" | P | Insect | | | | | |
| 655 | Corticioid 'white tuberculate' | S | W | | 1 | | | 1 |
| 303 | *Cortinaius* sp."stubby domes" | M | S | | | | | |
| 511 | *Cortinarius* sp. "multi red" | M | S | | | | | |
| 473 | *Cortinarius (Dermocybe)* sp. "orange" | S? | S | | | | | |
| 146 | *Cortinarius* (*Myxacium*) sp. "orange-brown viscid cap" | M | S | 4 | 4 | | 1 | 9 |
| 702 | *Cortinarius* (*Myxacium*) sp. 'khaki' | M | S | | | | 5 | 5 |
| 125 | *Cortinarius (Phlegmacium)* sp. "purple-grey" | M | S | | | | | |
| 158 | *Cortinarius* aff. *micro archerii* | M | S | 1 | | | 6 | 7 |
| 314 | *Cortinarius archerii* | M | S | | | | | |
| 207 | *Cortinarius australiensis* | M | S | 2 | 3 | | | 5 |
| 173 | *Cortinarius basirubescens* " brown large" | M | S | | | | | |
| 173 | *Cortinarius basirubescens* (red cap) | M | S | 1 | | | 1 | 2 |
| 173 | *Cortinarius basirubescens*(brown cap) | M | S | | | | | |
| 115 | *Cortinarius fibrillosus* | M | S | 8 | 9 | | 1 | 18 |
| 7 | *Cortinarius radicatus* | M | S | | | 2 | | 2 |
| 293 | *Cortinarius rotundisporus* | M | S | | | | | |
| 357 | *Cortinarius sinapicolor* | M | S | 4 | | | | 4 |
| 234 | *Cortinarius* sp. | M | S | | | | | |
| 485 | *Cortinarius* sp. | M | S | | | | | |
| 421 | *Cortinarius* sp. "brown cap, lilac white stem" | M | S | | | | 6 | 6 |
| 355 | *Cortinarius* sp. "brown with lavender margin and stem" | M | S | | | | 2 | 2 |
| 73 | *Cortinarius* sp. "brown with purplish tints" | M | S | | | | 5 | 5 |
| 466 | *Cortinarius* sp. "brown with white margin" | M | S | | | | | |
| 68 | *Cortinarius* sp. "brown" ?(34) | M | S | | | | | |
| 346 | *Cortinarius* sp. "brown, grey-lavender gills" | M | S | | | | | |
| 232 | *Cortinarius* sp. "cf sinapicolor" | M | S | | | | | |
| 500 | *Cortinarius* sp. "chestnut large" | M | S | | | | | |
| 382 | *Cortinarius* sp. "chestnut with yellow margin and yellow flesh" | M | S | | | | | |
| 154 | *Cortinarius* sp. "chestnut" | M | S | 9 | 8 | | 2 | 19 |
| 453 | *Cortinarius* sp. "decurrent gills, deep stem with double ring" | M | S | | | | | |
| 334 | *Cortinarius* sp. "fawn brown" | M | S | | | | | |
| 252 | *Cortinarius* sp. "glutinous cap/rooting stem" | M | S | 16 | | | | 16 |
| 348 | *Cortinarius* sp. "golden tan, long stem" | M | S | | | | 7 | 7 |
| 374 | *Cortinarius* sp. "golden-tan" | M | S | | | | | |

| Sp # | Species | Life Mode[1] | Substrate[2] | Treatments[3] | | | | TOTAL |
|---|---|---|---|---|---|---|---|---|
| | | | | ER | CB | SW | GR | |
| 257 | *Cortinarius* sp. "honey-brown" | M | S | | 2 | | | 2 |
| 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 | | | | | |
| 251 | *Cortinarius* sp. "orange-brown 2" | M | S | 1 | | | | 1 |
| 98 | *Cortinarius* sp. "pointy cap" | S | S | 33 | 21 | | 1 | 55 |
| 515 | *Cortinarius* sp. "red brown cap, slender lavender stem" | M | S | | | | | |
| 626 | *Cortinarius* sp. "red-brown pointy cap" | M | S | | | | | |
| 121 | *Cortinarius* sp. "slender brown" | M | S | | | | | |
| 131 | *Cortinarius* sp. "slender lilac" | M | S | | | | | |
| 432 | *Cortinarius* sp. "tan cap with chocolate gills" | M | S | | | | | |
| 171 | *Cortinarius* sp. "vinaceus lilac" | M | S | | 2 | | 3 | 5 |
| 96 | *Cortinarius* sp. "viscid - pink" | M | S | 1 | 3 | | 5 | 9 |
| 375 | *Cortinarius* sp. "yellow with brown fibrils and orange ring" | M | S | | | | | |
| 237 | *Cortinarius* sp. "yellow with orange brown fibrils" | M | S | 14 | 14 | | 5 | 33 |
| 492 | *Cortinarius* sp. "yellow with yellow stem" | M | S | | | | | |
| 354 | *Cortinarius* sp. "yellow-brown cap, lavender gills and stem" | M | S | | | | | |
| 231 | *Cortinarius* sp. "yellow-brown/tan margin" | M | S | | | | | |
| 255 | *Cortinarius* sp. "yellow-orange" | M | S | | | | | |
| 597 | *Cortinarius* sp. 'chestnut with banded stem' | M | S | | 1 | | | 1 |
| 611 | *Cortinarius* sp. 'dry, purple grey' | M | S | | | | | |
| 689 | *Cortinarius* sp. | M | S | 7 | 5 | | | 12 |
| 584 | *Cortinarius* sp. 'hygrophanous orange-brown cap, membranous ring' | M | S | | | | | |
| 596 | *Cortinarius* sp. 'pink brown, apressed fibrillose cap' | M | S | 2 | | | | 2 |
| 627 | *Cortinarius* sp. 'purple brown with glutinous stem" | M | S | | | | | |
| 670 | *Cortinarius* sp. 'small fibrilose in moss' | M | S | 27 | 4 | | 79 | 110 |
| 609 | *Cortinarius* sp. 'small purple umbonate' | M | S | | | | | |
| 608 | *Cortinarius* sp. 'sticky creamy beige' | M | S | | | | 3 | 3 |
| 605 | *Cortinarius* sp. 'viscid orange cap, yellow stem' | M | S | | | | | |
| 738 | *Cortinarius* sp. 'wrinkled witches hat' | M | S | | 3 | | | 3 |
| 279 | *Cortinarius* sp."brown fibrillose" | M | S | | | | | |
| 244 | *Cortinarius* sp."brown umbonate" | M | S | | | | | |
| 299 | *Cortinarius* sp."chocolate brown with mustard gills" | M | S | | | | | |
| 201 | *Cortinarius* sp."cream with orange gills" | M | S | 19 | 2 | 15 | 21 | 57 |
| 282 | *Cortinarius* sp."honey-brown dome /long stem" | M | S | | | | | |
| 212 | *Cortinarius* sp."orange brown" | M | S | 1 | 4 | | | 5 |
| 230 | *Cortinarius* sp."orange viscid" | M | S | | 30 | | | 30 |
| 223 | *Cortinarius* sp."orange" | M | S | 1 | 8 | 1 | 2 | 12 |
| 205 | *Cortinarius* sp."orange/yellow flesh/yellow gills" | M | S | | | 1 | | 1 |
| 267 | *Cortinarius* sp."snowy chestnut" | M | S | 7 | 4 | | 14 | 25 |
| 270 | *Cortinarius* sp."viscid, yellow-red-brown, white stem" | M | S | 1 | 7 | | | 8 |
| 273 | *Cortinarius* sp."white with deep rooting stem" | M | S | | | | | |
| 199 | *Cortinarius* sp."yellow orange" | M | S | | | | | |
| 184 | *Cortinarius* spp. (unidentified) | M | S | 23 | 16 | 7 | 27 | 73 |
| 171 | *Cortinarius vinaceolamellatus* | M | S | | | | | |
| 290 | *Cortinarius violaceous* | M | S | | | | | |
| 16 | *Cotylidia undulata* | S | S/Moss | 1 | 9 | | 2 | 12 |
| 469 | *Crepidotus* sp. "chestnut with fringed margin" | S | W | | | | | |
| 619 | *Crepidotus* sp. "ginger with white margin and gills" | S | W | 1 | 200 | | 1 | 202 |
| 118 | *Crepidotus* sp. "large creamy-tan" | S | W | 67 | 18 | 11 | 210 | 306 |
| 323 | *Crepidotus* sp. "rusty brown suede" | S | W | 8 | | | | 8 |
| 61 | *Crepidotus* sp. "small brown" | S | W/Bark | | | | | |

| Sp # | Species | Life Mode[1] | Substrate[2] | Treatments[3] | | | | TOTAL |
|---|---|---|---|---|---|---|---|---|
| | | | | ER | CB | SW | GR | |
| 83 | *Crepidotus* sp. "small creamy tan" | S | Bark/W | | | | 15 | 15 |
| 21 | *Crepidotus* sp. "small white" | S | W | | 6 | | 265 | 271 |
| 686 | *Crepidotus* sp. "white gelatinised" | S | T/W | | 25 | | 42 | 67 |
| 241 | *Crepidotus variabilis* | S | T/W | 1915 | 1072 | 20 | 162 | 3169 |
| 148 | *Crucibulum laeve* | S | T/L | 5 | 1 | 48 | 1 | 55 |
| 684 | Crust "creamy tuberculate crust" | S | T | | | | 1 | 1 |
| 679 | Crust fungi "creamy gelatinised, toothed' | S | T | | | 2 | | 2 |
| 678 | Crust fungus "khaki crust" | S | T | | | 9 | 3 | 12 |
| 296 | *Cyathus* sp."on roo poo" | C | Dung | | | | | |
| 307 | *Cyathus* sp. | S | L | 24 | 14 | 30 | | 68 |
| 138 | *Daldina concentrica* (*D. childiea*?) | S | W | | | | | |
| 110 | *Dermocybe* aff. *sanguinea* | M | S | | | | 2 | 2 |
| 147 | *Dermocybe austroveneta* | M | S | 3 | | | | 3 |
| 340 | *Dermocybe clelandii* "mini" | M | S | 3 | | | | 3 |
| 57 | *Dermocybe clelandii* "olive brown" | M | S | | | | | |
| 57 | *Dermocybe clelandii* (white mycelium) | M | S | 1 | 3 | | 7 | 11 |
| 172 | *Dermocybe clelandii* (yellow mycelium - glutinous cap) | M | S | 2 | 1 | | 9 | 12 |
| 172 | *Dermocybe clelandii* (yellow mycelium) | M | S | 2 | | 1 | | 3 |
| 328 | *Dermocybe* sp. "small olive" | M | S | | | | 2 | 2 |
| 486 | *Dermocybe* sp. "yellow stipe, yellow mycelium" | M | S | | | | | |
| 124 | *Dermocybe sp.* "yellow-olive" | M | S | | | | 1 | 1 |
| 168 | *Dermocybe* sp. "jarrah" | M | S | 2 | 1 | | 1 | 4 |
| 40 | *Dermocybe* sp."chestnut" | M | S | | | | | |
| 310 | *Dermocybe splendida* | M | S | | | | | |
| 617 | *Dermocybe/Cortinarius* sp. "red brown, scurfy cap" | S? | L | 2 | | | | 2 |
| 622 | Discomycete "creamy white discs on soil" | S | S | | | | | |
| 294 | Discomycete "small yellow on *Banksia grandis* leaf" | S | L | 48 | 477 | | 10 | 535 |
| 508 | *Discomycete "tiny cream disks on leaves"* | S | L | 293 | 40 | | 523 | 856 |
| 625 | Discomycete "tiny white cups - on marri nut" | S | Fruits | | | | | |
| 462 | Discomycete "tiny white on marri nut" | S | Fruit | | | | | |
| 681 | Discomycete "yellow stalked on marri nuts" | S | Fruits | | 39 | 25 | 10 | 74 |
| 123 | Discomycete "yellow stalked" | S | S | 102 | 78 | 1 | 289 | 470 |
| 729 | Discomycete 'light brown' | S | S | | | | 9 | 9 |
| 644 | Discomycete 'tiny bright yellow on nuts and twigs' | S | T | 20 | 18 | | | 38 |
| 31 | *Entoloma* (*Leptonia*) *moongum* "blue-black" | S | S | 2 | 2 | | 1 | 5 |
| 78 | Entoloma (*Leptonia*) sp. "grey/decurrent gills" | S | S | | | | | |
| 409 | *Entoloma* aff. incana | S | S | 1 | | | | 1 |
| 741 | *Entoloma* sp. 'orange green, scaly cap' | S | S | 7 | | | 4 | 11 |
| 222 | *Entoloma* sp. "black with grey-white gills | S | S | | | | 3 | 3 |
| 410 | *Entoloma* sp. "blue-black, marginate gills" | S | S | 1 | | | | 1 |
| 347 | *Entoloma* sp. "brown striate cap" | S | S | 1 | 1 | | | 2 |
| 227 | *Entoloma* sp. "brown-black with tan gills" | S | S | | | | | |
| 530 | *Entoloma* sp. "brown-black, marginate gills, bluish-grey stem" | S | S | 5 | | | | 5 |
| 471 | *Entoloma* sp. "buff with dimple" | S | S | | | | | |
| 30 | *Entoloma* sp. "creamy white" | S | S | 16 | 1 | | 2 | 19 |
| 167 | *Entoloma* sp. "dark grey/blue gill edge" | S | S | | | | 2 | 2 |
| 25 | *Entoloma* sp. "grey-brown/blue stem" | S | S | | | | | |
| 77 | *Entoloma* sp. "grey-brown/brown stem" | S | S | | | | 1 | 1 |
| 235 | *Entoloma* sp. "grey-brown/grey stem" | S | S | 4 | | 2 | 13 | 19 |
| 97 | *Entoloma* sp. "pure white" | ? | S | 3 | | | | 3 |
| 135 | *Entoloma* sp. "tall, grey-brown" | S | S | 4 | | | 1 | 5 |
| 514 | *Entoloma* sp. "very large brown-grey" | S | S | | | | | |
| 604 | *Entoloma* sp. 'dark cap, grey white scales' | S | S | | | | | |

| Sp # | Species | Life Mode[1] | Substrate[2] | Treatments[3] | | | | TOTAL |
|---|---|---|---|---|---|---|---|---|
| | | | | ER | CB | SW | GR | |
| 699 | *Entoloma* sp. 'fawn scurfy cap' | S | S | | | | 3 | 3 |
| 641 | *Entoloma* sp. | S | S | | | | 2 | 2 |
| 583 | *Entoloma* sp. 'khaki brown cap, white stem' | S | S | | | | | |
| 555 | *Entoloma* sp. 'small olive brown' | S | S | 1 | | | 8 | 9 |
| 606 | *Entoloma* sp. 'tall velvet grey brown cap' | S | S | 7 | 1 | | 1 | 9 |
| 589 | *Entoloma* sp. 'tall grey conical' | S | S | | | | | |
| 198 | *Entoloma* sp."brown black/tan/blue" | S | S | 2 | | | 3 | 5 |
| 194 | *Entoloma* sp."brown" | S | S | | | | | |
| 272 | *Entoloma* sp."grey-brown with dimple" | S | S | 11 | 2 | | 4 | 17 |
| 278 | *Entoloma* sp."suede grey-brown with dimple" | S | S | | | | | |
| 274 | *Entoloma viridomarginatum* | S | S | | | | | |
| 159 | *Exidia glandulosus* | S | W | | 4 | | 17 | 21 |
| 41 | *Fistulina spiculifera* | S | W | 6 | | | 9 | 15 |
| 91 | *Fistulinella mollis* | S | W | | 1 | | | 1 |
| 19 | *Formitopsis lilacino-gilva* | S | W | 16 | 2 | 11 | 9 | 38 |
| 11 | *Galerina* spp. "hanging gills" and "conic" | S | S/L | 97 | 89 | 42 | 162 | 390 |
| 111 | *Galerina* sp. "large" | S | S | 15 | 3 | 5 | 1 | 24 |
| 58 | *Galerina* sp. "small cap, eccentric stipe - on wood" | S | W | 65 | 147 | 14 | 324 | 550 |
| 42 | *Galerina* sp. "small on bark" | S | Bark | | | | | |
| 630 | *Galerina* sp. "tiny tan" | S | Bark | | | | | |
| 228 | *Geastrum* sp. | S | S/L | | 2 | | | 2 |
| 691 | *Grandinia barba-jovis* | S | W | 7 | 6 | | 14 | 27 |
| 174 | *Gymnopilus* "red/yellow/red" | S | W | 3 | 2 | | 4 | 9 |
| 8 | *Gymnopilus allantopus* | S | W | 70 | 112 | 17 | 168 | 367 |
| 690 | *Gymnopilus ferruginosus* | S | S | 16 | 9 | | | 25 |
| 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 | | | | | |
| 26 | *Gymnopilus* sp. "reddish cap, orange gills" | S | W | | | | 1 | 1 |
| 85 | *Gymnopilus* sp. "slender" | S | W | 114 | 105 | 88 | 315 | 622 |
| 663 | *Gymnopilus* sp. 'big gym' | S | W | 3 | | | | 3 |
| 591 | *Gymnopilus* sp. 'purple maroon' | S | W | | | | | |
| 217 | *Gyroporus* aff. *cyanescens* "intense blue stain" | M | S | | | | | |
| 292 | *Gyroporus* sp."beige-yellow, blue stain" - see sp 217? | M | S | | | | | |
| 433 | *Hebeloma* aff. *westraliensis* | S | S | 1 | 12 | | 1 | 14 |
| 600 | *Hebeloma aminophylum* | S | S | | | | | |
| 498 | *Hebeloma* sp. "small" | S | S | | | | | |
| 56 | *Heterotextus peziziformis* | S | W/T | 110 | 110 | 18 | 108 | 346 |
| 422 | *Hohenbuehelia* aff. *atracaerulea* "grey brown" | S | W | 38 | | | 50 | 88 |
| 339 | *Hohenbuehelia carbonaria* - on ground | S | S | | | | | |
| 343 | *Hohenbuehelia* sp. "soft brown" | S | W | | | | | |
| 480 | *Hydnellum* sp. "orange tipped spines" | S | L | 5 | | | | 5 |
| 704 | *Hydnellum* sp. 'rubber' | S | S | 48 | | | | 48 |
| 87 | *Hydnellum* sp."red brown" | S | L/S | 99 | 27 | | 36 | 162 |
| 698 | Hydnoid "mouldy marshmallow" | S | S | | | | 4 | 4 |
| 300 | *Hydnoplicata convoluta* | M | S | | | | | |
| 297 | *Hydnum repandum* | S? | S | 27 | | | | 27 |
| 380 | *Hydnum* sp. "chestnut" | S? | S | 1 | | | | 1 |
| 476 | *Hygrocybe* aff. *astatogala* | S | S | 1 | | | | 1 |
| 381 | *Hygrocybe cantharellus* | M | S | | | | | |
| 317 | *Hygrocybe conica* | S | S | | | | 1 | 1 |
| 445 | *Hygrocybe polychroma* | M | S | | | | | |
| 613 | *Hygrocybe* sp. 'dry, orange brown' | M | S | | | | 4 | 4 |

| Sp # | Species | Life Mode[1] | Substrate[2] | Treatments[3] | | | | TOTAL |
|---|---|---|---|---|---|---|---|---|
| | | | | ER | CB | SW | GR | |
| 631 | *Hygrocybe* sp. "yellow with orange stem" | M | S | 1 | | | | 1 |
| 122 | *Hygrocybe* sp. "yellow-orange" | S | Moss | 9 | 6 | | 8 | 23 |
| 734 | *Hygrocybe* sp. 'chrome yellow - large' | M | S | 1 | | | | 1 |
| 599 | *Hygrocybe* sp. 'olive yellow' | M | S | | | | | |
| 732 | *Hygrocybe* sp. 'pallid with orange stem' | M | S | 4 | | | | 4 |
| 616 | *Hygrocybe* sp. 'viscid, red, purple stem' | M | S | | | | | |
| 564 | *Hygrocybe* sp. yellow red' | M | S | 1 | 2 | | 8 | 11 |
| 281 | *Hygrocybe* sp."pallid yellow" | S | S | 4 | | | | 4 |
| 416 | *Hymenochaete* sp. | S | W | 15 | | 1 | 1 | 17 |
| 680 | *Hymenochaete* sp. "chocolate brown" | S | T | | | 4 | | 4 |
| 100 | *Hypholoma australe* | S | W | 107 | 34 | | 20 | 161 |
| 59 | *Hypholoma brunneum* | S | W | 70 | 100 | | 9 | 179 |
| 595 | *Hypholoma* sp. | S | S, L | 3 | | | 7 | 10 |
| 419 | *Hypocrea gelatinosum* | S | W/T | 24 | | | 10 | 34 |
| 108 | *Hypomyces chrysospermus* | P | Bolete | 4 | 3 | | 3 | 10 |
| 640 | *Hypomyces* sp - on *Lactarius* sp (*L. clarkeae*) | P | Fungi | 3 | 1 | 1 | 1 | 6 |
| 697 | *Hypomyces* sp. - on *Ramaria* sp. | P | Fungus | 3 | 1 | | | 4 |
| 726 | *Hypomyces* sp. 'creamy pimples' on *Coltricia* | P | Fungus | | | 14 | | 14 |
| 730 | *Hypomyces* sp. on *Crepidotus* | P | Fungus | 58 | | | | 58 |
| 268 | *Hypomyces* sp."brown/yellow-orange" | M | S | | 2 | | 10 | 12 |
| 581 | *Hysterangium inflatum* 'olive-brown gleba' | M | S | | | | | |
| 592 | *Hysterangium* sp. 'olive gleba' | M | S | 1 | | | | 1 |
| 516 | *Ileodictyon gracile* | S | S | | | | | |
| 1 | *Inocybe australiensis* | M | S | 89 | 29 | 3 | 165 | 286 |
| 203 | *Inocybe geophylla* | M | S | | | | | |
| 487 | *Inocybe* sp. "brown fibrillose, yellow gills" | M | S | 1 | | | 10 | 11 |
| 378 | *Inocybe* sp. "chocolate umbonate" | M | S | | | | | |
| 137 | *Inocybe* sp. "creamy-brown" | M | S | | | | | |
| 48 | *Inocybe* sp. "grey" | M | S | 2 | | | 25 | 27 |
| 484 | *Inocybe* sp. "large firillose, umbonate, yellow-tan gills" | M | S | 3 | | 4 | | 7 |
| 444 | *Inocybe* sp. "large orange-brown scaly cap" | M | S | | | | | |
| 65 | *Inocybe* sp. "large scaly cap" | M | S | 2 | | | 5 | 7 |
| 398 | *Inocybe* sp. "large scaly umbonate cap" | M | S | 11 | 3 | 6 | 6 | 26 |
| 226 | *Inocybe sp.* "orange brown" | M | S | | | 1 | | 1 |
| 113 | *Inocybe* sp. "radially fibrillose, pink stem" | M | S | 1 | 8 | | 2 | 11 |
| 20 | *Inocybe* sp. "scaly cap" | M | S | 5 | | 2 | 34 | 41 |
| 169 | *Inocybe* sp. "shaggy stem" | M | S | | | | | |
| 162 | *Inocybe* sp. "small light brown, fibrillose" | M | S | 15 | | | | 15 |
| 53 | *Inocybe* sp. "tan skirt" | M | S | 36 | 90 | 16 | 27 | 169 |
| 286 | *Inocybe* sp."umbonate, shaggy" | M | S | | | | 3 | 3 |
| 204 | *Inonotus* sp. | S | W | | | | | |
| 719 | *Isaria* sp. 'Yellow clubs' | P | Insects | 8 | | | | 8 |
| 74 | *Laccaria* aff. *masonii* | M | S | 347 | 27 | 18 | 421 | 813 |
| 36 | *Laccaria lateritia* | M | S | 37 | 15 | | 83 | 135 |
| 384 | *Laccocephalum basilapiloides* | S | W | | | | | |
| 383 | *Laccocephalum tumulosum* | S | W | | | | | |
| 221 | *Lactarius clarkeae* | M | S | 2 | | | | 2 |
| 142 | *Lactarius eucalypti* | M | S | 10 | 11 | | 2 | 23 |
| 245 | *Lactarius* sp. "cream yellow" | M | S | 5 | | | | 5 |
| 215 | *Lactarius* sp."cream custard" | M | S | | | | | |
| 478 | *Laetiporus potentosus* | S | W | 2 | | | | 2 |
| 737 | *Lanzia lanaripes* | S | W | | | | 25 | 25 |
| 335 | *Lentinellus* sp. "brown cap, saw-toothed gills" | S | W | 21 | 4 | | | 25 |
| 457 | *Lentinellus* sp. "brown fan, white saw-gills" | S | W | | | | 5 | 5 |

| Sp # | Species | Life Mode[1] | Substrate[2] | Treatments[3] | | | | TOTAL |
|---|---|---|---|---|---|---|---|---|
| | | | | ER | CB | SW | GR | |
| 468 | *Lentinellus* sp. "brown lobed, hirsute, brown gills" | S | W | | | | | |
| 271 | *Lepiota* aff. *haemorrhagica* "red stainer" | S | S | | | | | |
| 185 | *Lepiota cristata* | S | S | 5 | 6 | | 5 | 16 |
| 82 | *Lepiota* sp. "cream-grey" | S | S | | | | | |
| 264 | *Lepiota* sp. "cream-grey" | S | S | 1 | | | 1 | 2 |
| 475 | *Lepiota* sp. "creamy brown scaly cap, bifurcate gills" | S | S | | | | | |
| 246 | *Lepiota* sp. "purple-grey" | S | S | | | | | |
| 735 | *Lepiota* sp. 'amber drops' | S | W | | 1 | | 1 | 2 |
| 603 | *Lepiota* sp. 'creamy pink' | S | S | | | | | |
| 728 | *Lepiota* sp. 'red-brown' | S | S | | 3 | | | 3 |
| 166 | *Lepiota* sp."creamy-brown" | S | S | 4 | 6 | 6 | 7 | 23 |
| 76 | *Lepiota* sp."orange with brick red scales/white gills" | S | S | | | | 2 | 2 |
| 117 | *Lepista* sp. | M? | S | | | | | |
| 214 | *Leucopaxillus lilacinus* | M | S | | | 1 | | 1 |
| 127 | Lichenomphalia aff. *umbellifera* | S | S/Algae | | | 2 | 81 | 83 |
| 112 | Lichenomphalia *chromacea* | S | S/Algae | 9 | 7 | | 2 | 18 |
| 24 | *Lycoperdon* sp. | S | S | 2 | | 2 | 11 | 15 |
| 329 | *Lyophyllum* sp. "viscid buff, long stem" | M? | S | | | | | |
| 731 | *Macowanites luteiroseus*? | M | S | 4 | | | | 4 |
| 610 | *Macowanites* sp. | M | S | | | | | |
| 190 | *Macrolepiota clelandii* | S | S | 1 | | | | 1 |
| 318 | *Marasmellis* sp."small white, on twigs & leaves" | S | L/T | | 1 | | | 1 |
| 191 | *Marasmiellis* sp. "white umbrella" | S | T/W | | | | | |
| 239 | *Marasmiellus* sp. "on zamia" | S | T | | | | | |
| 318 | *Marasmiellus* sp. 'jarrah coppice' | S | Bark | | | | | |
| 55 | *Marasmius crinisequi* | S | L | 367 | 189 | 137 | 344 | 1037 |
| 183 | *Marasmius elegans* | S | S | 45 | 2 | | | 47 |
| 618 | *Marasmius sp.* | S | T | | | | | |
| 443 | *Marasmius* sp. "small tan" | S | S | | | | 1 | 1 |
| 341 | *Marasmius* sp. "tiny red on twigs" | S | L/T | 36 | | | 1 | 37 |
| 309 | *Marasmius* sp. | S | S/L | 36 | | | | 36 |
| 75 | *Marasmius* sp."large brown, on Zamia stems" | S | T | | | | | |
| 529 | *Melanoleuca* sp. "grey-brown/white/white" | S | S | | | | | |
| 612 | *Melanophyllum echinatum* | S | S | | | | | |
| 22 | *Melanotus hepatocrous (Crepidotus subhaustellaris)* | S | W | 37 | 32 | 2 | 119 | 190 |
| 373 | *Merulius* sp "creamy yellow, on jarrah stick' | S | W | | | | | |
| 643 | *Merulius* sp. 'on leaves' | S | L | | 3 | | | 3 |
| 55b | *Micromphale* sp. "garlic" | S | L | | | | | |
| 262 | *Multiclavula* sp. "tiny white candles" | S | S | | | | 1 | 1 |
| 44 | *Mycena* aff. *atrata* | S | W | 5 | | | 16 | 21 |
| 372 | *Mycena* aff. *fumosa* | S | W | | | | | |
| 134 | *Mycena albidocapillaris (*aff. *subcapillaris)* | S | L | 14 | 1 | 1 | 5 | 21 |
| 80 | *Mycena carmeliana* | S | W | 141 | 69 | 12 | 196 | 418 |
| 312 | *Mycena fuherii* "pink,bleach" | S | S/L | | | | | |
| 327 | *Mycena maldea* | S | L | | | | 3 | 3 |
| 50 | *Mycena mijoii* | S | L | 229 | 317 | 49 | 70 | 665 |
| 66 | *Mycena pura* | S | S/L | 9 | | 1 | 19 | 29 |
| 144 | *Mycena sanguinolenta* | S | S | 2 | 2 | | 2 | 6 |
| 491 | *Mycena* sp. "brown pointy cap" | S | L | | | | | |
| 521 | *Mycena* sp. "brown pura" | S | L | | 1 | | | 1 |
| 523 | *Mycena* sp. "brown striate with dark umbo" | S | L | | | | | |
| 456 | *Mycena* sp. "brown-grey, viscid conic" | S | L | | | | | |
| 51 | *Mycena* sp. "buff umbrella" | S | L/T | 430 | 49 | 25 | 44 | 548 |
| 285 | *Mycena* sp. "light brown striate/white stems, on wood" | S | W | | | | 5 | 5 |

| Sp # | Species | Life Mode[1] | Substrate[2] | Treatments[3] | | | | TOTAL |
|---|---|---|---|---|---|---|---|---|
| | | | | ER | CB | SW | GR | |
| 18 | *Mycena* sp. "light brown-olive" | S | S | | | | | |
| 376 | *Mycena* sp. "small brown with decurrent gills" | S | W | | | | 1 | 1 |
| 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 | 31 | 34 | 12 | 7 | 84 |
| 502 | *Mycena* sp. "striate cap, decurrent gills, on burnt ground" | S | S | | | | | |
| 477 | *Mycena* sp. Adonidae "tiny rosy pink" | S | S | | 1 | | | 1 |
| 386 | *Mycena* sp. "tiny white sticky cap" | S | L | 40 | | | | 40 |
| 88 | *Mycena* sp. "tiny white with decurrent gills" | S | S | 14 | 9 | | 109 | 132 |
| 64 | *Mycena* sp. "tiny white, on twigs" | S | T | 14 | 9 | | 6 | 29 |
| 574 | *Mycena* sp. 'dry grey, creamy white gills' | S | S | | | | | |
| 701 | *Mycena* sp. 'dusty purple conic' | S | S | | | | 2 | 2 |
| 590 | *Mycena* sp. 'grey brown with creamy brown margin' | S | S | 1 | | | | 1 |
| 650 | *Mycena* sp. 'maroon' | S | S | | | | 2 | 2 |
| 658 | *Mycena* sp. 'orange striate cap, dimpled' | S | W | 8 | | | | 8 |
| 565 | *Mycena* sp. 'red gills' | S | L | | | | | |
| 308 | *Mycena* sp. "grey-brown,/no bleach" | S | S | 5 | 5 | 1 | | 11 |
| 302 | *Mycena* sp. "nipple umbrellas" | S | W | | | | | |
| 295 | *Mycena* sp. "small buff" | S | L | 9 | | 2 | 5 | 16 |
| 182 | *Mycena* spp. (unidentified) | S | | 24 | | 1 | 6 | 31 |
| 163 | *Mycena subgallericulata* | S | W | 271 | 196 | 6 | 315 | 788 |
| 238 | *Mycena yuulongicola* | S | W | 41 | 99 | | 49 | 189 |
| 27 | *Mycena yuulongicola* "long stem" | S | W | | | | | |
| 336 | *Mycena/Tephrocybe* sp. "dk brown on burnt ground" | S | S | | | | | |
| 510 | *Mycoacia subceracea* | S | T/W | | | | | |
| 703 | *Nectria* aff. *cinnabarina* | P | Fruits | | | | 1 | 1 |
| 164 | *Nidula niveotomentosa* | S | L/T | | | | | |
| 413 | *Nidularia* aff. *farcta* "white dots on roo poo" | C | Dung | | | | | |
| 441 | *Nothocastorium* sp. | M | S | | | | | |
| 535 | *Nothojafnea thaxterii* | S | S | | | | | |
| 461 | *Omphalina* sp. | S | S | | 1 | | 17 | 18 |
| 557 | *Omphalina* sp. 'napthalene' | | | 31 | 9 | | 1 | 41 |
| 213 | *Omphalotus nidiformis* | S | W | | | | | |
| 130 | Orange parasite on white resupinate polypore (sp.116) | P | | | | | | |
| 558 | *Paecilomyces tenuipes* 'fluffy antlers' | P | Insect | | | | | |
| 104 | *Panellus ligulatus* | S | W | 12 | 1 | | 3 | 16 |
| 311 | *Panus fasciatus* | S | W | | 2 | | 17 | 19 |
| 356 | *Paxillus* sp. "robust with bulbous base" | M | S | | | | | |
| 522 | *Paxillus* sp. "yellow" (*P. infundibuliformis*?) | M | S | | | | | |
| 179 | *Paxillus macnabii* | M | S | 16 | 3 | | 9 | 28 |
| 332 | *Peziza "praetervisa"* | S | S | | | | | |
| 442 | *Peziza* (*Sepultaria*) sp. "hollow spheres" | M/S? | S | | | | | |
| 524 | *Peziza* aff. *thozetii* | S | S | 1 | | | | 1 |
| 501 | *Peziza* sp. "black, flat" | S | S | | | | | |
| 455 | *Peziza* sp. "brown" | S | S | | | | | |
| 527 | *Peziza* sp. "dark brown, smooth" | S | S | | | | | |
| 499 | *Peziza* sp. "dark brown-burgandy, tan underside" | S | S | | | | | |
| 256 | *Peziza* sp. "white cup" | ? | | | | | | |
| 330 | *Peziza tenacella* | S | S | | | | | |
| 488 | *Phaeocollybia ratticauda* | S | W/S | | | | | |
| 598 | *Phaeocollybia tasmanica* - see sp. 488 | S | S | | 2 | | | 2 |
| 136 | *Phellinus gilvus* | S | W | 16 | 1 | | 23 | 40 |
| 37 | *Phellinus* sp. "yellow rim" | S | W | | | | 10 | 10 |
| 70 | *Phellodon* aff. *niger* | S | L/S | 29 | 26 | | | 55 |

| Sp # | Species | Life Mode[1] | Substrate[2] | Treatments[3] | | | | TOTAL |
|---|---|---|---|---|---|---|---|---|
| | | | | ER | CB | SW | GR | |
| 621 | *Phellodon* sp. "black, silver/brown grey spines" | S | L | 80 | | | | 80 |
| 435 | *Phellodon* sp. "brown" | M | S | 13 | | | | 13 |
| 634 | *Phellodon* sp. "flimsy, silver grey" | S | S | | | | | |
| 479 | *Phellodon* sp. "niger brown" | S | L | 300 | 141 | | 30 | 471 |
| 447 | *Phellodon* sp. "silver-blue" | S | S | | | | | |
| 84 | *Phellodon* sp. '*niger* slender' (sp. 70b) | S | L/S | 2 | 3 | | | 5 |
| 563 | *Phellodon sp. olive* brown spines' | S | S/L | 30 | 82 | | | 112 |
| 101 | *Phlebia rufa* | S | W/Bark | | 1 | | 4 | 5 |
| 614 | *Phlebia* sp. 'orange' | S | W | | 5 | | | 5 |
| 160 | *Pholiota communis* | S | S | | | 1 | | 1 |
| 160 | *Pholiota highlandensis* | S | S | 24 | 9 | 2 | 7 | 42 |
| 119 | *Pholiota multicingulata* | S | W | 22 | 9 | 13 | 77 | 121 |
| 156 | *Pholiota* sp. "light brown - red scales on stem" | S | S | | | | | |
| 506 | *Pholiota* sp. "water soaked gills" | S | S | 4 | | | | 4 |
| 481 | *Phylloporus* sp. | M | S | | | | | |
| 363 | *Piptoporus australiensis* | S | W | | 1 | | | 1 |
| 403 | *Pisolithus* aff. *arhizus* "black-yellow" | M | S | | | | | |
| 353 | *Pisolithus* sp. 'small, stalked" | M | S | | | | | |
| 401 | *Pisolothus mamoratus* | M | S | | | | | |
| 192 | *Plectania* sp. "black" | S | L | | 6 | | | 6 |
| 133 | *Pluteus attromarginata* | S | W | 1 | | | 1 | 2 |
| 248 | *Pluteus cervinus* | S | W | | | | | |
| 47 | *Pluteus lutescens* "orange" | S | W | 2 | 1 | | 4 | 7 |
| 47 | *Pluteus lutescens* "yellow-green" | S | W | 14 | 3 | | 3 | 20 |
| 4 | *Pluteus* sp. "brown velvet" | S | S | | | | | |
| 157 | *Podoserpula pusio* | S/M? | L/S | | 3 | | | 3 |
| 277 | Polypore "beige" | S | W | 1 | | | | 1 |
| 393 | Polypore "bracket on B. grandis cone" | S | L | | | | | |
| 13 | Polypore "brown with white margin" | S | W | | | | | |
| 3 | Polypore "long white shelf" | S | W | | 9 | | | 9 |
| 333 | Polypore "on dead waterbush" | S | W | | | | | |
| 585 | Polypore ' resupinate, white floccose' | S | W | | 7 | | 18 | 25 |
| 474 | Polypore "soft pored bracket" | S | W | | | | | |
| 361 | Polypore "white resuipinate on twig" | S | W/T | | | | | |
| 116 | Polypore "white resupinate" | S | T/W | | 8 | | | 8 |
| 639 | Polypore 'thick white resupinate on twigs' | S | W | | 5 | | 1 | 6 |
| 494 | *Polyporus* sp. "brown stalked" | S | W | | | | | |
| 145 | *Poronia ericii* | C | Dung | | 22 | | | 22 |
| 236 | *Postia* (*Tyromyces*) *peliculosa* | S | W | 7 | 1 | | | 8 |
| 155 | *Protubera canescens* | M? | S | 5 | | | | 5 |
| 727 | *Psathyrella* sp. | S | S | | 4 | 6 | | 10 |
| 17 | *Psathyrella* sp. | S | S/L | | | | | |
| 229 | *Psathyrella* sp. | S | L | 1 | 2 | 3 | | 6 |
| 250 | *Psathyrella* sp. | S | L | | | | | |
| 337 | *Psathyrella* sp. | S | S | | | | | |
| 414 | *Psathyrella* sp. "brown cap, white fibrillose stem" | S | L | | 5 | | | 5 |
| 359 | *Psathyrella* sp. "brown with white skirt" | S | S | | | | | |
| 705 | *Psathyrella* sp. "delicate brown bells" | M | S | 34 | | | | 34 |
| 682 | *Psathyrella* sp. "grey, delicate fibrillose" | S | S | | | 8 | | 8 |
| 177 | *Psilocybe coprophila* | C | Dung | 4 | 1 | | 11 | 16 |
| 349 | *Psilocybe musci* | S? | S | | | | | |
| 331 | *Pulvinula archerii* | S | S | | | | | |
| 280 | *Pulvinula* sp. | S | S | | | | | |
| 129 | *Pulvinula* sp. (*P. tetraspora?)* | S | S | | | | | |

| Sp # | Species | Life Mode[1] | Substrate[2] | Treatments[3] | | | | TOTAL |
|---|---|---|---|---|---|---|---|---|
| | | | | ER | CB | SW | GR | |
| 176 | *Pycnoporus coccineus* | S | W | 1 | | | | 1 |
| 366 | *Pyronema* sp. | S | S | | | | | |
| 351 | *Ramaria* / *Clavulina* "creamy white" | M | S | 6 | | | | 6 |
| 72 | *Ramaria australiana* "purple-pink with pink tips" | M | S | 19 | 7 | 4 | 6 | 36 |
| 52 | *Ramaria capitata* | M | S | 5 | | 2 | | 7 |
| 377 | *Ramaria lorithamnus* | S | S | 28 | 6 | | 17 | 51 |
| 102 | *Ramaria ochroceosalmonicolor* | M | S | 81 | 12 | 5 | 65 | 163 |
| 242 | *Ramaria* sp. "cream/flat" | M | S | 7 | | | | 7 |
| 624 | *Ramaria* sp. "golden orange" | S | S | | | | | |
| 247 | *Ramaria* sp. "lemon yellow" | M | S | 1 | | | | 1 |
| 86 | *Ramaria* sp. "orange-red, yellow stem" | M | S | 2 | | | | 2 |
| 490 | *Ramaria* sp. "tan, *Allocasuarina* litter" | S | S | | | | | |
| 254 | *Ramaria vesatilis* "purple" | M | S | 5 | 7 | | | 12 |
| 534 | *Ramariopsis pulchella* | S | S | | | | 1 | 1 |
| 79 | *Resupinatus cineroscens* | S | T/Bark | 100 | 19 | | 72 | 191 |
| 452 | *Rhizopogon* sp. | M | S | | | | | |
| 397 | *Rhodocybe* ? sp. "grey agaric" | S | S | | | | 1 | 1 |
| 209 | *Rickenella fibula* | S | Moss | 139 | 27 | 3 | 7 | 176 |
| 69 | *Russula adusta* | M | S | 12 | 7 | | 11 | 30 |
| 552 | *Russula* aff. *albonigra* | M | S | | | | 3 | 3 |
| 90 | *Russula* aff. *cyanoxantha* | M | S | 39 | 1 | | | 40 |
| 89 | *Russula clelandii* group | M | S | 121 | 16 | 1 | 22 | 160 |
| 202 | *Russula flocktoniae* | M | S | 28 | | | | 28 |
| 92 | *Russula neerimea* | M | S | 72 | 30 | | 18 | 120 |
| 178 | *Russula persanguinea* | M | W | 12 | 3 | | 2 | 17 |
| 107 | *Russula* sp. "grey-white" | M | S | 2 | 2 | | 2 | 6 |
| 692 | *Russula sp.* "grey-white" | M | S | 1 | | | | 1 |
| 10a | *Russula* sp. "small white-white-white" | M | S | | 11 | | | 11 |
| 10b | *Russula* sp. "tiny, white-white-white" | M | S | 3 | 7 | | | 10 |
| 10c | *Russula* sp. "white/white/white" | M | S | 52 | 22 | | 16 | 90 |
| 559 | *Russula* sp. 'peaches and cream' | M | S | | 1 | | | 1 |
| 276 | *Russula* sp."purple-mottled" | M | S | | | | | |
| 342 | *Ryvardinia campyla* | S | W | 2 | | | | 2 |
| 263 | *Sarcodon* sp. "brown" | S | S | 8 | | | 5 | 13 |
| 322 | *Scleroderma* sp. (Truffle) "black gleba" | M | S | | | | | |
| 315 | *Scleroderma* sp."yellow/yellow mycelium" | M | S | | | | | |
| 150 | *Scutellina* aff. *margaritacea* | S | W/T | | | | | |
| 12 | *Simocybe* sp."olive" | S | W | 9 | | | | 9 |
| 306 | *Sphaerobolus stellatus* | S | L | | | | 20 | 20 |
| 132 | *Steccherinum* sp. "creamy yellow crust" | S | W | | | | | |
| 539 | *Steccherinum* sp. 'Fairy castle crust' | S | W | | | | | |
| 94 | *Steccherinum* sp."tiered white shelves" | S | W | 85 | | | 1 | 86 |
| 62 | *Stereum hirsutum* | S | W | 343 | 125 | 15 | 47 | 530 |
| 149 | *Stereum illudens* brown hymenium | S | W | 6 | | | 144 | 150 |
| 5 | *Stereum* sp. "grey-brown white hirsute, purple fertile layer" | S | W | 3 | | | | 3 |
| 325 | *Stereum* sp. "purple margin - algae" | S | W | | | | | |
| 748 | *Streum illudens* grey hymenium | S | W | 6 | | | | 6 |
| 67 | *Stropharia semiglobata* | C | Dung | 8 | 4 | | 6 | 18 |
| 451 | *Stropharia* sp. "shaggy stem, on roo poo" | C | Dung | | | | | |
| 507 | *Tapinella curtisii* | S | W | | | | | |
| 14 | *Tephrocybe* sp. | S | S | | | | | |
| 513 | *Tephrocybe* sp. "dark grey-brown convex" | S | S | | | | | |
| 249 | *Tephrocybe* sp. "grey" | S | S | | | | | |

| Sp # | Species | Life Mode[1] | Substrate[2] | Treatments[3] | | | | TOTAL |
|---|---|---|---|---|---|---|---|---|
| | | | | ER | CB | SW | GR | |
| 233 | *Tephrocybe* sp. "grey/dimple" | S | S | | | | | |
| 153 | *Tephrocybe* sp. "small dark grey-brown" | S | S | | | 2 | | 2 |
| 512 | *Tephrocybe* sp. "small grey-brown" | S | S | | | | | |
| 587 | *Tephrocybe* sp. 'dark brown with grey brown gills' | S | S | 4 | | | | 4 |
| 301 | *Tephrocybe* sp."dark grey with dimple" | S | S | | 2 | | 4 | 6 |
| 266 | *Thelephora* sp. "white with orange margin" | M | S/Host | 1 | 1 | | 16 | 18 |
| 549 | *Thelephora* sp. 'small rosette' | S/M | S | | | | | |
| 615 | Thelephore 'creamy grey maze' | S | W | | 9 | | 1 | 10 |
| 593 | Thelephore 'pinkish beige skin' | S | W | 9 | | | | 9 |
| 623 | Thelephore "creamy pimpled, orange margin and stem" | S | Charcoal | | | | | |
| 582 | Thelephore 'white parchment' | S | T | | | | 2 | 2 |
| 454 | Thelephore "creamy jagged-ridged crust" | S | S | 3 | 7 | | 34 | 44 |
| 632 | Thelephore "purple splash" | S | W | | | | | |
| 586 | Thelephore 'brown feathers' | M? | S | | | | | |
| 683 | Thelephore 'thin creamy maze' | S | W | 8 | 1 | | 5 | 14 |
| 482 | *Torrendia* sp. | M | S | | | | | |
| 688 | *Trametes* sp. "beige" | S | W | 6 | | | | 6 |
| 669 | *Trametes velutina* | S | W | 10 | 10 | | 25 | 45 |
| 63 | *Trametes versicolor* (brown or grey) | S | W | 117 | 84 | 40 | 13 | 254 |
| 287 | *Tremella globispora* | S | W | 9 | | | 52 | 61 |
| 685 | *Tremella globispora* "translucent white" 31 | S | W | 2 | | | 30 | 32 |
| 60 | *Tremella mesentericia* | S | W | 3 | | | | 3 |
| 289 | *Tremella* sp."tiny yellow knobs" | S | W | 28 | 25 | 12 | 25 | 90 |
| 288 | *Tremella* sp."yellow buttons" | S | W | 2 | | | | 2 |
| 109 | *Trichaptum byssogenum*."purple splash" | S | W | 1 | | | | 1 |
| 533 | *Trichoglossum hirsutum* | S | S | | | | | |
| 161 | *Tricholoma* aff. *virgatum* | M | S | | | | | |
| 54 | *Tricholoma eucalypticum* | M | S | 27 | 3 | 3 | 3 | 36 |
| 483 | *Tricholoma* sp | S | S | | | | | |
| 211 | *Tricholoma* sp. | M | S | | | | 1 | 1 |
| 594 | *Tricholoma* sp. | M | S | 8 | | | | 8 |
| 446 | *Tricholoma* sp. "orange with ring" | S | S | 3 | | | | 3 |
| 495 | *Tricholoma* sp. "orange with white stem" | S | S | | | | | |
| 736 | *Tricholoma* sp. 'creamy tan' | M | S | 8 | | | | 8 |
| 733 | *Tricholoma* sp. 'olive green' | M | S | 1 | | | | 1 |
| 560 | *Tricholoma* sp. 'tan gills, ring' | M | S | 8 | | | | 8 |
| 464 | Truffle "pale yellow" | M | S | | | | | |
| 321 | Truffle "pink gleba" | M | S | | | | | |
| 258 | Truffle "sticky" | M | S | | | | | |
| 687 | Truffle *Cystangium* sp. | M | S | | | | 5 | 5 |
| 696 | Truffle FC1289 | M | S | | | | 11 | 11 |
| 723 | Truffle *Stephanospora* sp. 2 | M | S | | | | 6 | 6 |
| 189 | *Tubaria rufofulva* | S | W | 2 | | | 82 | 84 |
| 602 | *Tubifera fuliginosa* 'strawberry myxo' | S | W | | | | | |
| 305 | *Tylopilus* sp."yellow" | M | S | 3 | 9 | | | 12 |
| 505 | *Tyromyces caesius* | S | W | | | | | |
| 567 | Unknown 'fluffy salmon buttons' (on *Podocarpus* fruits) | S | Fruits | | | | | |
| 725 | Unknown 'orange pustules-fluffy' on Macrozamia seed | P/S? | Fruits | | | 100 | | 100 |
| 667 | Unknown 'rusty nuts' | S | L | | 1 | | | 1 |
| 651 | Unknown 'white mycelium on bark and litter' | S | W | | | | | |
| 440 | White mycelium on roo poo | C | Dung | | | 1 | | 1 |
| 2 | *Xerula australis* | S | S | | 1 | | 1 | 2 |
| 175 | *Xylaria hypoxylon* | S | W | 54 | 2 | 7 | 9 | 72 |
| 459 | *Xylaria* sp. "black and white spears" | S | W/S | | | | | |

| Sp # | Species | Life Mode[1] | Substrate[2] | Treatments[3] | | | | TOTAL |
|---|---|---|---|---|---|---|---|---|
| | | | | ER | CB | SW | GR | |
| 528 | Yellow discs on Emu poo | C | Dung | | | | | |
| 629 | *Zelleromyces* sp. "yellow, olive gleba" | M | S | | | | | |
| 601 | *Zelleromyces* sp. 'orange' | M | S | | | | | |
| 640 | Number of species | | | **248** | **195** | **86** | **218** | **371** |
| | Number of fruit bodies | | | **9164** | **5739** | **1797** | **8536** | **25236** |

= Additional species recorded at Donnelly 2003-2006

[1] S = saprotrophic, M = mycorrhizal, P = parasitic, C = coprophilous

[2] S = soil, L = litter, T = twigs, W = wood

[3] E.C. = external reference, S.W. = shelterwood, S.C. = selective cut, G.R. = gap release

## CRYPTOGAMS

Ray Cranfield, Richard Robinson and Verna Tunsell

### Introduction

Lichen, moss and liverwort are collectively known as cryptogams. Some species of lichens are important indicators of ecosystem health, being sensitive to changes and disturbance in the environment in which they grow. Many colonise 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. Lichens, mosses and liverworts are a major component of the biodiversity of forest ecosystems, and most species in Western Australia have poorly known distributions and many are yet to be named.

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

Following the first five years of monitoring, the survey methods for cryptogams was reviewed and modified. The revised methods are described below. Previously the survey method relied on collecting specimens and identifying them in the laboratory. A monitoring list of 35 cryptogams was collated for the purpose of simplifying the survey effort and testing as indicator species. The new methods were devised to minimise repetitive collection and removal of material from the grids.

The initial objectives of monitoring cryptogams remain, but additional objectives are:

- To monitor the availability and usage of suitable substrates
- To monitor the availability and usage of strata levels
- To record the general abundance of lichen, moss and liverwort flora
- To record the presence of 35 monitoring (or indicator) species
- To determine the relationship of cryptogam presence with litter cover
- To determine successional trends in communities
- To determine trends within cryptogam life-forms

### Monitoring

The Donnelly FORESTCHECK cryptogam flora was surveyed on all ten monitoring grids from 22-25 September 2008. Previous survey was conducted by a collecting foray around the outer perimeter of each monitoring grid. In 2008, the method was modified to include 20 1x1 m plots, 10 m apart along a 200 m transect. Alternate plots were situated 2m to the left or right of the transect line. The transect included two adjoining sides of the central 100 x 100 m area, running from W1-2 to W1-4 then from W1-4 to W3-4 (see Fig. 1 in Introduction).

In each 1x1 m plot the following data was recorded:

- The number of lichen, moss and liverwort individuals

- The presence of any of the selected "monitoring" species
- The presence (or absence) of each cryptogam life form
- The presence and use (colonisation) of cryptogam substrates
- The level within the strata that cryptogams occurred

Previous years monitoring indicated that the presence of a litter layer impacted on the presence and abundance of species, therefore litter coverage was scored for each plot. A recording form has been developed along with an illustrated monitoring species booklet to facilitate the collection of relevant data.

**Voucher Specimen Processing**

Vouchers were extensively collected in 2001. In 2008, specimen vouchering was restricted to a small number of samples that represented material needed for positive identification and new species records. All specimens collected in 2008 have been identified or phrase named for ease of re-determination. Advances in identification, and re-examination of previously collected specimens has resulted in name changes previously used for a number of species. These have recently been updated on the database. All new collections have been prepared for database entry and label generation prior to submitting these vouchers to the PERTH Herbarium.

**Preliminary Results and Discussion**

Although the 2008 survey at Donnelly was conducted much later in the year than previous FORESTCHECK surveys, the cryptogam flora was well represented. This is due partly to the durable nature of cryptogams and their continued presence over extended periods independent of rain. Although fragile when desiccated, and easily damaged, several lichen species appear only to vegetatively reproduce and probably rely on some fragmentation for dispersal. Some moss species can be spread through fragmentation but mostly, like liverworts, are dependant on spore spread.

The use of the new recording sheet and booklet has shown that possibly a further four to six species need to be included in the field guide. These prospective species have been noted and appear to be more widespread than previously thought but are part of the FORESTCHECK unknown genera, an attempt to identify them is underway and expert assistance is being sort.

**Substrate availability and usage**

Survey results indicated that on most grids all substrates needed for the establishment and maintenance of cryptogams were available, but not always fully utilised (Fig. 1). On the external reference grids, wood, soil and organic material were the most utilised habitats with stone and charcoal secondarily favoured. On coupe buffer and shelterwood grids wood and soil were the preferred habitat with bark and charcoal second. On gap release grids wood and charcoal were the most utilised substrates followed by soil. It appears that the time since treatment has an influence on the condition of substrates and their consequent colonisation by cryptogams.

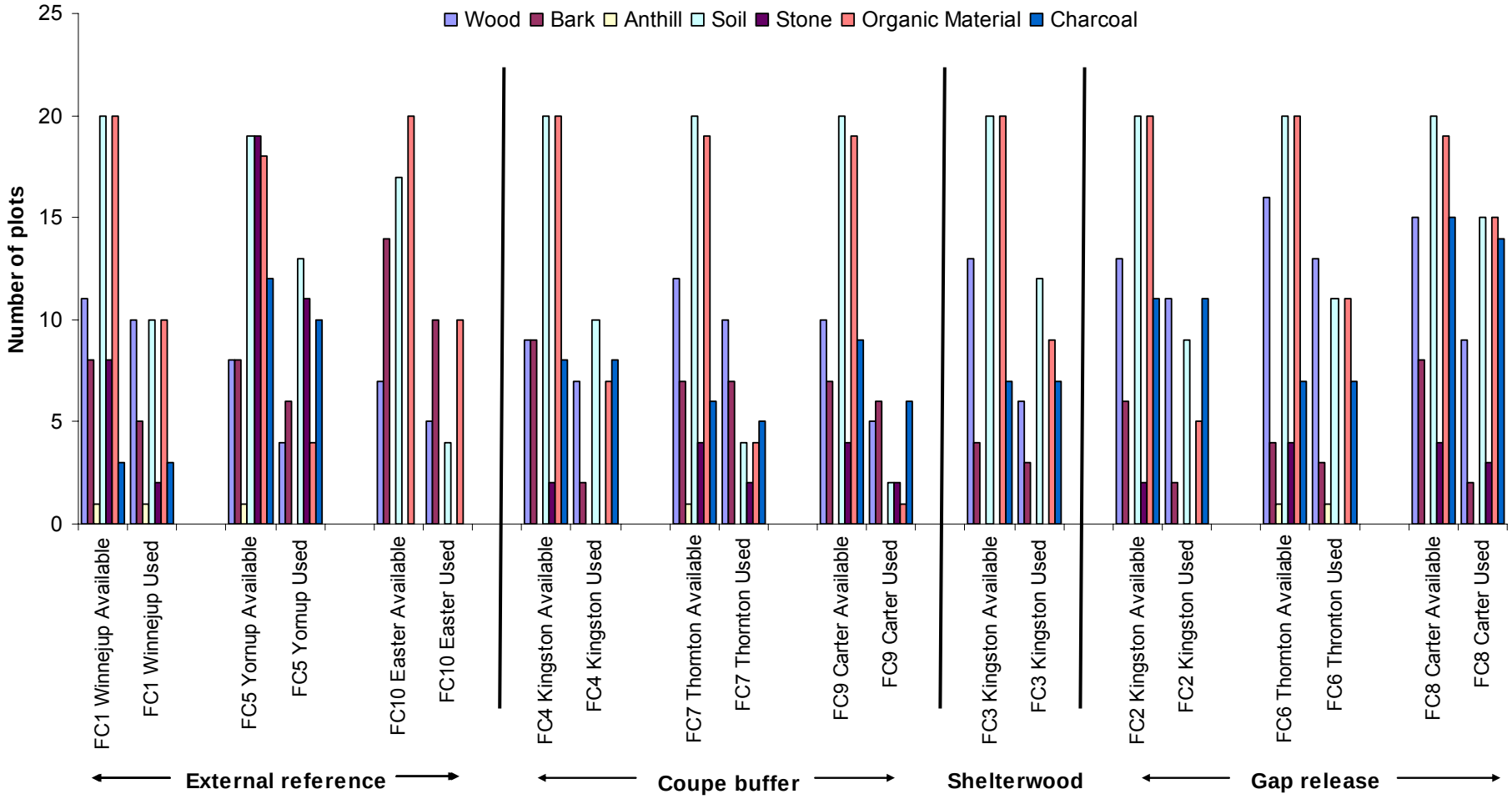



**Figure 1**. The number of plots with substrates available for colonization and their utilization by cryptogams on each Donnelly FORESTCHECK grid in 2008.

### Lichen, moss and liverwort abundance

On all grids, lichens were the most numerous followed by mosses. Liverworts were always in low numbers or absent (Fig. 2). This was also the case for the overall mean number of individuals per grid in each treatment (Fig. 3). The average number of lichens, mosses and liverworts varied between grids (Fig. 2) but was similar in each treatment (Fig. 3).

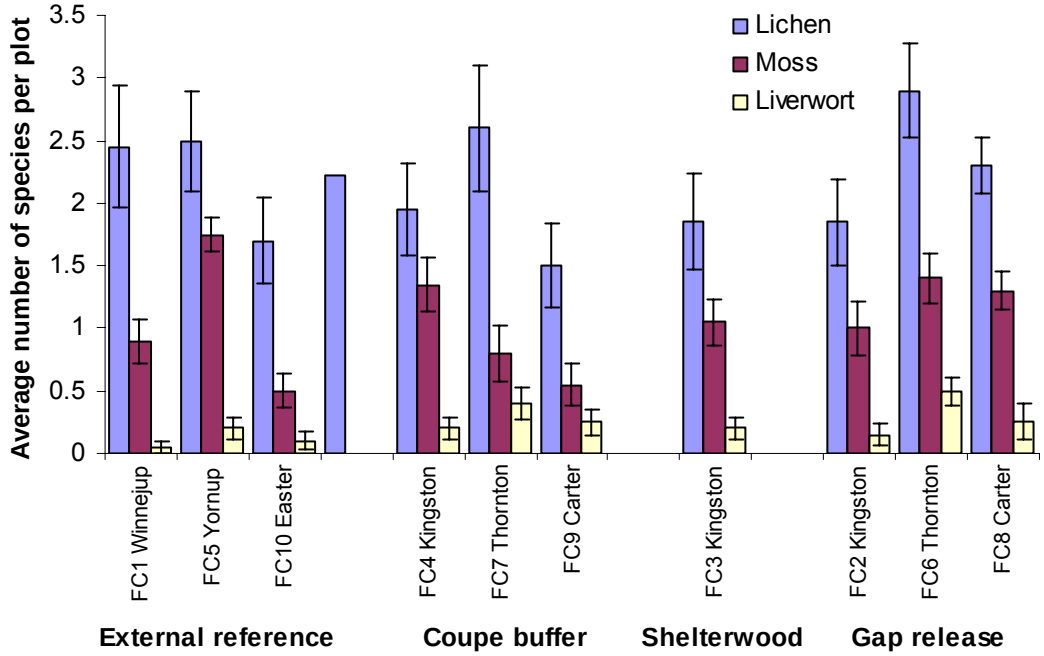



**Figure 2**. The average number of lichen, moss and liverwort species recorded in 1x1 m plots on each Donnelly FORESTCHECK grid in 2008.

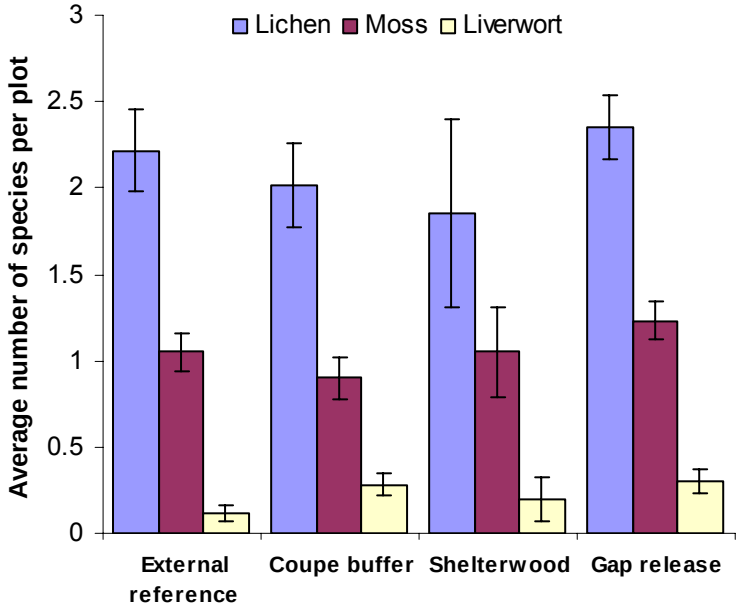



**Figure 3**. The average number of lichen, moss and liverwort species per plot in each treatment recorded at Donnelly in 2008.

### Strata layers and cryptogam colonisation

The presence of cryptogams at different levels in the strata depends on the availability of suitable substrates at each level. Of the three strata layers investigated, the ground layer (0-30 cm) was the most utilised strata in every plot (Fig. 4). Colonisation of the shrub layer (31cm-3m) was variable within and between treatments and appears to be affected by canopy cover and time since fire (age and structure of shrubs). The epiphytic tree layer (over 3.1 m) is difficult to examine and surveys depend on recording material which has fallen from tree crowns, and as such the results may not reflect the true extent of tree crown colonisation.

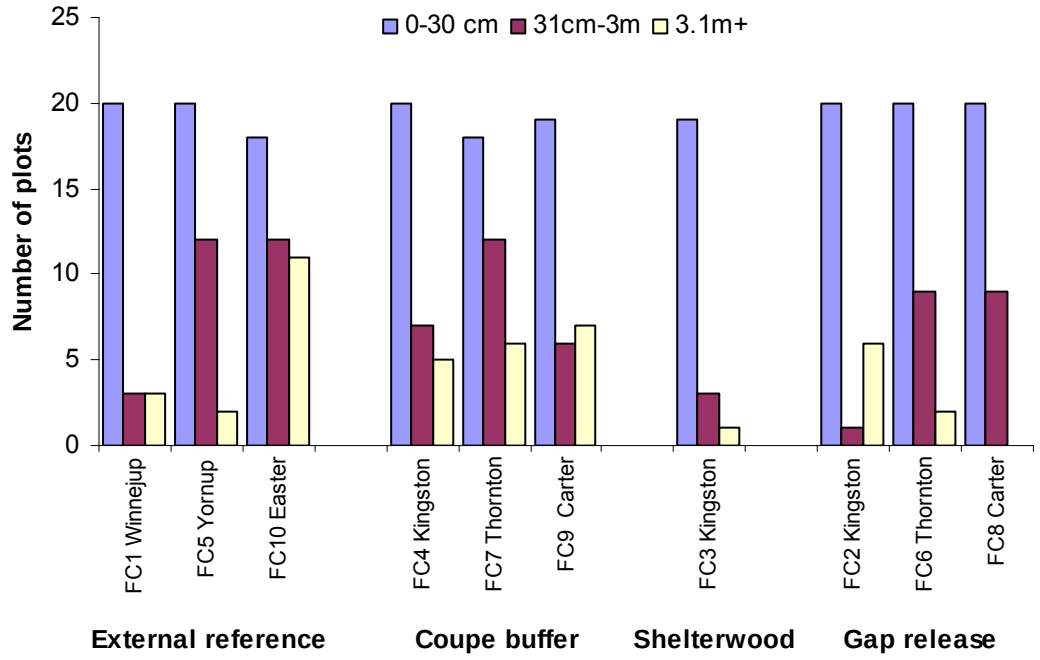



**Figure 4:** Number of plots with different strata levels occupied by cryptogams on each Donnelly FORESTCHECK grid in 2008.

### Life forms and population structure

To simplify the identification of cryptogams, they can be artificially grouped according to their morphology. Lichens can be foliose, crustose or fruiticose, mosses are creeping or tufted and liverworts are thalose or leafy. These groups are referred to as life forms, as species in each of these groups have similar life strategies. Tufted mosses and fruticose lichens were the most common, being recorded in the largest number of plots on each grid (Fig. 5). Although crustose lichens colonise the most abundant and stable substrates, such as soil, rock and wood surfaces, they occurred in a lower number of plots than expected on most grids. Leafy liverworts were recorded in more plots than thalose liverworts but both occurred in few plots on most grids.

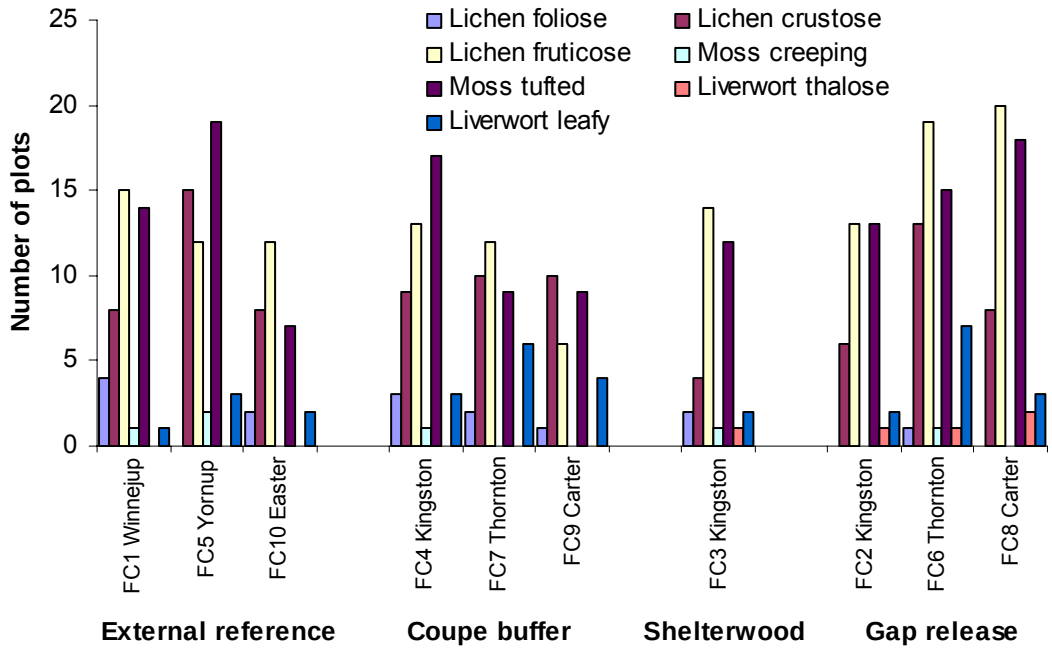



**Figure 5**. The number of 1x1 m plots in which each cryptogam life form was recorded on each Donnelly FORESTCHECK grid in 2008.

### Monitoring species recorded on grids and in treatments

Following the analysis of the first five years of monitoring, a specific cryptogam monitoring (or indicator) species list was developed (Table 1). Species were selected on the basis of the substrates and strata layers they occupied and on their perceived resilience and response to environment and physical changes. Currently thirty five taxa have been selected. Their presence and abundance is recorded on each 1x1 m plot on each FORESTCHECK monitoring grid.

Only three lichens, *Cladia rigida*, *Thysanothecium scutellatatum* and *Usnea inermis*, were recorded on all grids. *Xanthoparmelia isidiiigera*, a species more common in the drier northern jarrah forest, was the only species not recorded on any grids. *Flavoparmelia haysonii*, was only found on the Yornup external control grid (FC5) and was reasonably abundant (Fig. 6).

Three species of moss were recorded on 8 grids, but no individual moss species were common to all grids. *Dicranoloma diaphanoneum*, which colonises old rotting logs in shaded habitats, was recorded on the Kingston, Carter and Thornton coupe buffers (FC4, FC7 & FC9 respectively) and the Kingston shelterwood (FC3) and Carter gap release (FC6) but was not recorded on external reference grids (Fig. 7).

Liverworts are more common in the wetter southern regions of the jarrah forest. *Cephaloziella exiliflora* was the most common species, recorded on every grid except the Yornup external control (FC5). *C. exiliflora* colonises bark, generally in the lower shrub layer. In contrast, *Fossombronia intestinalis*, which colonises soil in damp drainage areas, was only recorded on the Yornup external grid (Fig. 8).

**Table 1**. Monitoring Species (35) with code number, species type and life form

| Monitoring # | Species name | Group[1] | Life form[2] |
|---|---|---|---|
| 1 | *Cladia aggregata* | L | Fru. |
| 2 | *Cladia schizopora* | L | Fru. |
| 3 | *Cladonia cervicornis* var. *verticellata* | L | Fru. |
| 4 | *Cladonia krempelhuberi* | L | Fru. |
| 5 | *Cladonia rigida* | L | Fru. |
| 6 | *Cladonia sulcata* | L | Fru. |
| 7 | *Calicium glaucellum* | L | Cru. |
| 8 | *Diploschistes strictus* | L | Cru. |
| 9 | *Flavoparmelia haysonii* | L | Fol. |
| 10 | *Hypocenomyce foveata (brown domes)* | L | Cru. |
| 11 | *Hypocenomyce scalaris* | L | Cru. |
| 12 | *Hypogymnia subphysodes var. subphysodes* | L | Fol. |
| 13 | *Menegazzia platytrema* | L | Fol. |
| 14 | *Opegrapha sp.* | L | Cru. |
| 15 | *Ochrolechia* sp. ( G. Kantavilis 306/92) | L | Cru. |
| 16 | *Pannoparmelia wilsonii* | L | Fol. |
| 17 | *Paraporpidia glauca* | L | Cru. |
| 18 | *Parmotrema reticulatum* | L | Fol. |
| 19 | *Ramboldia stuartii* | L | Cru. |
| 20 | *Tephromela atra* | L | Cru. |
| 21 | *Thysanothecium hookeri* | L | Fru. |
| 22 | *Thysanothecium scutellatum* | L | Fru. |
| 23 | *Usnea inermis* | L | Fru. |
| 24 | *Usnea* sp. (leuco*)* | L | Fru. |
| 25 | *Xanthoparmelia isidiigera* | L | Fol. |
| 26 | *Xanthoparmelia notata* | L | Fol. |
| 27 | *Cephaloziella exiliflora* | H | Lea. |
| 28 | *Chiloscyphus semiteres* | H | Lea. |
| 29 | *Fossombronia intestinalis* (leafy) | H | Tha. |
| 30 | *Frullania prosbosciphora* | H | Lea. |
| 31 | *Barbula calycina* | B | Tuf. |
| 32 | *Campylopus introflexus* | B | Tuf. |
| 33 | *Dicranoloma diaphanoneum* | B | Tuf. |
| 34 | *Funaria hygrometrica* | B | Tuf. |
| 35 | *Sematophyllum subhumile* var. *contiguum* | B | Cre. |

[1] L = lichen, B = bryophyte (moss) and H = Heptophyte (liverwort)
[2] FRU = fruticose, CRU = crustose, Fol = foliose, LEA = leafy, THA = thaline, TUF = tufted, CRE = creeping,

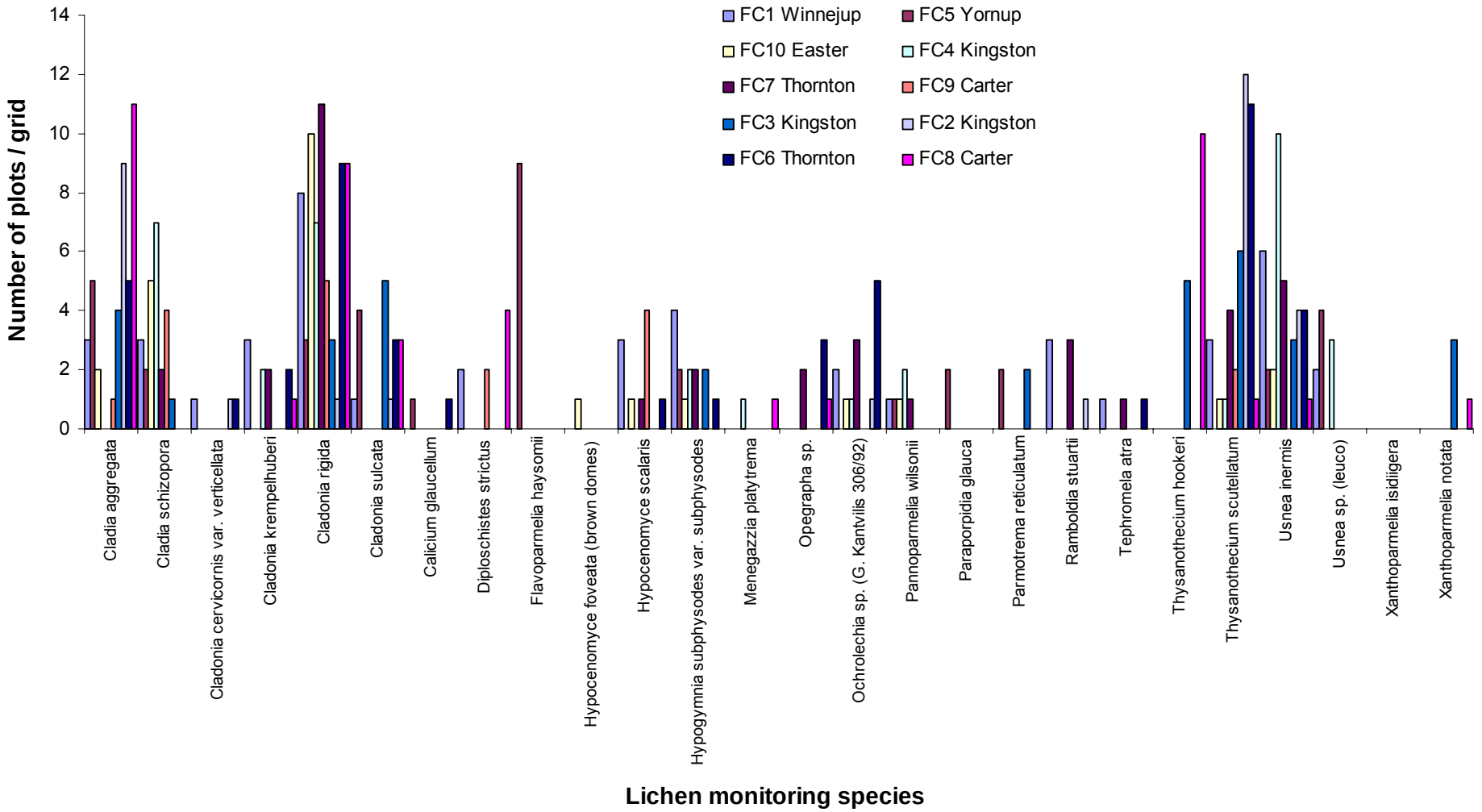



**Figure 6**. Total number of plots containing lichen monitoring species on each Donnelly FORESTCHECK grid in 2008.

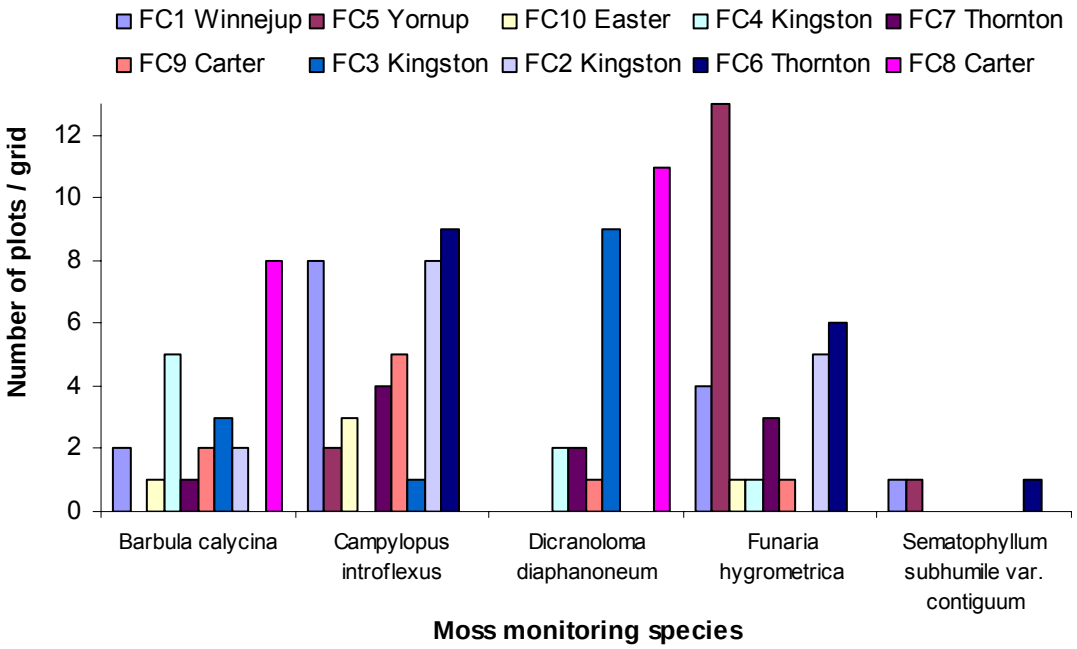



**Figure 7**. Total number of plots containing moss monitoring species on each Donnelly FORESTCHECK grid in 2008.

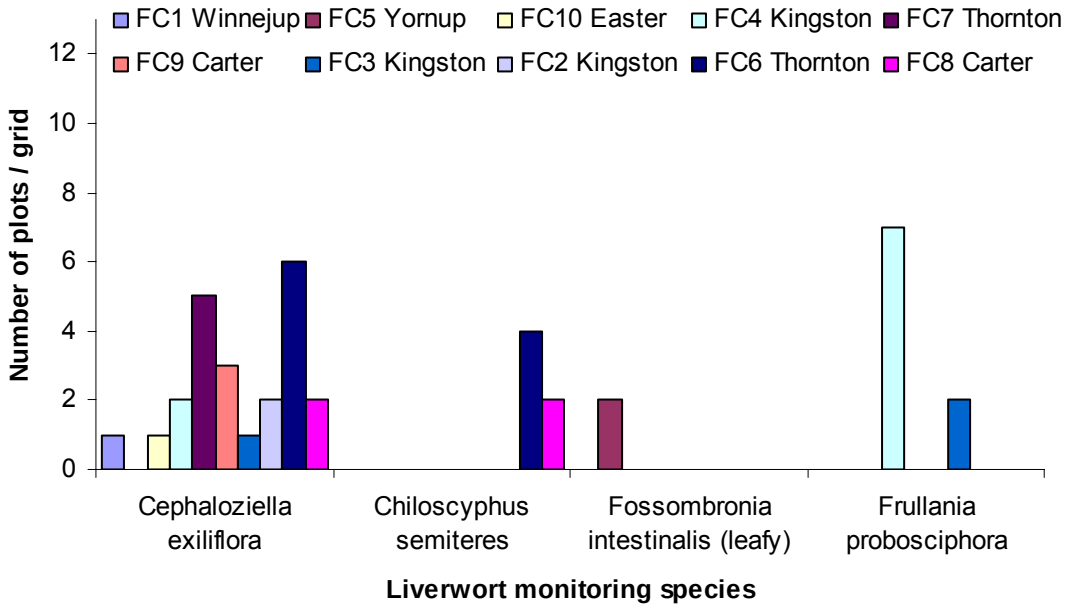



**Figure 8**. Total number of plots containing liverwort monitoring species on each Donnelly FORESTCHECK grid in 2008.

To test the dependability of using monitoring species to pick up trends or differences between treatments, the mean number of monitoring species per grid was determined for each treatment and graphed (Fig. 9). Species richness does not show any major

differences between treatments. However species composition needs to be further investigated as some species show definite preferences for specific treatments (associated with the disturbance and stage of recovery) (Fig. 10).

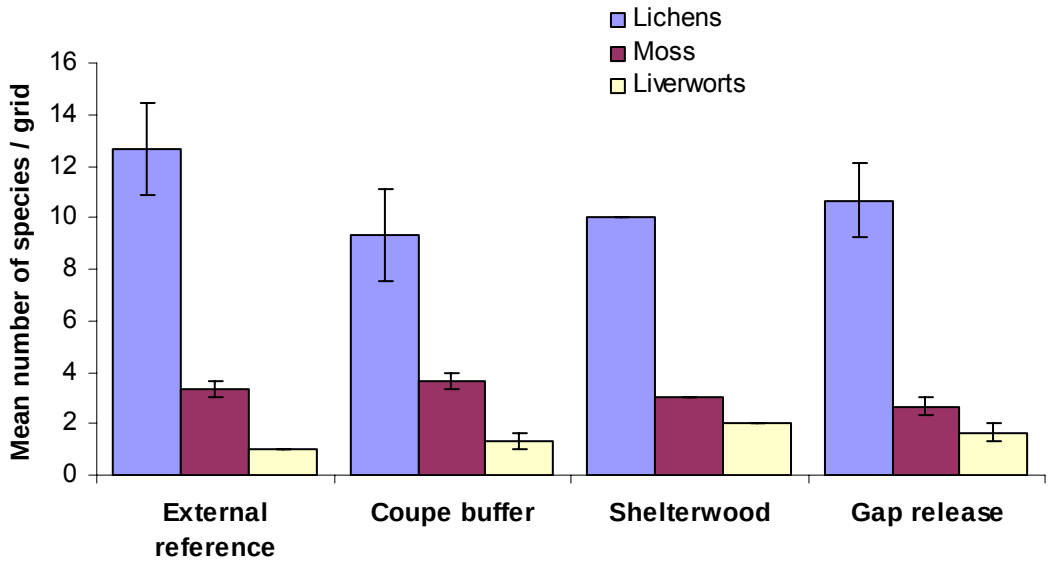



**Figure 9**. Mean number of cryptogam monitoring species per grid in each treatment on Donnelly FORESTCHECK grids in 2008.

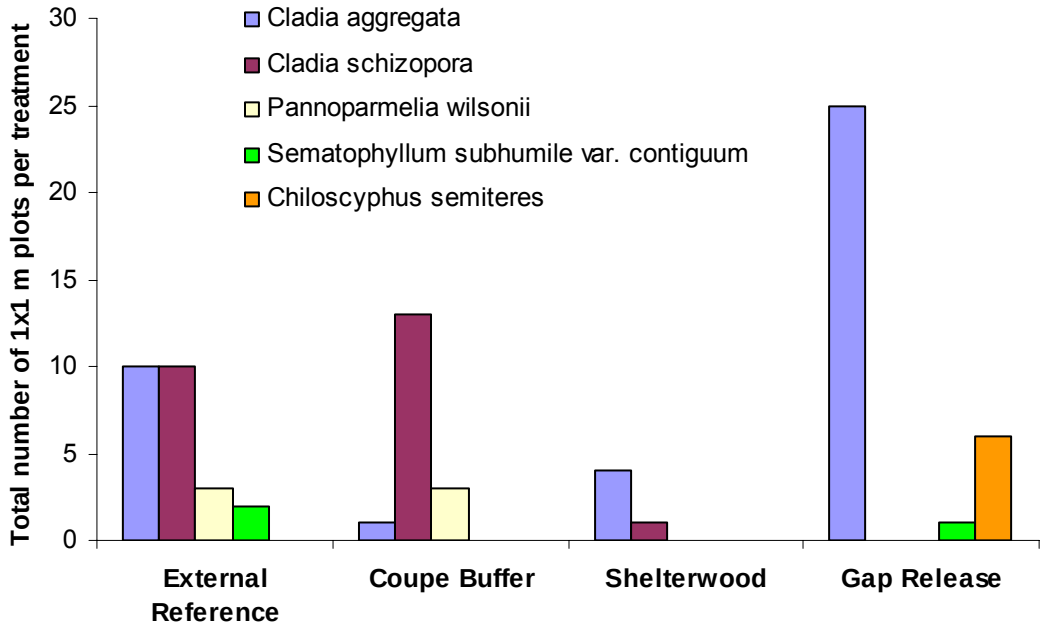



**Figure 10**. Total number of plots per treatment that selected monitoring species were recorded in on Donnelly FORESTCHECK grids in 2008.

Because of the large area of jarrah forest and the variety of ecosystem types represented by the five established FORESTCHECK locations (Donnelly, Wellington,

Perth Hills, Wellington East and Blackwood) several monitoring species do not naturally occur in all localities. The suitability of the list of monitoring species will be further tested as the other FORESTCHECK locations are monitored over the next four years.

### Litter cover on individual 1x1 m plots

In previous years it was noted that litter cover appeared to affect several cryptogam species by retarding their growth, so in 2008 a visual estimate of litter cover was determined for each 1 x 1 m plot on each grid (Fig. 11). Overall, and on each grid, the majority of plots had a dense (>75% cover) of litter (Fig. 12). Both moss and liverwort species were excluded or dramatically reduced in numbers on plots with dense litter cover. Lichens growing on soil or stones may rapidly decline when covered by litter. However, in areas where litter is temporary or able to be moved by wind and not become trapped, cryptogams may be able to withstand short periods of covering without total exclusion occurring.

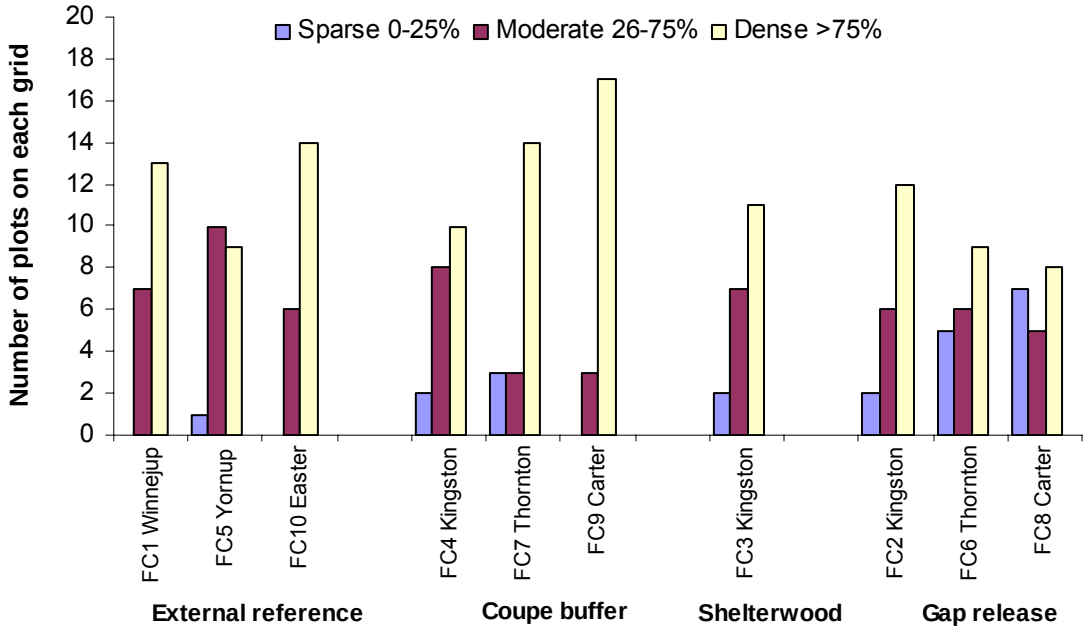



**Figure 11**. The number of 1x1 m plots with sparse, moderate and dense litter cover on each Donnelly FORESTCHECK grid in 2008.

## Conclusions

The revised survey methods for 2007-08 will allow a selected number of monitoring species to be analysed to pick up changes and trends within and between treatments. This will be tested in ore detail in subsequent years. The use of small plots on permanent 200 m transects standardises data collection and allows for valid data comparison between grids and locations. However, to detect changes in overall

community structure, additional surveys using a fixed transect (200 m) will be undertaken on each grid to provide a complete species list for each grid and for each location.


**Figure 12**. The overall proportion of 1x1 m plots with sparse, moderate and dense litter cover on Donnelly FORESTCHECK grids in 2008.

Changes due to time since treatment in vegetation structure and availability of substrates are apparent on some grids. Impacts of fire on cryptogam substrates may alter both individual species and community dynamics. Some trends observed in 2008 are:

- There appears to be a succession trend where *Funaria hygrometrica* (fire moss) is being replaced in gap release sites by *Barbula calycina* and or *Didymondon torquatus*.
- On charred bark *Hypocenomyce scalaris* acts as a primary coloniser and is replaced by either *Hypogymnia subphysodes* or *Pannoparmelia wilsonii*, usually within the shrub layer.
- *Cephaloziella exiliflora* is a common liverwort on non-charred decayed wood but also appears to quickly colonise the surface of charred wood following prescribed fire.

General observations on other (monitoring) species are:

- *Opegraphia* sp. (black rays) appears to indicate an early to moderate stage of wood decay (it is not present on wood in an advanced stage of decay).
- *Cladonia rigida* is a common species with a high preference for decaying wood and
- *Cladia aggregata* is also common, mainly on the ground, but can suffer from litter covering.

## VASCULAR PLANTS

Bruce Ward and Ray Cranfield

### Introduction

When timber is harvested in native forests, disturbance might include soil movement, mixing and compaction in addition to the removal of overstorey and damage to understorey vegetation. This disturbance may impact more severely and cause a loss in diversity either through a decrease in species richness or a shift in species abundance. Understorey plants are key organisms for monitoring impacts of commercial timber harvesting in jarrah (*Eucalyptus marginata*) forest. FORESTCHECK utilises data on species richness and abundance to determine impacts across silvicultural harvesting treatments.

One of the strengths of this monitoring is that it was applied at an operational scale under standard industry conditions which means that the results are representative of the forest management practices. The vegetation complexes of the southwest 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. When analysing species richness data from harvest treatment sites it is important to also consider time since fire as observed differences may be due to succession following fire rather than a direct impact of timber harvesting.

The specific aim of monitoring vascular plants on FORESTCHECK monitoring grids is to:

- Determine species richness and abundance in the various silvicultural treatments of managed jarrah forest (shelterwood, selective cut and gap release) and in uncut reference forest
- Compare species richness, abundance and composition recorded within and between silvicultural treatment grids to those in uncut reference grids, and
- Compare results from Donnelly in 2001 with those from 2007.

### Monitoring

Flora surveys on the Donnelly FORESTCHECK grids were undertaken in the spring of 2007, coinciding with the peak flowering time for most plants. Species richness and understorey vegetation structure was determined, by recording each species, estimating its area of cover, and measuring its position in the understorey strata in four 1000 $m^2$ plots in each grid (40 in total). Species density was measured by recording species occurrence and abundance in 20 1$m^2$ plots in each grid (200 in total). 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 and voucher flowering plant specimens to aid in or confirm their identification.

The recent 5-year analysis of FORESTCHECK monitoring revealed that 1000 $m^2$ plot locations picked up heterogeneous variation within the grids and that 1 $m^2$ plots were compromised by edge effects. The analysis also showed that there were insufficient

numbers of small (1 $m^2$) plots to pick up the entire plant population and many more would be required. To overcome the shortcoming of plot arrangement, two additional 1000 $m^2$ plots were added so that a diagonal line of plots were aligned across the survey area. This increased the area of each monitoring grid sampled from 20% to 30%. In future, the 20 1x1 m plots previously used for sampling are to be discontinued in favour of the increased number of larger plots.

A full list of species recorded in each treatment is shown in Appendix 1.

**Preliminary Results and Discussion**

**Species richness:**

A total of 210 species were recorded from the 1000 $m^2$ plots and 155 species from the 1 $m^2$ plots (see Table 1 for comparison of species numbers). The area around each grid was used to search for flowering voucher plant specimens and since about 60% of the species had already been collected in the first round of monitoring, only 12 species were added to the voucher collection for this ecosystem type. Missing species vouchers for these grids will be collected on subsequent visits.

Species richness within treatments shows some variation with the shelterwood treatment having the lowest number of species. This may be the result of the shelterwood silvicultural treatment using deliberate scarification of the seed bed to promote the development of jarrah lignotubers and that only one shelterwood grid was established at Donnelly. In the 2001 assessment the Kingston gap release (FC 2) treatment had the lowest number of species and in the intervening years the species richness on this grid has recovered (Fig. 1). Additionally, the opening up of the canopy and removal of the shrubs has allowed the development of more (16) weed species than the external reference grids (Fig 1). The harvested grids generally have higher numbers of weed species and those close to farmland the highest (e.g. Kingston and Winnejup grids). A comparison of the two forest locations reveal a marked difference in the level of weed species infestation with Kingston grids being 0.5 to 1.5km from farmland while Thornton/Carter grids were considerably further away. Those grids <1.5km had a mean of 15% weed infestation while those much > 1.5km having a mean of 4%. A review of vectors responsible for the spread of weed species needs careful consideration and mechanisms to ameliorate this problem implemented.

Overall, there has not been any serious collapse in species richness and natural site differences may account for the variation between grids.

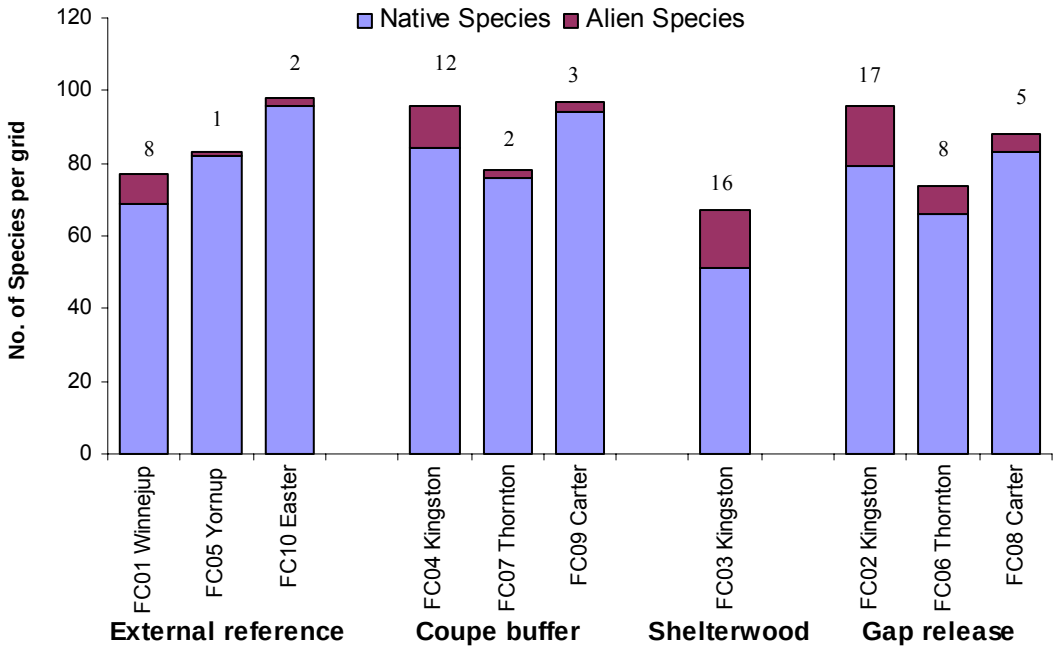



**Figure 1:** A comparison of species richness for all grids measured in the Jarrah South site in 2007 and the figures above the bars refer to the numbers of weed species.

A comparison of species richness between the 2001 and 2007 measurements for Donnelly showed that there was very little difference (3%) between the surveys (Table 1). The slightly higher number of species recorded in 2007 may be the result of adding two additional 1000 $m^2$ plots but it probably falls within the normal range of sampling error. Alternatively, seasonal variability and time of survey can have an effect on the numbers of species detected. For example a difference of a week or two in time of measurement can affect how many annuals are present. Some may have already finished their life cycle prior to measurement which affects the total count.

A more detailed analysis of species composition may reveal if there has been any shift in the community structure and will be the subject of further investigation.

**Table 1**. A comparison of plant species richness between the 2001 and 2007 surveys of the Donnelly FORESTCHECK grids at two scales of measurement (1000 $m^2$ plots and 1 $m^2$ plots)

| Location | 30 x 30 m Plots Species Numbers | 1 x 1 m Plots Species Numbers | Percent difference in specie numbers | Number of Weed Species |
|---|---|---|---|---|
| **Donnelly 2002** | 203 | 158 | 22 | 24 |
| **Donnelly 2007** | 210 | 155 | 26 | 20 |

There was a high number of unique species across the various silvicultural treatments (Table 2) which is most likely due to the wide geographic spread of grids. A non

linear MDS was previously performed on the 2001 data and showed that treatment grids within forest blocks (Kingston and Thornton/Carter) generally had similar species assemblages but reference grids were randomly spread (Fig. 2) which is likely to be the reason why reference grids had the highest number of unique species (Table 2). This shows that species composition is dissimilar across the grids with climatic, topographic and edaphic factors driving species composition.

**Table 2**. The number of plant species unique to each silvicultural treatment in plots on Donnelly FORESTCHECK grids in 2007).

| | External reference | Coupe buffer | Shelterwood | Gap release |
|---|---|---|---|---|
| Number of unique species | 34 | 16 | 8 | 19 |

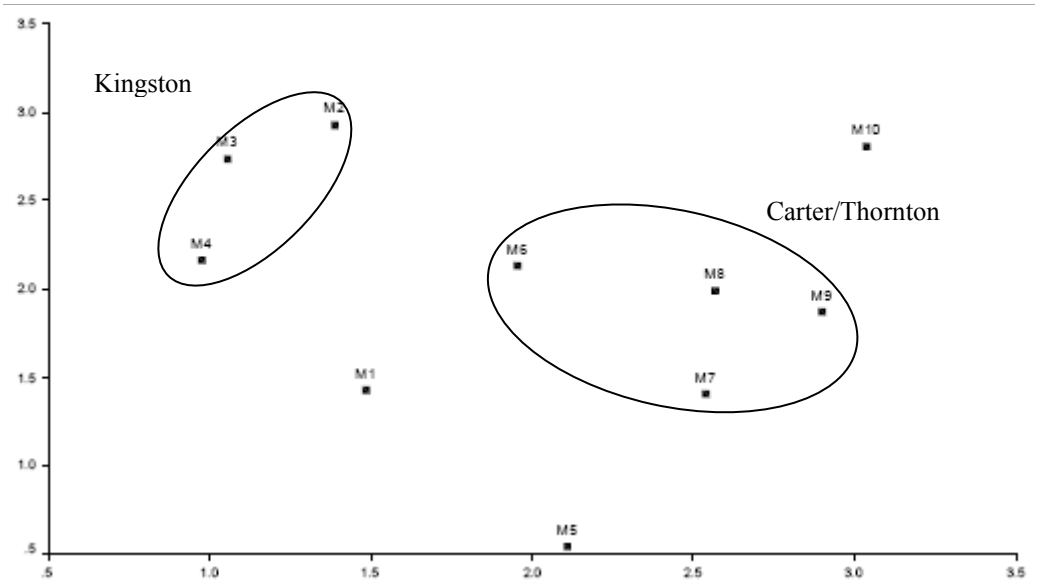



**Figure 2**. A non linear MDS plot of species data showing that grids from the same forest blocks have clustered roughly together and external reference grids are widely scattered (derived from the 2001 survey data).

### Species Abundance

There appears to be no apparent pattern in species abundance and neither time since fire nor silvicultural treatment appear to be having an influence. It is more likely that other site factors such as light, soil moisture, soil nutrients and soil depth may be responsible for explaining these patterns in understorey plant abundance (Fig. 3).

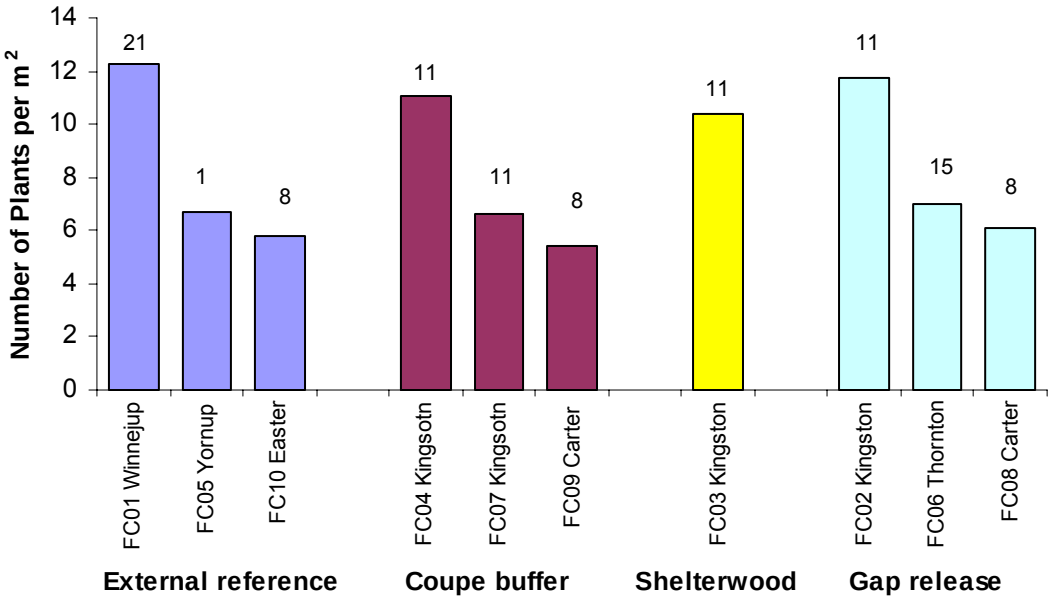



**Figure 3**. Mean abundance of plants per $m^2$ measured in $1000m^2$ plots for each grid. The numbers above the bars show age since last burn.

### Life-forms

Plant numbers in the various life-form categories were compared between treatments and were lowest in the shelterwood treatment but highest in the external control treatment (Fig. 4). This suggests that the shelterwood silvicultural treatment has had an impact on many of the life-form categories. However, some caution needs to be applied as there is only one shelterwood grid while all other treatments have at least three grids spread over a wide geographical range. The tree category had the least number of species (Fig. 4) but trees are the dominant plants. Depending on their stage of development, trees have the capacity to limit resources to other plant species. For example, the 2001 survey showed that the Kingston gap release (FC2) had the lowest species richness but a dense cover of marri and jarrah regeneration. In 2007, the regeneration had thinned considerably and the grid had developed a more typical species assemblage.

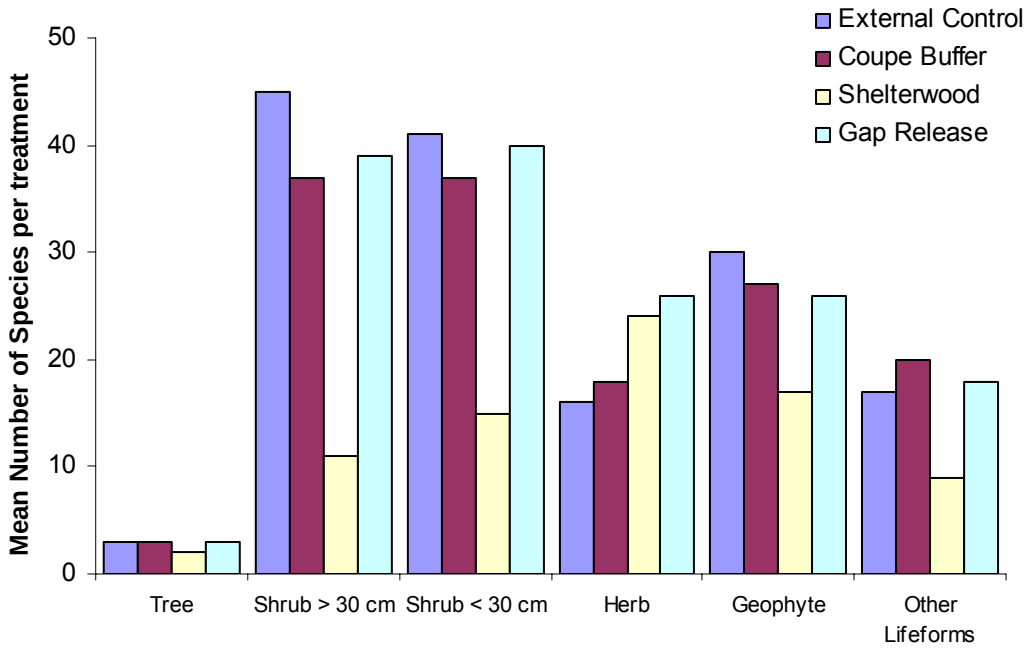



**Figure 4:** The number of individual plants within each life-form category for each silvicultural and external control treatment on Donnelly FORESTCEHCK grids.

## Conclusions

The main observations made following monitoring of vascular plants and measurement of plant structure and density at the Donnelly FORESTCHECK location:

- Harvesting treatments appeared not to have caused any major collapse in species richness and abundance. Variations within treatments can be attributed to other site factors such as site quality, light, soil moisture and soil nutrients.
- Low plant numbers for some life-form categories in the shelterwood treatment suggest silvicultural methods associated with this treatment may be impacting on plant species. Although some caution in interpretation needs to be applied as there was only one grid in this treatment while others had at least three grids spread over a wide geographical range.
- The comparison of data between the two measurements (2001 and 2007), show no difference in the plant community structure and composition.
- Consideration of weed invasion to harvested sites needs careful planning and consideration to mitigate against this problem.
- Further comparisons at the Family level may reveal trends not seen by comparisons of species richness or life-form.

## References

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

**APPENDIX 1**. The list of vascular plants recorded in each treatment on Donnelly FORESTCHECK grids in 2007-08, indicated by their presence in 30 x 30 m and/or 1 x 1 m plots.

| Species Code | Species Name | Life form[1] | External reference | | Coupe buffer | | Shelterwood | | Gap release | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 30 x 30 | 1 x 1 | 30 x 30 | 1 x 1 | 30 x 30 | 1 x 1 | 30 x 30 | 1 x 1 |
| ACAALA | *Acacia alata* | S | ● | | ● | ● | | | ● | ● |
| ACABRO | *Acacia browniana* | S | | | ● | ● | | | ● | ● |
| ACADIV | *Acacia divergens* | S | | | ● | | | | ● | |
| ACAECH | *Acaena echinata* | DS | ● | | ● | ● | ● | | ● | |
| ACAEXT | *Acacia extensa* | S | ● | ● | ● | | | | ● | |
| ACAMYR | *Acacia myrifolia* | S | | | | | ● | | | |
| ACAPRE | *Acacia preissiana* | DS | ● | ● | ● | | | | | |
| ACAPUL | *Acacia pulchella* | S | ● | | ● | ● | ● | | ● | ● |
| ACAURO | *Acacia urophylla* | S | | | ● | | | | | |
| ADEOBO | *Adenanthos obovatus* | S | ● | | | | | | | |
| AGRSCA | *Agrostocrinum scabrum* | GP | | | ● | | | | | |
| AIRCUP | *Aira cupaniana* | GR | ● | ● | ● | ● | ● | ● | ● | ● |
| AMPAMP | *Amphipogon amphipogonoides* | DS | ● | | ● | ● | | | ● | |
| AMPERI | *Amperea ericoides* | DS | ● | | ● | ● | ● | ● | ● | ● |
| ANAARV | *Anagalis arvensis* | H | | | | | ● | | | |
| ANDCAE | *Andersonia caerulea* | DS | ● | | | | | | | |
| ASTPAL | *Astroloma pallidum* | DS | ● | | | | | | | |
| AUSCAE | *Austrodanthonia caespitosa* | GR | ● | ● | ● | ● | ● | ● | ● | ● |
| BANDAL | *Banksia dallanneyi* | S | | | | | | | ● | |
| BANGRA | *Banksia grandis* | T | ● | ● | ● | ● | | | ● | ● |
| BANLIT | *Banksia littoralis* | S | | | ● | | | | ● | |
| BILFLO | *Billardiera floribunda* | S | | ● | | | | | | |
| BILFUS | *Billardiera fuscifomis* | S | | | | | ● | | ● | ● |
| BILVAR | *Billardiera variifolia* | V | ● | ● | ● | | | | ● | |
| BORMEG | *Boronia megastigma* | S | | | ● | | | | | |
| BORSPA | *Boronia spathulata* | S | ● | | | | | | | |
| BOSAQULAI | *Bossiaea aquifolium* subsp. *laidlawiana* | S | ● | ● | ● | ● | | | ● | ● |
| BOSLIN | *Bossiaea linophylla* | S | ● | | ● | | | | ● | |
| BOSORN | *Bossiaea ornata* | S | ● | ● | ● | ● | | | ● | ● |
| BRIMIN | *Briza minor* | GR | | | | | ● | ● | ● | |
| BURCON | *Burchardia congesta* | GP | ● | ● | ● | ● | | | ● | ● |
| CAEMIC | *Caesia micrantha* | GP | | | ● | ● | | | | |
| CALFLA | *Caladenia flava* | GP | ● | ● | ● | ● | ● | | ● | ● |
| CALLAN | *Callistachys lanceolata* | S | | | | | ● | | | |
| CALLES | *Calytrix leschenaultii* | S | ● | ● | | | | | | |
| CALREP | *Caladenia reptans* | GP | ● | ● | ● | ● | ● | ● | ● | |
| CALSP. | *Caladenia sp.* | GP | | | ● | | ● | | | |
| CARTEN | *Carduus tenuiflorus* | H | | | | | ● | ● | ● | |
| CASRAC | *Cassytha racemosa* | P | ● | | ● | | | | ● | ● |
| CENERY | *Centaurium erythraea* | H | ● | | ● | ● | ● | ● | ● | ● |
| CERGLO | *Ceratium glomeratum* | H | | | | | ● | | | |
| CHACOR | *Chamaescilla corymbosa* | GP | ● | ● | ● | ● | ● | ● | ● | ● |
| CHOENO | *Chorizandra enodis* | Z | | | ● | | | | | |
| CHONAN | *Chorezima nanum* | DS | ● | | ● | | ● | | ● | ● |
| CLEPUB | *Clematis pubescens* | V | ● | ● | ● | ● | ● | ● | ● | ● |
| COMCAL | *Comesperma calymega* | DS | ● | | ● | | | | ● | ● |
| COMCON | *Comesperma confertum* | S | | | ● | | | | | |
| CONACU | *Conostylis aculeata* | DS | | | ● | ● | | | | |
| CONBON | *Conyza bonariensis* | H | | | ● | | ● | ● | ● | |
| CONCAP | *Conospermum capitatum* | S | ● | | | | | | | |
| CORCAL | *Corymbia calophylla* | T | ● | | ● | ● | ● | ● | ● | ● |
| CORREC | *Corybas recurvus* | GP | ● | | | | | | | |
| CRAVAR | *Craspedia variabilis* | GP | ● | ● | ● | ● | ● | ● | ● | ● |
| CREFOE | *Crepis foetida* | H | | | ● | ● | ● | | ● | |

| Species Code | Species Name | Life form[1] | External reference | | Coupe buffer | | Shelterwood | | Gap release | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 30 x 30 | 1 x 1 | 30 x 30 | 1 x 1 | 30 x 30 | 1 x 1 | 30 x 30 | 1 x 1 |
| CYASER | *Cyanicula sericea* | GP | ● | | | | | | ● | |
| CYRHUE | *Cyrtostylis huegelii* | GP | ● | ● | ● | ● | ● | ● | ● | ● |
| DAMLIN | *Dampiera linearis* | DS | ● | | ● | | | | ● | |
| DAUGLO | *Daucus glochidiatus* | H | ● | ● | ● | ● | ● | ● | ● | ● |
| DAVCOR | *Daviesia cordata* | S | ● | | | | | | ● | |
| DAVPRE | *Daviesia preissii* | S | ● | | ● | | | | | |
| DESFAS | *Desmocladus fasciculatus* | Z | ● | ● | ● | ● | | | ● | ● |
| DESFLE | *Desmocladus flexuosus* | Z | ● | | | ● | | | | |
| DIAREV | *Dianella revoluta* | H | | | | | ● | | ● | |
| DISBRA | *Disa bracteata* | GP | | | ● | | | | ● | |
| DROERY | *Drosera erythrorhiza* | GP | ● | ● | | | | | | |
| DROLEU | *Drosera leucoblasta* | GP | | | | | | | ● | |
| DROMEN | *Drosera menziesii* | GP | ● | ● | ● | ● | ● | ● | ● | ● |
| DROPAL | *Drosera pallida* | GP | ● | ● | ● | ● | ● | | ● | ● |
| DROSP. | *Drosera sp.* | GP | | | | ● | | | | |
| DROSTO | *Drosera stolonifera* | GP | | | ● | ● | ● | | ● | ● |
| EUCCOL | *Euchiton collinus* | H | ● | ● | ● | ● | ● | ● | ● | ● |
| EUCMAR | *Eucalyptus marginata* | T | ● | ● | ● | ● | ● | ● | ● | ● |
| GALMUR | *Galium murale* | H | | ● | ● | ● | ● | ● | ● | ● |
| GASBIL | *Gastrolobium bilobum* | S | | | | | ● | | | |
| GENSP. | Genus sp. | | | | | | | | | ● |
| GENSP. | Genus sp. | | | | | | | ● | | |
| GERSOL | *Geranium solanderi* | DS | | | ● | ● | ● | ● | ● | ● |
| GLIAUR | *Glischrocaryon aureum* | S | | | ● | | | | | |
| GOMMAR | *Gompholobium marginatum* | DS | | | | | | | ● | |
| GOMOVA | *Gompholobium ovatum* | DS | ● | | ● | ● | | | ● | ● |
| GOMPRE | *Gompholobium preissii* | DS | ● | ● | | | | | | |
| GRECEN | *Grevillea centristigma* | S | | | | | | | ● | |
| HAESIM | *Haemodorum simplex* | GP | | | ● | | | | | |
| HAKAMP | *Hakea amplexicaulis* | S | ● | ● | ● | ● | | | ● | |
| HAKLIS | *Hakea lissocarpha* | S | ● | | ● | ● | | | ● | |
| HARCOM | *Hardenbergia comptoniana* | V | ● | ● | ● | ● | ● | ● | ● | ● |
| HIBAMP | *Hibbertia amplexicaulis* | S | ● | ● | ● | ● | ● | ● | ● | ● |
| HIBCOM | *Hibbertia commutata* | S | ● | ● | ● | ● | ● | ● | ● | ● |
| HIBCUN | *Hibbertia cuneformis* | S | | | ● | | | | ● | |
| HIBRAC | *Hibbertia racemosa* | S | | | ● | | | | ● | |
| HIBSP. | *Hibbertia* sp. | S | | | | ● | | | ● | |
| HIBSP. | *Hibbertia* sp. | S | | | ● | | | | | |
| HOMHOM | *Homalosciadium homalocarpum* | H | ● | | | | | | | |
| HOVCHO | *Hovea chorizemifolia* | DS | ● | | ● | ● | | | ● | ● |
| HOVELL | *Hovea elliptica* | S | ● | ● | ● | ● | | | ● | ● |
| HOVTRI | *Hovea trisperma* | S | | | ● | | | | | |
| HYACOT | *Hyalosperma cotula* | H | | | ● | ● | ● | | ● | |
| HYADEM | *Hyalosperma demissum* | H | | | | | | | | ● |
| HYBDEB | *Hybanthus debilissimus* | DS | | | | | | | ● | |
| HYDCAL | *Hydrocotyle callicarpa* | H | ● | | | ● | ● | ● | ● | ● |
| HYDDIA | *Hydrocotyle diantha* | H | ● | ● | | | | | | |
| HYPANG | *Hypocalymma angustifolia* | S | ● | | | | | | | |
| HYPEXS | *Hypolaena exsulca* | Z | | | ● | | | | | |
| HYPGLA | *Hypochaeris glabra* | H | ● | ● | ● | ● | ● | ● | ● | ● |
| HYPOCC | *Hypoxis occidentalis* | DS | | | ● | | | | | |
| ISOCUN | *Isotropis cunefolia* | S | ● | ● | ● | ● | | | ● | |
| ISOHYP | *Isotoma hypocrateriformis* | H | | | ● | | ● | ● | ● | ● |
| JOHLUP | *Johnsonia lupulina* | GP | ● | | | | | | ● | |
| KENCOC | *Kennedia coccinea* | V | ● | | ● | | | | ● | ● |
| KENPRO | *Kennedia prostrata* | V | | | | | | | | ● |
| LAGHUE | *Lagenophora huegelii* | GP | ● | ● | ● | ● | ● | ● | ● | ● |

| Species Code | Species Name | Life form[1] | External reference | | Coupe buffer | | Shelterwood | | Gap release | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 30 x 30 | 1 x 1 | 30 x 30 | 1 x 1 | 30 x 30 | 1 x 1 | 30 x 30 | 1 x 1 |
| LAXSQU | *Laxmannia squarrosa* | DS | ● | | | | | | | |
| LECBIL | *Lechenaultia biloba* | S | | | | | | | ● | |
| LEPCUN | *Leptomeria cunninghamii* | S | ● | | | | | | | |
| LEPLEP | *Lepidosperma leptostachyum* | Z | | | ● | | | | ● | ● |
| LEPMEN | *Leptoceras menziesii* | GP | ● | | | | | | | |
| LEUAUS | *Leucopogon australis* | S | ● | | ● | | | | ● | ● |
| LEUCAP | *Leucopogon capitellatus* | S | ● | ● | ● | ● | ● | ● | ● | ● |
| LEUPRO | *Leucopogon propinquus* | S | ● | ● | ● | ● | ● | ● | ● | ● |
| LEUPUL | *Leucopogon pulchellus* | S | ● | ● | | | | | | |
| LEUVER | *Leucopogon verticillatus* | S | ● | ● | ● | ● | | | ● | ● |
| LEVPUS | *Levenhookia pusilla* | H | ● | ● | ● | ● | ● | ● | ● | ● |
| LINLIN | *Lindsaea linearis* | F | ● | | ● | ● | | | ● | ● |
| LOGSER | *Logania serpyllifolia* | DS | ● | ● | | | | | | |
| LOGVAG | *Logania vaginalis* | S | ● | | | | | | | |
| LOMCAE | *Lomandra caespitosa* | DS | ● | ● | ● | ● | ● | | ● | ● |
| LOMDRU | *Lomandra drummondii* | DS | ● | ● | ● | ● | | | ● | ● |
| LOMHER | *Lomandra hermaphrodita* | DS | ● | | ● | ● | | | ● | ● |
| LOMINT | *Lomandra integra* | DS | ● | ● | ● | ● | | | ● | |
| LOMNIG | *Lomandra nigricans* | DS | ● | ● | ● | ● | | | ● | ● |
| LOMPUR | *Lomandra purpurea* | DS | ● | | | | | | | |
| LOMSER | *Lomandra sericea* | DS | ● | ● | ● | ● | | | ● | ● |
| LOMSON | *Lomandra sonderi* | DS | ● | | | | | | ● | |
| LOMSP. | *Lomandra* sp. | DS | | ● | | | | | | |
| LOMSP. | *Lomandra* sp. | DS | ● | | | | | | | |
| LOTSUB | *Lotus subbiflorus* | H | | | ● | | ● | ● | ● | ● |
| LUPLUT | *Lupinus luteus* | H | ● | | ● | | | | | |
| LUZMER | *Luzula meridionalis* | R | ● | | ● | ● | ● | ● | ● | ● |
| MACRIE | *Macrozamia riedlei* | CY | ● | ● | ● | ● | ● | ● | ● | ● |
| MEDPOL | *Medicago polymorpha* | H | | | | | | | ● | |
| MICSTI | *Micrantha stipoides* | GR | | | | | | | ● | ● |
| MILTEN | *Millotia tenuifolia* | H | ● | ● | ● | ● | ● | ● | ● | ● |
| MYOTET | *Myoporum tetrandrum* | S | | | | | ● | | | |
| OPEHIS | *Opercularia hispidula* | S | ● | ● | ● | ● | ● | ● | ● | ● |
| ORTLAX | *Orthrosanthus laxus* | GP | | | ● | | | | | |
| OXACOR | *Oxalis corniculata* | GP | ● | ● | ● | ● | ● | ● | ● | ● |
| PARLAT | *Parentucellia latifolia* | H | | | ● | ● | ● | ● | | |
| PARLOP | *Paraserianthes lophantha* | S | | | | | ● | | | |
| PATBAB | *Patersonia babianoides* | GP | ● | ● | ● | ● | | | ● | |
| PATOCC | *Patersonia occidentalis* | DS | | | ● | | | | ● | ● |
| PATPYG | *Patersonia pygmaea* | GP | | ● | | | | | | |
| PATUMB | *Patersonia umbrosa* | DS | ● | ● | ● | ● | | | ● | ● |
| PATUMBXAN | *Patersonia umbrosa* var. *xanthina* | DS | ● | | ● | ● | | | ● | |
| PELLIT | *Pelargonium littorale* | DS | | | ● | ● | ● | | ● | ● |
| PENPEL | *Pentapeltis peltigera* | DS | ● | ● | ● | ● | | | ● | |
| PENSIL | *Pentapeltis silvatica* | S | ● | ● | ● | ● | | | ● | ● |
| PERLON | *Persoonia longifolia* | S | ● | ● | ● | ● | ● | ● | ● | ● |
| PHYCAL | *Phyllanthus calycinus* | DS | ● | | ● | ● | ● | | ● | ● |
| PIMROS | *Pimelea rosea* | S | ● | | | | | | | |
| PLATEN | *Platysace tenuissima* | DS | ● | ● | ● | ● | | | ● | ● |
| PODDRO | *Podocarpus drouynianus* | S | ● | | ● | ● | | | ● | ● |
| PORMIC | *Poranthera microphylla* | DS | ● | ● | | | | | ● | ● |
| PSELUT | *Pseudognaphalium luteoalbum* | H | ● | | ● | | ● | ● | ● | ● |
| PTEESC | *Pteridium esculentum* | F | ● | ● | ● | ● | ● | ● | ● | ● |
| PTEPYR | *Pterostylis pyramidalis* | GP | ● | ● | ● | ● | ● | ● | ● | ● |
| PTEREC | *Pterostylis recurva* | GP | | | ● | | | | ● | |
| PTEVIT | *Pterostylis vittatus* | GP | ● | | ● | ● | | | | ● |
| PTIMAN | *Ptilotus manglesii* | DS | | | | | | | ● | |

| Species Code | Species Name | Life form[1] | External reference | | Coupe buffer | | Shelterwood | | Gap release | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 30 x 30 | 1 x 1 | 30 x 30 | 1 x 1 | 30 x 30 | 1 x 1 | 30 x 30 | 1 x 1 |
| PULRET | *Pultenaea reticulata* | S | | | | | | | ● | |
| PYRNIG | *Pyrorchis nigricans* | GP | ● | ● | | | | | | |
| RANCOL | *Ranunculus colonorum* | GP | ● | | ● | ● | ● | ● | ● | |
| RHOCIT | *Rhodanthe citrina* | H | | | | ● | | | ● | ● |
| SCASTR | *Scaevola striata* | DS | ● | ● | ● | ● | ● | | ● | ● |
| SENHIS | *Senecio hispidulus* | DS | ● | | ● | | ● | | ● | ● |
| SENLAU | *Senecio lautus* | S | | | | | | | ● | |
| SENQUA | *Senecio quadridentatus* | S | | | | | | ● | ● | |
| SENSP. | *Senecio* sp. | S | | | ● | | | | | |
| SONASP | *Sonchus asper* | H | ● | | | | ● | | ● | |
| SONOLE | *Sonchus oleraceus* | H | | | | | | | ● | ● |
| SOWLAX | *Sowerbaea laxiflora* | GP | ● | ● | ● | ● | ● | ● | ● | ● |
| SPHCAP | *Sphaerolobium capitatum* | DS | ● | | | | | | | |
| SPHCAP | *Sphenotoma capitatum* | DS | ● | | | | | | | |
| SPHMED | *Sphaerolobium medium* | S | ● | | ● | | | | ● | |
| SPHSP. | *Sphaerolobium* sp. | S | ● | | | | | | | |
| SPHSP. | *Sphenotoma* sp. | DS | | | | | | | ● | ● |
| SPHSP. | *Sphenotoma* sp. | DS | | | | | | | ● | |
| STAMON | *Stackhousia monogyna* | S | ● | ● | | | ● | | ● | |
| STYADN | *Stylidium adnatum* | DS | | | ● | | | | | |
| STYAMO | *Stylidium amoenum* | DS | ● | ● | ● | ● | | | ● | ● |
| STYBUL | *Stylidium bulbiferum* | GP | ● | | | | | | | |
| STYCAL | *Stylidium calcaratum* | H | ● | | ● | | | | ● | ● |
| STYCIL | *Stylidium cilatum* | DS | ● | ● | | | | | | |
| STYLUT | *Stylidium luteum* | DS | ● | ● | | | | | | |
| STYRHY | *Stylidium rhynchocarpum* | DS | ● | | ● | ● | ● | | ● | |
| STYSCA | *Stylidium scandens* | | | ● | | | | | | |
| STYSP. | *Stylidium* sp. | DS | ● | | | | | | | |
| STYTEN | *Styphelia tenuiflora* | S | ● | ● | | | | | | |
| TAXPAR | *Taxandria parviceps ms* | S | ● | ● | ● | | | | ● | |
| TETAFF | *Tetratheca affinis* | S | ● | ● | ● | ● | | | ● | |
| TETCAP | *Tetraria capillaris* | Z | ● | ● | ● | ● | | | ● | ● |
| TETLAE | *Tetrarrhena laevis* | GR | ● | ● | ● | ● | ● | ● | ● | ● |
| THECRI | *Thelymitra crinita* | GP | | | ● | | | | | |
| THESP. | *Thelymitra* sp. | GP | | | | ● | | | ● | |
| THESP. | *Thelymitra* sp. | GP | | ● | | | | | | |
| THESP. | *Thelymitra* sp. | GP | | | | | | ● | | |
| THESP. | *Thelymitra* sp. | GP | | | ● | | | | | |
| THESP. | *Thelymitra* sp. | GP | ● | | | | | | | |
| THESP. | *Thelymitra* sp. | GP | | | | | ● | | ● | |
| THOFOL | *Thomasia foliosa* | S | | | | | | | ● | |
| THYMAN | *Thysanotus manglesianus* | GP | ● | ● | ● | ● | ● | ● | ● | ● |
| THYMUL | *Thysanotus multiflorus* | GP | ● | ● | ● | ● | ● | | ● | |
| THYSP. | *Thysanotus* sp. | GP | | ● | | | | | | |
| THYTEN | *Thysanotus tenellus* | H | ● | ● | | | ● | | ● | |
| TRAPIL | *Trachymene pilosa* | H | ● | ● | ● | ● | ● | ● | ● | ● |
| TREDIF | *Tremandra diffusa* | S | ● | ● | ● | ● | | | ● | ● |
| TRESTE | *Tremandra stelligera* | DS | ● | ● | ● | ● | | | ● | ● |
| TRICAM | *Trifolium campestre* | H | | | ● | ● | ● | ● | ● | |
| TRIELA | *Tricoryne elatior* | | | | | ● | | | | ● |
| TRIHUM | *Tricoryne humilis* | DS | | | | | | | ● | |
| TRISPA | *Trichocline spathulata* | GP | ● | ● | | | | ● | ● | |
| TRYFLO | *Trymalium floribundum* | S | ● | ● | ● | | | | ● | ● |
| TRYLED | *Trymalium ledifolium* | S | ● | | | | | | | |
| VELTRI | *Velleia trinervis* | DS | ● | ● | | | | | ● | ● |
| VERCAL | *Veronica calycina* | DS | ● | ● | ● | ● | ● | ● | ● | ● |
| WAHGRA | *Wahlenbergia gracilenta* | H | ● | | ● | | ● | ● | ● | ● |

| Species Code | Species Name | Life form[1] | External reference | | Coupe buffer | | Shelterwood | | Gap release | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 30 x 30 | 1 x 1 | 30 x 30 | 1 x 1 | 30 x 30 | 1 x 1 | 30 x 30 | 1 x 1 |
| WURSIN | *Wurmbea sinora* | GP | ● | | ● | | | | ● | |
| XANATK | *Xanthosia atkinsoniana* | S | ● | ● | | | | | | |
| XANCAN | *Xanthosia candida* | DS | ● | ● | ● | | | ● | ● | ● |
| XANGRA | *Xanthorrhoea gracilis* | X | ● | | ● | ● | | | ● | ● |
| XANHUE | *Xanthosia huegelii* | DS | ● | ● | ● | ● | | | ● | |
| XANPRE | *Xanthorrhoea preissii* | X | ● | ● | ● | | | | | |
| | Total | | 147 | 90 | 141 | 98 | 77 | 53 | 152 | 97 |

[1] Cy = cycad, DS = dwarf shrub (1-30 cm), F = Fern, GP = geophyte, GR = grass, H = herb, P = parasite, R = rush, S = shrub (> 31 cm), T = tree, V = vine, X = Xanthorrhoea/Kingia, Z = sedge, U = unknown.

## INVERTEBRATES

Janet Farr, Allan Wills, and Paul Van Heurck

### Introduction

Invertebrates, including class Insecta, comprise over 95% of the planet's biodiversity and therefore represent a crucial component in any ecosystem. Invertebrates play a major role in decomposition, nutrient recycling, plant pollination 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 relics. 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 and uncut forest.
- Analyse trends in species composition, richness and abundance
- To monitor the presence of Gondwanan relic and affinity invertebrate species with respect to the above treatments
- To monitor the presence of known insect pest species.

### Field survey and laboratory procedure

Sampling at Donnelly was carried out in November (spring) 2007 and April (autumn) 2008 using the protocol formerly established at Donnelly in 2001. To briefly summarise: 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 one person hour per capture/habitat method. Light traps were run for three nights simultaneously at each site achieving one trap night per week for three weeks (there were light trap failures on 18/3/2008 at grids FC7 and FC9 but light trapping was successfully repeated for those grids on 19/3/2008); pit fall 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 were they were stored in a portable freezer. At the conclusion of a sampling period, specimens were then transported to the laboratory in Manjimup where they were sorted and compared to the extensive collection of voucher specimens held there. Morphospecies were assigned and vouchers for each morphospecies were erected as necessary and labelled according to site, date of capture and capture method and preserved as either pinned or alcohol specimens as a reference collection. To constrain sample processing times only macro-invertebrates were recorded, that is, invertebrates with a body length 10 mm or greater and Lepidoptera with a wing length of 12 mm or greater. Highly distinctive or relictual morphospecies, smaller than these sizes, were also recorded. Samples waiting to be processed were stored either frozen or in 70% ethanol.

Sampling was conducted at all 10 Donnelly sample grids. Sorting, specimen identification and cataloguing has also been completed. This report details sampling results for 2007-08 and also includes a brief comparison with the initial Donnelly results for 2001-02. Note however, this is a preliminary report and results are from data as it exists for February 2009. Morphospecies assignment may have changed following data refinement from progressive taxonomic evaluation and will continue to

be influenced by minor adjustments in the future as morphospecies assignment is further refined.

**Preliminary results**

Following the 2007-08 monitoring, the number of morphospecies recorded for FORESTCHECK increased to 1776. The total number of individual specimens captured was 13,581, comprising 787 morphospecies, this compares with 572 (adjusted from original data for synonymy) morphospecies captured in 2001 (general abundance over all sampling methods was not available for 2001 due to no abundance records for pit falls). A total of 312 new morphospecies were recorded for the Donnelly grids that were not recorded in 2001-02, and 133 of these were new records for FORESTCHECK (although this figure will reduce following our annual morpho-species revision where synonomy is examined). Figure 1 shows the cumulative captures for the successive sampling locations. The graph's slope is consistent between successive sampling periods and shows no current trend of reduction indicating that, at this point, there is neither a sampling plateau nor an approach to one. Following this trend we can predict that the second round of sampling in Wellington will have 245 new species and therefore 2021 total morpho-species count for 2008-09.

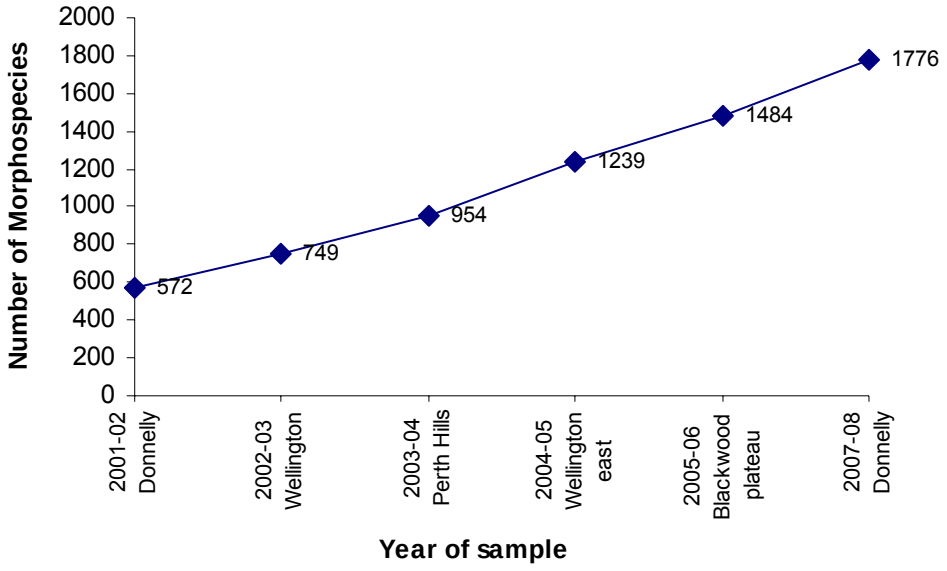



**Figure 1**. Cumulative morphospecies for 2001 (Donnelly) to 2007 (Donnelly)

Total morphospecies capture for past sampling districts and periods are shown in Table 1. Donnelly appears the most diverse site followed by Blackwood and Wellington East. The greatest abundance of invertebrates was sampled from Wellington East, followed by the most recent Donnelly sample (Table 1). Unlike prior reports, Gondwanan affinity and relictual species are not included as assignment of these categories is under review.

**Table 1**. Morphospecies comparisons between sample regions.

| District | Sample period | Number of Morphospecies | Number of individuals |
|---|---|---|---|
| Donnelly | 2001 - 02 | 572 | |
| Wellington | 2002 - 03 | 373 | 3080 |
| Perth Hills | 2003 - 04 | 428 | 4883 |
| Wellington East | 2004 - 05 | 624 | 28265 |
| Blackwood | 2005 - 06 | 728 | 6959 |
| Donnelly | 2007 - 08 | 787 | 13581 |

The numbers of morphospecies for orders where 10 or more morphospecies have been assigned are compared for Donnelly 2007-08 and 2001-02 in Figure 2. The increase capture rates in Donnelly 2007-08 are reflected in the number of species captured per taxa such that capture rates for some ordinal taxa have more than doubled. Examples of strong increases include the araneomorph spiders, Coleoptera (beetles), wasps (Hymenoptera), isopods, Lepidoptera (moths and butterflies) and lace-wings (Neuroptera). It might be argued that differences may be due to operator effort/skill since 33% of the team has changed since the initial Donnelly sample. In addition operator skill may also have increased with successive sampling years. To examine this more closely, comparison with trapping captures will be made later in this report.

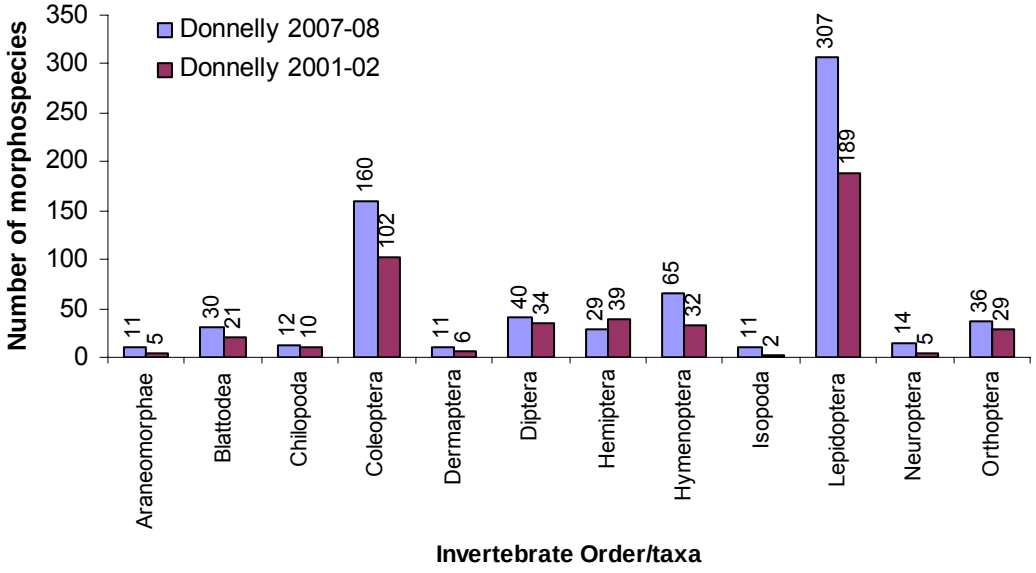



**Figure 2:** Comparison of Donnelly 2007-08 and 2001-02 morphospecies numbers for invertebrate orders where ten or greater morphospecies have been assigned.

### Comparing capture methods

Light trapping resulted in the most abundant and diverse captures (Table 2) with an autumn capture of 319 morphospecies comprising 3012 individuals; and a spring capture of 324 morphospecies comprising 9107 individuals. In general, diversity and abundance is highest in spring with the exception of the hand sampling techniques of beating and litter searches where diversity was similar for both seasons. Litter searches result in low diversity and abundances; however this is still a valid search technique as it can capture species not otherwise encountered with other methods. Targeted pursuit is used as an additional capture technique to catch species which are distinctive and not necessarily part of a particular operator's method or within their specified search protocol; in addition this technique is employed when habitat for a specific hand sampling method (e.g. litter or CWD) is scarce and thus maintains consistent operator sampling effort within each sample grid. Although this method can inform on important taxa it is not useful in a general concept of seasonal differences but has been included in Table 2 to explain total abundance for spring and autumn.

**Table 2:** Number of morphospecies and specimen abundance for Donnelly in 2007-08 for each capture method (CWD = coarse woody debris, TP = Targeted pursuit).

| **Capture** | **Number of morphospecies** | | **Abundance** | |
|---|---|---|---|---|
| **Method** | Spring | Autumn | Spring | Autumn |
| Light | 324 | 319 | 9107 | 3012 |
| Pit fall | 86 | 30 | 802 | 113 |
| Sweep | 55 | 40 | 127 | 60 |
| Beat | 32 | 31 | 77 | 47 |
| CWD | 56 | 29 | 104 | 61 |
| Litter | 23 | 17 | 29 | 20 |
| TP | 7 | 8 | 10 | 10 |
| Total | | | 10256 | 3323 |

Comparisons of capture technique for the two Donnelly samples, expressed as number of morphospecies combined for both seasons (abundance data shows the same results), showed that most of the increase in diversity between the two sample periods is from light trap captures (Fig. 3). The additional species are mainly mobile Lepidopterans, Coleopterans and Hymenopterans (refer to Fig. 2). For pit fall traps (mainly ground dwelling insects) the two sample periods are similar in species diversity (Donnelly 2001-02 is slightly higher but this difference is unlikely to be significant). The hand capture methods of sweeping and litter searching also show the same trend, similar diversity, if not slightly higher for Donnelly 2001-02. The operators were consistent for hand sweeping and litter searching. For hand beating, operators were different in the two sample periods. But, although differences are more defined between the two periods (i.e. 63 species for Donnelly 2007-08

compared with 107 species for Donnelly 2001-02) the trend is consistent with the other hand sampling techniques. For CWD however, the trend is reversed with higher diversity in the Donnelly 2007-08 sample. In Donnelly 2001-02 we operated a three person team and therefore CWD was sampled by three different people simultaneously for 20 mins each (total effective sample time of 60 min) after all other sampling had been completed, whereas in 2007-08 there was one dedicated person allocated to CWD searches. The higher diversity for the 2007-08 sample may therefore indicate that only 20 mins may be an ineffective time for an individual operator to mentally and physically engage in the CWD capture technique.

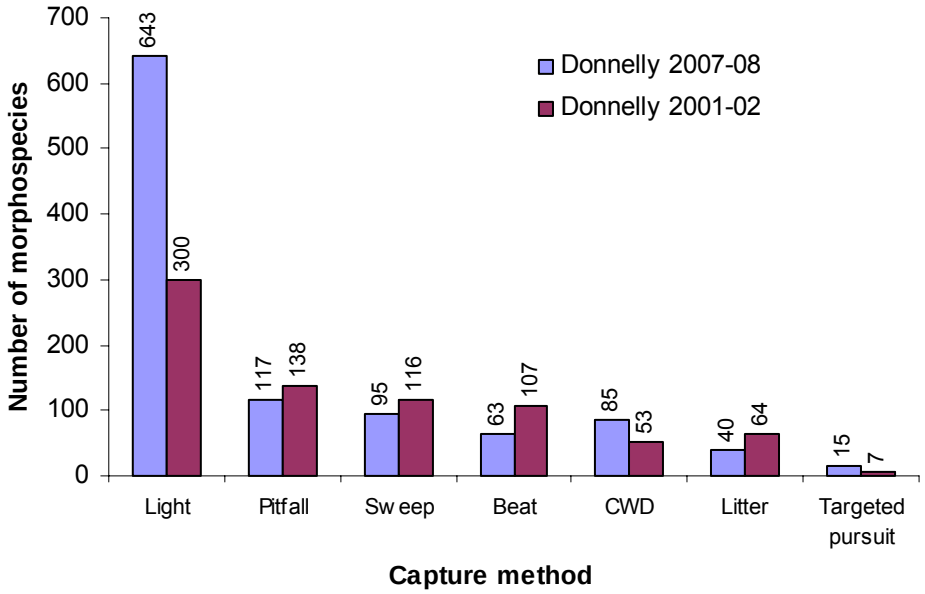



**Figure 3:** Comparison of the number of morpho-species (total over both seasons) for Donnelly 2007-08 and Donnelly 2001-02 in respect to capture method.

In addition the gap release sites have had five years to develop an understorey which may account for some of the increased diversity. In respect to the lower diversity in beating samples, this may reflect more advanced understorey and possibly a drop in understorey nutrition, but this needs a closer investigation of both the invertebrate data and site characteristics data.

### Comparing sample grids and silvicultural treatments

Donnelly grid comparisons for silvicultural treatments expressed as the total morphospecies and abundance for all capture methods and summed for spring and autumn seasons is shown in Figure 4. The Yornup external reference grid (FC5) had the greatest number of species (236) followed closely by the Kingston coupe buffer (FC4), and the Thornton gap release (FC6) grids. Abundance was highest at the Kingston external reference grid followed by the Kingston gap release grid (FC2). The lowest diversity and abundance was at the Easter external reference grid (FC10) and the Carter gap release (FC8).

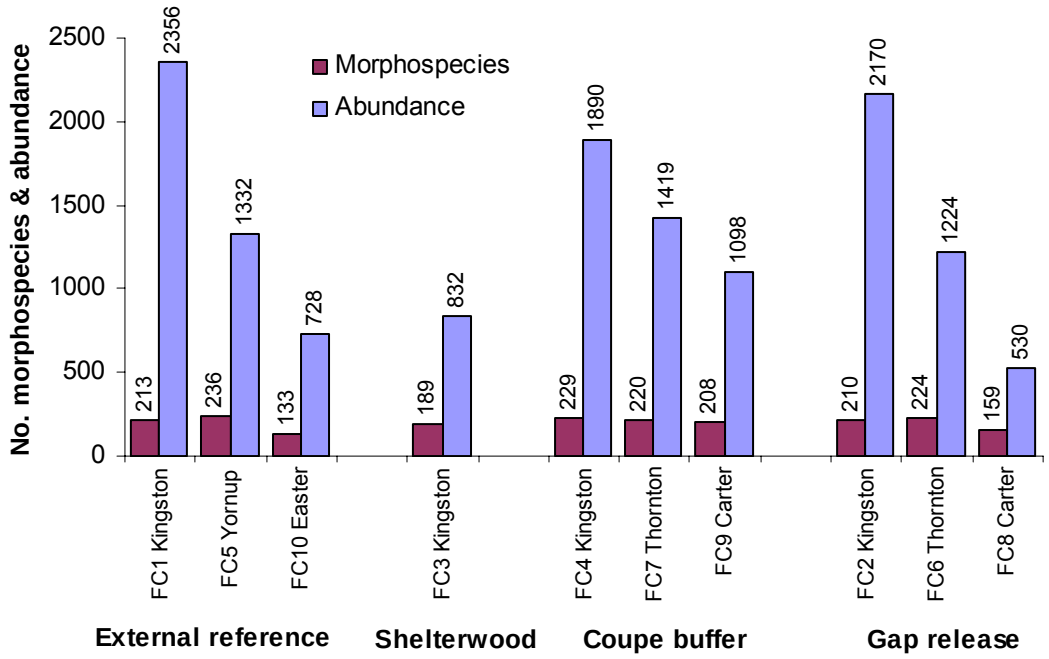



**Figure 4:** Comparison of individual Donnelly treatment grids for total morphospecies and number of individuals (abundance), for all capture methods, combining both seasons.

Comparison of means between treatments (Fig. 5) indicates few distinct patterns. For both Donnelly sample periods, the coupe buffer grids are most diverse but the difference is small and unlikely to be significant.

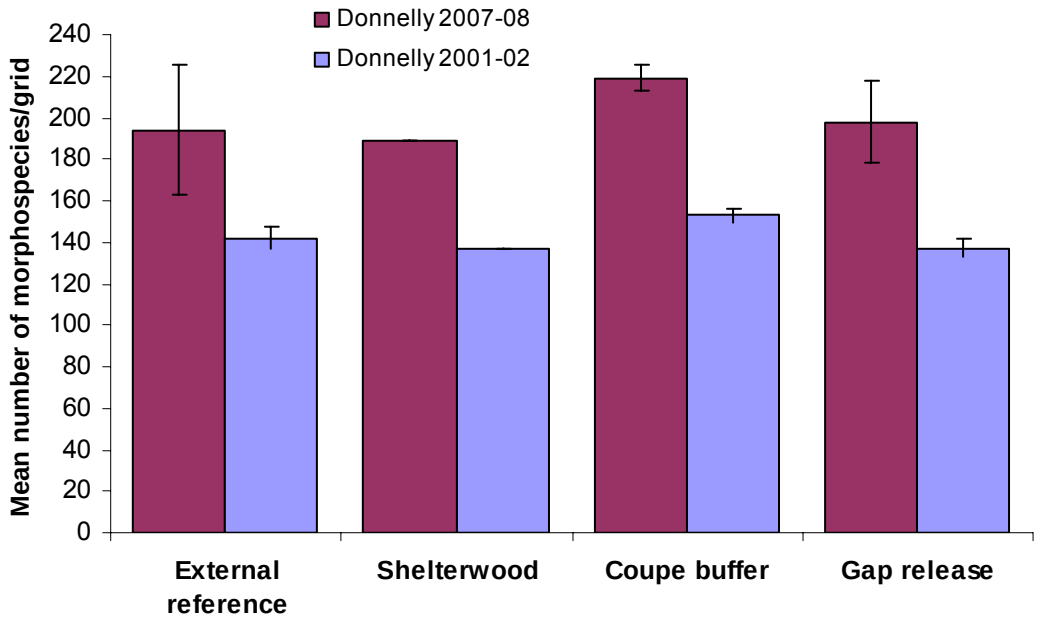



**Figure 5:** Comparison of means (n=3 for all treatments except shelterwood where n=1, ± SE) for number of morphospecies recorded at Donnelly 2007-08 and 2001-02 in respect to silvicultural treatment.

For the purpose of consistency and reference with past reports a summary of diversity and abundance (number of individuals captured at each grid) for capture methods, season and site are shown in Table 3. There were very little differences between treatments for pit fall traps (spring & autumn) except both spring and autumn abundance in the Easter external reference (FC10) was much higher (335, 37 respectively) although diversity was similar to other control grids. This indicates ground dwelling invertebrates were more mobile on this grid. The consistency of this data between seasons indicates there is a significant feature on this site influencing ground invertebrate behaviour that may be worth investigating more fully. The main species contributing to the high abundance was amphipod 1303. Interestingly the abundance for active captures and light traps is the lowest for the controls at this grid (26, 173 respectively) and light trap diversity the lowest at this grid compared with all Donnelly 2007 grids. Nothing outstanding however is apparent in the Donnelly 2001 equivalent data but unfortunately abundance levels for pit falls were not recorded.

Figure 6 shows comparisons for silvicultural treatments for spring light trap captures in the two Donnelly samples. Although there is no apparent difference between grid treatments and there is a difference of an order of magnitude for the abundance data. Trends in the data match for both sample periods such that abundance is highest in the external references and lowest for the shelterwood grid. In autumn however these trends are not apparent (Fig. 7) although abundance in the shelterwood grid is consistently amongst the higher range for both samples.

**Species differences between localities**

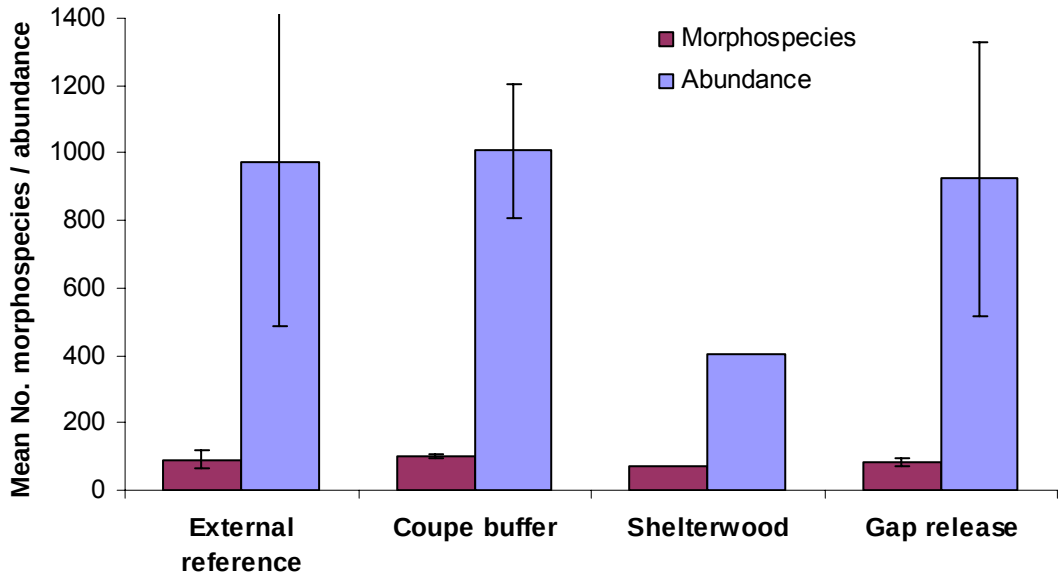
Table 5 shows the most frequent species captured for Donnelly 2007-08, Wellington (2002-03) and Donnelly 2001-02. Isopod sp. 544 was the most common species collected in Donnelly 2007-08, but this species did not feature in the top 10 for the other sample regions. Isopod sp. 544 had initially been recorded in Donnelly 2001-02 at the Kingston external reference grid (FC1) as part of species complex 539 and as a consequence was a singleton species. Thus to consider the frequency of this species it needs to be considered in conjunction with 539 (also a singleton species in Donnelly 2001-02). The Tipulid fly sp. 16 was the second most frequent capture at Donnelly in 2007-08 and consistently features as a high frequency capture in other regions. In Wellington, two top ten species (235 and 163) were not collected from the Donnelly 2007-08 sample although were collected previously in 2001-02. Only one of the top ten species from the Wellington grids was part of the top ten species from Donnelly 2007-08, the ant *Camponotus* sp. 423 (Donnelly 2007-08 rank 7). *Camponotus sp*. sp. 423 is a common species in all FORESTCHECK grids. For Donnelly 2001-02, the Orthopteran sp. 235 again was a frequent capture, but not caught in 2007-08. Three species in the top ten Donnelly 2001-02 sample were present in the top ten 2007-08 sample, namely the Arctiid moth sp. 6, The Noctuid *Proteuxoa sp*. sp. 39 and *Camponotus sp*. sp. 423. Top ten species frequency rankings for other FORESTCHECK regions can be found in the FORESTCHECK 2005-06 report for Blackwood.

Of the 787 morphospecies found at Donnelly in 2007-08 only 284 were common to the Donnelly 2001-02 sample. In other words 64% of the current Donnelly sample consisted of species not previously sampled in the Donnelly grids. Conversely 289 species from the initial Donnelly sample were not present in the current sample.

**Table 3**. Diversity (number of morphospecies) and abundance for active (beat, sweep, coarse woody debris, litter), light and pit fall trap capture techniques in spring (Sp) and autumn (Au) for Donnelly 2007-08 individual grids.

| Treatment/ | Site No | Location | Season | Active | | Light | | Pit fall | | All Capture methods | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample year | | | | Abundance | Species | Abundance | Species | Abundance | Species | Abundance | Species |
| **2007-08** | | | | | | | | | | | |
| External reference | FC1 | Kingston | Sp | 38 | 25 | 1843 | 107 | 63 | 20 | 1944 | 141 |
| External reference | FC5 | Yornup | Sp | 44 | 29 | 899 | 129 | 40 | 15 | 983 | 164 |
| External reference | FC10 | Easter | Sp | 26 | 23 | 173 | 37 | 335 | 21 | 534 | 73 |
| Gap release | FC2 | Kingston | Sp | 38 | 28 | 1687 | 87 | 19 | 11 | 1744 | 122 |
| Gap release | FC6 | Thornton | Sp | 45 | 22 | 791 | 101 | 77 | 19 | 913 | 133 |
| Gap release | FC8 | Carter | Sp | 32 | 21 | 290 | 62 | 47 | 22 | 369 | 103 |
| Shelterwood | FC3 | Kingston | Sp | 29 | 23 | 404 | 70 | 29 | 14 | 462 | 102 |
| Coupe buffer | FC4 | Kingston | Sp | 33 | 27 | 1373 | 109 | 33 | 16 | 1439 | 146 |
| Coupe buffer | FC7 | Thornton | Sp | 28 | 21 | 950 | 106 | 66 | 15 | 1044 | 132 |
| Coupe buffer | FC9 | Carter | Sp | 34 | 27 | 697 | 89 | 93 | 27 | 824 | 138 |
| **2001-02** | | | | | | | | | | | |
| External reference | FC1 | Kingston | Au | 21 | 18 | 384 | 80 | 7 | 5 | 412 | 102 |
| External reference | FC5 | Yornup | Au | 14 | 13 | 330 | 76 | 5 | 5 | 350 | 94 |
| External reference | FC10 | Easter | Au | 17 | 15 | 140 | 51 | 37 | 5 | 194 | 71 |
| Gap release | FC2 | Kingston | Au | 23 | 21 | 398 | 98 | 5 | 5 | 426 | 124 |
| Gap release | FC6 | Thornton | Au | 27 | 21 | 277 | 95 | 7 | 4 | 311 | 119 |
| Gap release | FC8 | Carter | Au | 14 | 9 | 139 | 59 | 8 | 6 | 161 | 74 |
| Shelterwood | FC3 | Kingston | Au | 31 | 22 | 326 | 92 | 13 | 4 | 370 | 115 |
| Coupe buffer | FC4 | Kingston | Au | 20 | 17 | 419 | 93 | 12 | 7 | 451 | 116 |
| Coupe buffer | FC7 | Thornton | Au | 14 | 12 | 352 | 98 | 9 | 4 | 376 | 113 |
| Coupe buffer | FC9 | Carter | Au | 17 | 15 | 247 | 78 | 10 | 5 | 274 | 97 |

(a) Donnelly 2007-08 spring light traps




(b) Donnelly 2001-02 spring light traps

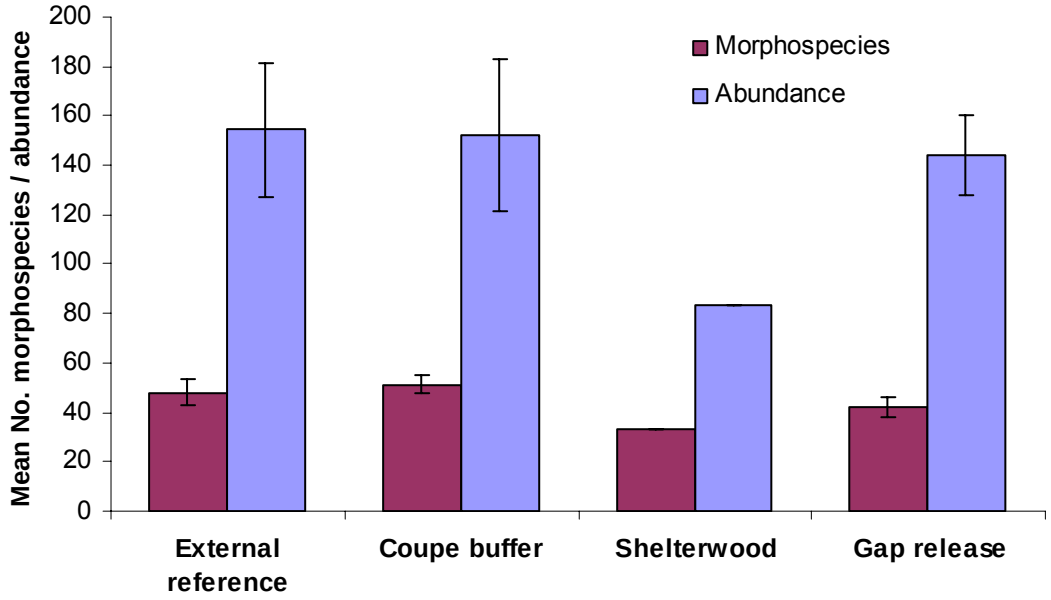
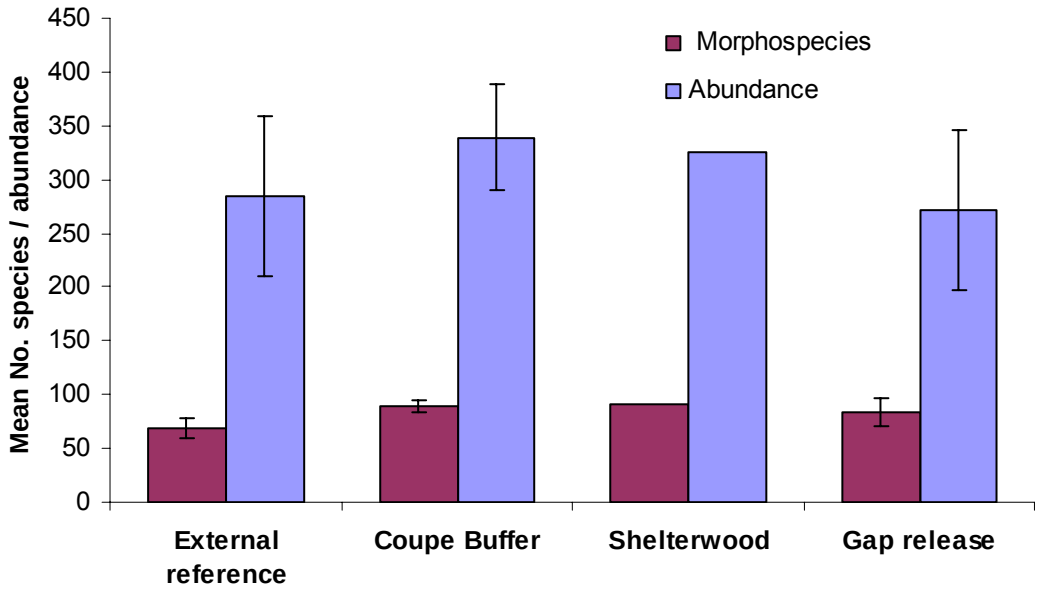



**Figure 6:** Mean diversity(number of morphospecies, ± SE, n = 3) for spring light trap captures against treatment grids for (a) Donnelly 2007-08 and (b) Donnelly 2001-02 (note: Shelterwood n=1, and different scale on y-axis in each graph).

(a) Donnelly 2007-08 autumn light traps




(b) Donnelly 2001-02 autumn light traps

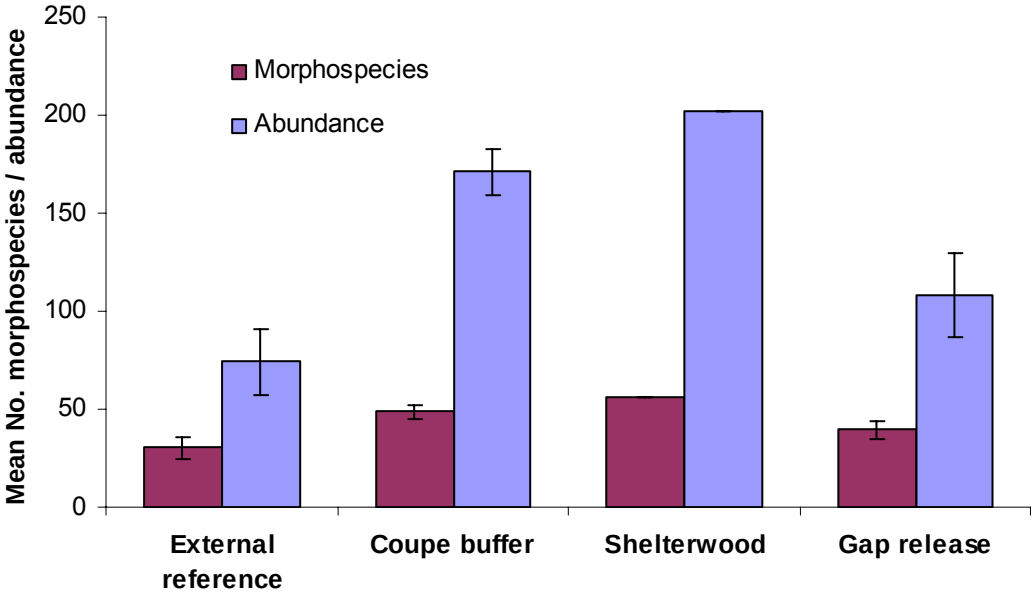



**Figure 7**. Mean diversity (number of morphospecies, ± SE, n = 3,) autumn light trap captures against treatment grids for (a) Donnelly 2007-08 and (b) Donnelly 2001-02 (Note: shelterwood n=1, and different scale on y-axis in each graph).

**Table 5**. Ten most frequent species captured for Donnelly 2007-08, Wellington 2002-3, and Donnelly 2001-02 Capture frequency is the number of times a specimen is collected over all 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 Donnelly 2007-08 samples, eg. a rank of 7 for a Wellington 2002-03 specimen means this species was the 7th most frequent species at Donnelly 2007-08, rank 33 indicates 3 specimens only were sampled from Donnelly 2007-08; a rank >35 indicates a single specimen only found in Donnelly 2007-08; a rank = 0 indicates no specimen captured in Donnelly 2007-08.

| Location | Species ID number | Capture frequency | Donnelly 2007-08 capture frequency rank | Order | Family | Genus |
|---|---|---|---|---|---|---|
| **Donnelly 2007-08** | | | | | | |
| | 544 | 63 | 1 | Isopoda | | |
| | 16 | 47 | 2 | Diptera | Tipulidae | |
| | 316 | 44 | 3 | Lepidoptera | | |
| | 526 | 44 | 3 | Orthoptera | Stenopelmatidae | *Osandrus* |
| | 14 | 41 | 4 | Coleoptera | Hydrophilidae | |
| | 6 | 38 | 5 | Lepidoptera | Arctiidae | |
| | 1303 | 36 | 6 | Amphipoda | | |
| | 423 | 35 | 7 | Hymenoptera | Formicidae | *Camponotus* |
| | 63 | 34 | 8 | Lepidoptera | | |
| | 333 | 33 | 9 | Lepidoptera | Pyralidae | |
| | 48 | 33 | 9 | Lepidoptera | | |
| | 39 | 30 | 10 | Lepidoptera | Noctuidae | *Proteuxoa* |
| **Wellington 2002-03** | | | | | | |
| | 436 | 84 | 33 | Lepidoptera | Geometridae | |
| | 52 | 72 | 26 | Hymenoptera | Apidae | *Apis* |
| | 145 | 52 | 13 | Trichoptera | | |
| | 4 | 27 | 29 | Lepidoptera | Notodontidae | *Destolmia* |
| | 235 | 25 | 0 | Orthoptera | Acrididae | |
| | 258 | 22 | 33 | Dermaptera | | |
| | 163 | 22 | 0 | Hemiptera | Reduviidae | |
| | 10 | 20 | 16 | Lepidoptera | Thaumetopoeidae | *Ochrogaster* |
| | 423 | 19 | 7 | Hymenoptera | Formicidae | *Campanotus* |
| | 1 | 19 | 32 | Lepidoptera | Carthaeidae | *Carthaea* |
| **Donnelly 2001-02** | | | | | | |
| | 52 | 64 | 26 | Hymenoptera | Apidae | *Apis* |
| | 6 | 54 | 5 | Lepidoptera | Arctiidae | |
| | 235 | 45 | 0 | Orthoptera | Acrididae | |
| | 373 | 28 | 24 | Lepidoptera | Hepialidae | *Abantiades* |
| | 39 | 27 | 10 | Lepidoptera | Noctuidae | *Proteuxoa* |
| | 145 | 26 | 13 | Trichoptera | | |
| | 18 | 26 | 24 | Lepidoptera | Noctuidae | *Agrotis* |
| | 45 | 26 | 34 | Lepidoptera | Zygaenidae | *Pollanisus* |
| | 376 | 26 | 11 | Lepidoptera | | |
| | 423 | 24 | 7 | Hymenoptera | Formicidae | *Campanotus* |
| | 16 | 23 | 2 | Diptera | Tipulidae | |

### Pest presence

Jarrah leaf miner (JLM) was present on all grids except FC10 (Table 6). Gumleaf skeletonizer (GLS) was present at FC10 where, egg rafts and leaf damage was seen. Leaf skeletonising was also observed at grid FC7 but leaf damage alone is not recorded as a positive sighting for GLS. Bullseye borer (BEB) was present at all grids and abundant in FC1 and FC4. Comparing the previous assessment in 2001, incidence of GLS and BEB has increased, whereas JLM has decreased.

**Table 6:** Pest presence and abundance assessment at each grid (JLM = jarrah leaf miner; GLS = gumleaf skeletonizer; BEB = bullseye borer; 0 = absent, 1 = present, 2 = abundant).

| Silvicultural Treatment | Site No. | Location | JLM | GLS | BEB |
|---|---|---|---|---|---|
| External reference | FC1 | Kingston | 1 | 0 | 2 |
| External reference | FC5 | Yornup | 1 | 0 | 1 |
| External reference | FC10 | Easter | 0 | 1 | 1 |
| Gap release | FC2 | Kingston | 1 | 0 | 1 |
| Gap release | FC6 | Thornton | 1 | 0 | 1 |
| Gap release | FC8 | Carter | 1 | 0 | 1 |
| Shelterwood | FC3 | Kingston | 1 | 0 | 1 |
| Coupe buffer | FC4 | Kingston | 1 | 0 | 2 |
| Coupe buffer | FC7 | Thornton | 1 | 0 | 1 |
| Coupe buffer | FC9 | Carter | 1 | 0 | 1 |

### Helena gum moth

One immediately apparent feature of the 2007-08 sample was the abundance of *Opodiphthera helena* (Helena gum moth, Table 7 & Fig. 8). Although this is a large distinctive species (Fig. 9), prior to 2007-08 few adults were collected in or around light traps, but in 2007-08 this species was the 3rd most abundant species captured in the Donnelly grids and the 16th most frequent species. Mature larvae of this species, although cryptically coloured are large and consume a large amount of eucalypt foliage before pupating (Fig. 10). Normal experience is that few larvae succeed to pupation due to a very high parasite load in the natural population, particularly for late instar larvae. Thus for a capture of 633 adults, compared to just four in 2001-02, larval impact in the canopy must be significant. The highest numbers were from the Thornton gap release (FC6) and coupe buffer (FC7) grids, although the external reference site at Easter (FC10) also had high numbers (Table 8). Nonetheless all sites with the exception of FC2 and FC3 in Kingston had abundances much greater than total annual abundances summed for all other FORESTCHECK regional samples.

**Table 7**. Helena gum-moth abundance (numbers summed over sites for each respective sample year) from FORESTCHECK sites using light traps from 2001-2007.

| Year | Sampling District | Abundance |
|---|---|---|
| 2001-02 | Donnelly | 4 |
| 2002-03 | Wellington | 1 |
| 2003-04 | Dwellingup | 0 |
| 2004-05 | Wellington East | 6 |
| 2005-06 | Blackwood | 0 |
| 2007-08 | Donnelly | 633 |

**Table 8**. Helena gum moth abundance captures from light traps stratified on site for spring 2007.

| *Grid No.* | *Treatment* | *Location* | *Abundance* |
|---|---|---|---|
| FC1 | External reference | Kingston | 27 |
| FC2 | Gap release | Kingston | 4 |
| FC3 | Shelterwood | Kingston | 5 |
| FC4 | Coupe buffer | Kingston | 32 |
| FC5 | External reference | Yornup | 21 |
| FC6 | Gap release | Thornton | 158 |
| FC7 | Coupe buffer | Thornton | 264 |
| FC8 | Gap release | Carter | 23 |
| FC9 | Coupe buffer | Carter | 22 |
| FC10 | External reference | Easter | 77 |

**Figure 8**. A high abundance of adult *Opodiphthera helena* at a 2008 Donnelly spring light trap.

**Figure 9**. Adult *Opodiphthera helena*

**Figure 10**. Late instar larvae of *Opodiphthera helena*. White spots show parasite eggs.

## Conclusions

In 2007-08 the Donnelly FORESTCHECK grids were re-sampled using the same sampling methods as for 2001-02.

- The total number of invertebrate morphospecies recorded for FORESTCHECK is now 1776.
- In 2007-08, 64% of invertebrate species recorded were not captured in 2001-02. The higher diversity in 2007-08 was mainly attributed to light trap captures as other sampling techniques showed comparable, if not lower diversity with exception of CWD searches.
- Hand sampling techniques show a consistency in capture rate patterns across the two sample periods although the hand sampling technique for CWD has resulted in improved sampling effectiveness.
- In 2007-08, a significant increase in Amphipods, Isopods and Helena gum moth abundance was recorded. There was also evidence of increased GLS presence.

## Acknowledgements

We thank Asako Wills for assistance in the field and laboratory, John Austin for assistance sorting specimens in the laboratory and Ian Jones for assistance with data enrty.

**Appendix 1**. Invertebrate morpho-species list current for February 2009. Taxon 3 refers to either a sub order, sub family or tribe etc. as may clarify specimen identity; Msp ID # = morphospecies identification number; Abun = species abundance summed for all grids from 2001-08. [Note: due to data anomalies not all of the 1776 morpho-species current for February 2009 are listed in this table. These anomalies will be rectified at a later date.]

| Order | Family | Taxon 3 | Genus | Species | Msp ID # | Abun. |
|---|---|---|---|---|---|---|
| Amphipoda | | | | | 1303 | 359 |
| Amphipoda | | | | | 261 | 9 |
| Araneomorphae | | | | | 472 | 1 |
| Araneomorphae | Araneidae | | *Eriophora* | | 1680 | 1 |
| Araneomorphae | Araneidae | | *Eriophora* | | 2038 | 1 |
| Araneomorphae | Araneidae | | *Gasteracantha* | *minax ?* | 1213 | 8 |
| Araneomorphae | Araneidae | | *Nephila* | *edulis* | 1551 | 2 |
| Araneomorphae | Araneidae | | *Phonographa* | *graeffei* | 1471 | 2 |
| Araneomorphae | Araneidae | | *Eriophora* | | 285 | 1 |
| Araneomorphae | Corinnidae | | *Supunna* | *albopunctata* | 536 | 2 |
| Araneomorphae | Ctenidae | | | | 2073 | 5 |
| Araneomorphae | Ctenidae ? | | | | 1980 | 1 |
| Araneomorphae | Ctenidae ? | | | | 553 | 5 |
| Araneomorphae | Deinopidae | | | | 2964 | 1 |
| Araneomorphae | Deinopidae | | *Deinopis ?* | | 1544 | 1 |
| Araneomorphae | Gnaphosidae | | | | 941 | 1 |
| Araneomorphae | Gnaphosidae | | | | 975 | 1 |
| Araneomorphae | Gnaphosidae | | | | 560 | 2 |
| Araneomorphae | Gnaphosidae | | *Rebilus* | | 938 | 18 |
| Araneomorphae | Gnaphosidae | | *Rebilus* | | 1427 | 6 |
| Araneomorphae | Gnaphosidae | | *Rebilus* | | 620 | 4 |
| Araneomorphae | Lycosidae | | | | 1373 | 1 |
| Araneomorphae | Lycosidae | | | | 1558 | 1 |
| Araneomorphae | Lycosidae | | | | 1581 | 1 |
| Araneomorphae | Lycosidae | | | | 1588 | 25 |
| Araneomorphae | Lycosidae | | | | 1589 | 4 |
| Araneomorphae | Lycosidae | | | | 1593 | 1 |
| Araneomorphae | Lycosidae | | | | 1595 | 1 |
| Araneomorphae | Lycosidae | | | | 2106 | 1 |
| Araneomorphae | Lycosidae | | | | 3001 | 1 |
| Araneomorphae | Lycosidae | | | | 554 | 1 |
| Araneomorphae | Lycosidae | | | | 741 | 1 |
| Araneomorphae | Miturgidae | | | | 740 | 1 |
| Araneomorphae | Miturgidae | | | | 933 | 12 |
| Araneomorphae | Miturgidae | | | | 1428 | 2 |
| Araneomorphae | Miturgidae | | | | 1448 | 1 |
| Araneomorphae | Miturgidae | | | | 1449 | 6 |
| Araneomorphae | Miturgidae | | | | 1476 | 2 |
| Araneomorphae | Miturgidae | | | | 1477 | 5 |
| Araneomorphae | Miturgidae | | | | 1564 | 1 |
| Araneomorphae | Miturgidae | | | | 1574 | 1 |
| Araneomorphae | Miturgidae | | | | 1579 | 1 |
| Araneomorphae | Miturgidae | | | | 1580 | 3 |
| Araneomorphae | Miturgidae | | | | 1885 | 1 |
| Araneomorphae | Miturgidae | | | | 597 | 3 |
| Araneomorphae | Miturgidae | | | | 271 | 1 |
| Araneomorphae | Miturgidae | | | | 812 | 5 |
| Araneomorphae | Sparassidae | | | | 1044 | 2 |

| Order | Family | Taxon 3 | Genus | Species | Msp ID # | Abun. |
|---|---|---|---|---|---|---|
| Araneomorphae | Sparassidae | | | | 1432 | 1 |
| Araneomorphae | Sparassidae | | | | 1446 | 1 |
| Araneomorphae | Sparassidae | | | | 1986 | 1 |
| Araneomorphae | Sparassidae | | | | 2055 | 1 |
| Araneomorphae | Sparassidae | | | | 2976 | 1 |
| Araneomorphae | Sparassidae | | | | 286 | 3 |
| Araneomorphae | Sparassidae | | *Olios* | | 939 | 2 |
| Araneomorphae | Stiphididae | | | | 2686 | 4 |
| Araneomorphae | Stiphidiidae | | | | 1403 | 1 |
| Araneomorphae | Stiphidiidae | | | | 1570 | 8 |
| Araneomorphae | Stiphidiidae | | | | 2083 | 2 |
| Araneomorphae | Stiphidiidae | | | | 2692 | 3 |
| Araneomorphae | Stiphidiidae | | *Baiami* | | 732 | 13 |
| Araneomorphae | Stiphidiidae | | *Baiami* | *volucripes* | 735 | 5 |
| Araneomorphae | Stiphidiidae | | *Baiami ?* | *volucripes* | 725 | 2 |
| Araneomorphae | Zodariidae | | | | 972 | 1 |
| Araneomorphae | Zodariidae | | | | 1007 | 5 |
| Araneomorphae | Zodariidae | | | | 1015 | 1 |
| Araneomorphae | Zodariidae | | *Storena* | | 468 | 11 |
| Araneomorphae | Zoridae | | | | 932 | 2 |
| Araneomorphae | Zoridae | | | | 1584 | 1 |
| Blattodea | | | | | 2662 | 1 |
| Blattodea | | | | | 2667 | 1 |
| Blattodea | | | | | 2669 | 2 |
| Blattodea | | | | | 2672 | 1 |
| Blattodea | | | | | 2673 | 1 |
| Blattodea | | | | | 2684 | 1 |
| Blattodea | | | | | 2685 | 1 |
| Blattodea | | | | | 2699 | 1 |
| Blattodea | | | | | 2701 | 1 |
| Blattodea | | | | | 2949 | 2 |
| Blattodea | | | | | 2970 | 2 |
| Blattodea | | | | | 2978 | 1 |
| Blattodea | | | | | 2979 | 1 |
| Blattodea | | | | | 509 | 1 |
| Blattodea | Blaberidae | | | | 1101 | 13 |
| Blattodea | Blaberidae | | | | 1115 | 3 |
| Blattodea | Blaberidae | | | | 148 | 88 |
| Blattodea | Blaberidae | | | | 410 | 26 |
| Blattodea | Blaberidae | | | | 479 | 1 |
| Blattodea | Blaberidae | Diplopterinae | *Calolampra* | | 147 | 54 |
| Blattodea | Blaberidae | Epilamprinae | *Laxta* | | 27 | 246 |
| Blattodea | Blaberidae | Epilamprinae | *Laxta* | | 119 | 15 |
| Blattodea | Blaberidae | Epilamprinae | *Laxta* | | 1462 | 1 |
| Blattodea | Blattelidae | | | | 926 | 1 |
| Blattodea | Blattelidae | | | | 1118 | 2 |
| Blattodea | Blattelidae | | | | 2017 | 2 |
| Blattodea | Blattelidae | | | | 190 | 6 |
| Blattodea | Blattellidae | Parcoblattini | *Neotemnopteryx* | | 120 | 16 |
| Blattodea | Blattellidae | Parcoblattini | *Neotemnopteryx* | | 591 | 2 |
| Blattodea | Blattellidae | Parcoblattini | *Neotemnopteryx* | | 780 | 5 |
| Blattodea | Blattidae | | | | 878 | 4 |

| Order | Family | Taxon 3 | Genus | Species | Msp ID # | Abun. |
|---|---|---|---|---|---|---|
| Blattodea | Blattidae | | | | 891 | 4 |
| Blattodea | Blattidae | | | | 936 | 3 |
| Blattodea | Blattidae | | | | 961 | 1 |
| Blattodea | Blattidae | | | | 967 | 1 |
| Blattodea | Blattidae | | | | 1434 | 1 |
| Blattodea | Blattidae | | | | 1460 | 2 |
| Blattodea | Blattidae | | | | 1559 | 2 |
| Blattodea | Blattidae | | | | 1573 | 1 |
| Blattodea | Blattidae | | | | 1587 | 2 |
| Blattodea | Blattidae | | | | 1780 | 1 |
| Blattodea | Blattidae | | | | 1933 | 14 |
| Blattodea | Blattidae | | | | 1974 | 2 |
| Blattodea | Blattidae | | | | 1991 | 1 |
| Blattodea | Blattidae | | | | 2037 | 2 |
| Blattodea | Blattidae | | | | 2098 | 1 |
| Blattodea | Blattidae | | | | 490 | 3 |
| Blattodea | Blattidae | | | | 508 | 1 |
| Blattodea | Blattidae | Polyzosteriinae | *Platyzosteria* | | 121 | 5 |
| Blattodea | Blattidae | Polyzosteriinae | *Platyzosteria* | | 122 | 4 |
| Blattodea | Blattidae | Polyzosteriinae | *Platyzosteria* | | 254 | 2 |
| Blattodea | Blattidae | Polyzosteriinae | *Platyzosteria* | | 282 | 1 |
| Blattodea | Blattidae | Polyzosteriinae | *Platyzosteria* | | 483 | 3 |
| Blattodea | Blattidae | Polyzosteriinae | *Platyzosteria* | | 547 | 1 |
| Blattodea | Blattidae | Polyzosteriinae | *Platyzosteria* | | 781 | 1 |
| Blattodea | Blattidae | Polyzosteriinae | *Platyzosteria* | | 874 | 3 |
| Blattodea | Blattidae | Polyzosteriinae | *Platyzosteria* | | 899 | 9 |
| Blattodea | Blattidae | Polyzosteriinae | *Platyzosteria* | | 905 | 4 |
| Blattodea | Blattidae | Polyzosteriinae | *Platyzosteria* | | 968 | 9 |
| Blattodea | Blattidae | Polyzosteriinae | *Platyzosteria* | | 971 | 6 |
| Blattodea | Blattidae | Polyzosteriinae | *Platyzosteria* | | 1016 | 1 |
| Blattodea | Blattidae | Polyzosteriinae | *Platyzosteria* | | 1035 | 1 |
| Blattodea | Blattidae | Polyzosteriinae | *Platyzosteria* | | 1474 | 4 |
| Blattodea | Blattidae | Polyzosteriinae | *Platyzosteria* | | 1888 | 2 |
| Blattodea | Blattidae | Polyzosteriinae | *Platyzosteria* | | 1897 | 2 |
| Blattodea | Blattidae | Polyzosteriinae | *Platyzosteria* | | 2008 | 1 |
| Blattodea | Blattidae | Polyzosteriinae | *Platyzosteria* | | 2013 | 2 |
| Blattodea | Blattidae | Polyzosteriinae | *Platyzosteria* | | 2015 | 2 |
| Blattodea | Blattidae | Polyzosteriinae | *Platyzosteria* | | 2033 | 1 |
| Blattodea | Blattidae | Polyzosteriinae | *Platyzosteria* | | 219 | 4 |
| Blattodea | Blattidae | Polyzosteriinae | *Platyzosteria* | | 266 | 4 |
| Blattodea | Blattidae | Polyzosteriinae | *Platyzosteria* | | 507 | 17 |
| Blattodea | Blattidae | Polyzosteriinae | *Polyzosteria* | | 292 | 1 |
| Blattodea | Blattidae | Polyzosteriinae | *Polyzosteria* | | 592 | 4 |
| Blattodea | Blattidae | Polyzosteriinae | *Polyzosteria* | | 2003 | 1 |
| Blattodea | Blattidae | Polyzosteriinae | *Polyzosteria* | | 2007 | 1 |
| Blattodea | Blattidae | Polyzosteriinae | *Polyzosteria* | | 269 | 1 |
| Chilopoda | | | | | 2969 | 1 |
| Chilopoda | | | | | 2981 | 1 |
| Chilopoda | Geophilidae | | | | 1531 | 6 |
| Chilopoda | Geophilidae | | | | 226 | 7 |
| Chilopoda | Geophilidae | | | | 227 | 11 |
| Chilopoda | Lithobiidae | | | | 1429 | 2 |

| Order | Family | Taxon 3 | Genus | Species | Msp ID # | Abun. |
|---|---|---|---|---|---|---|
| Chilopoda | Lithobiidae | | | | 1563 | 8 |
| Chilopoda | Lithobiidae | | | | 228 | 38 |
| Chilopoda | Lithobiidae | | | | 229 | 6 |
| Chilopoda | Scolopendridae | | | | 586 | 2 |
| Chilopoda | Scolopendridae | | | | 1882 | 6 |
| Chilopoda | Scolopendridae | | | | 1883 | 1 |
| Chilopoda | Scolopendridae | | | | 2050 | 1 |
| Chilopoda | Scolopendridae | | | | 225 | 28 |
| Chilopoda | Scolopendridae | | | | 267 | 3 |
| Chilopoda | Scolopendridae | | | | 277 | 2 |
| Chilopoda | Scolopendridae | | | | 623 | 2 |
| Chilopoda | Scolopendridae | Otostigminae | *Ethmostigmus ?* | | 223 | 90 |
| Chilopoda | Scolopendridae | Otostigminae | *Ethmostigmus ?* | | 224 | 11 |
| Chilopoda | Scolopendridae ? | | | | 875 | 1 |
| Chilopoda | Scolopendridae ? | | | | 877 | 1 |
| Chilopoda | Scolopendridae ? | | | | 1583 | 3 |
| Chilopoda | Scolopendridae ? | | | | 716 | 2 |
| Chilopoda | Scolopendridae ? | | | | 815 | 1 |
| Coleoptera | | | | | 116 | 1 |
| Coleoptera | | | | | 158 | 2 |
| Coleoptera | | | | | 194 | 3 |
| Coleoptera | Belidae | | | | 100 | 4 |
| Coleoptera | Belidae | | *Araiobelus* | | 201 | 5 |
| Coleoptera | Belidae | | *Rhinotia* | | 168 | 2 |
| Coleoptera | Bostrichidae | | | | 1943 | 4 |
| Coleoptera | Buprestidae | | | | 173 | 1 |
| Coleoptera | Buprestidae | | | | 215 | 1 |
| Coleoptera | Buprestidae | Agrilinae | *Cisseis* | | 1437 | 3 |
| Coleoptera | Buprestidae | Agrilinae ? | | | 1464 | 1 |
| Coleoptera | Buprestidae | Buprestinae | *Castiarina* | | 1890 | 1 |
| Coleoptera | Buprestidae | Buprestinae | *Cyria* | *vittata* | 299 | 1 |
| Coleoptera | Buprestidae | Buprestinae | *Melobasis* | | 1443 | 1 |
| Coleoptera | Buprestidae | Buprestinae | *Melobasis* | *gloriosa ?* | 1435 | 1 |
| Coleoptera | Buprestidae | Buprestinae | *Melobasis* | *vittatus* | 1999 | 2 |
| Coleoptera | Buprestidae | Polycestinae | *Xyroscelis* | *crocata* | 159 | 1 |
| Coleoptera | Cantharidae | | | | 2974 | 8 |
| Coleoptera | Cantharidae | | | | 2993 | 2 |
| Coleoptera | Cantharidae | Chauliognathinae | *Chauliognathus ?* | | 795 | 20 |
| Coleoptera | Cantharidae | Dysmorphocerinae | *Heteromastix* | | 198 | 1 |
| Coleoptera | Carabidae | | | | 566 | 6 |
| Coleoptera | Carabidae | | | | 842 | 20 |
| Coleoptera | Carabidae | | | | 851 | 3 |
| Coleoptera | Carabidae | | | | 992 | 2 |
| Coleoptera | Carabidae | | | | 1000 | 1 |
| Coleoptera | Carabidae | | | | 1939 | 1 |
| Coleoptera | Carabidae | | | | 1978 | 9 |
| Coleoptera | Carabidae | | | | 1979 | 13 |
| Coleoptera | Carabidae | | | | 2688 | 8 |
| Coleoptera | Carabidae | | | | 587 | 4 |
| Coleoptera | Carabidae | | | | 529 | 3 |
| Coleoptera | Carabidae | Agoninae | *Notagonum* | | 1087 | 2 |
| Coleoptera | Carabidae | Broscinae | *Cerotalis* | | 2612 | 5 |

| Order | Family | Taxon 3 | Genus | Species | Msp ID # | Abun. |
|---|---|---|---|---|---|---|
| Coleoptera | Carabidae | Broscinae | *Promecoderus* | | 253 | 14 |
| Coleoptera | Carabidae | Carabinae | | | 439 | 11 |
| Coleoptera | Carabidae | Carabinae | *Calosoma* | *schayeri* | 1058 | 2 |
| Coleoptera | Carabidae | Carabinae | *Carenum ?* | | 280 | 5 |
| Coleoptera | Carabidae | Esydrinae | | | 1442 | 3 |
| Coleoptera | Carabidae | Esydrinae | | | 265 | 4 |
| Coleoptera | Carabidae | Harpalinae | *Cenogmus ?* | | 264 | 20 |
| Coleoptera | Carabidae | Harpalinae | *Lecanomerus* | | 2695 | 1 |
| Coleoptera | Carabidae | Lebiinae | *Agonocheila* | | 1059 | 6 |
| Coleoptera | Carabidae | Lebiinae | *Agonocheila* | | 1522 | 2 |
| Coleoptera | Carabidae | Lebiinae | *Philophloeus* | *eucalypti* | 956 | 26 |
| Coleoptera | Carabidae | Licininae | *Dicrochile ?* | | 914 | 1 |
| Coleoptera | Carabidae | Pterostichinae | *Notonomus ?* | | 746 | 18 |
| Coleoptera | Carabidae | Pterostichinae | *Platycoelus* | | 2127 | 12 |
| Coleoptera | Carabidae | Pterostichinae | *Pseudoceneus* | | 528 | 9 |
| Coleoptera | Carabidae | Scaritinae | *Neocarenum* | | 2085 | 1 |
| Coleoptera | Carabidae | Scaritinae | *Scaraphites ?* | | 2081 | 5 |
| Coleoptera | Cerambycidae | | | | 2942 | 1 |
| Coleoptera | Cerambycidae | Cerambycinae | | | 2725 | 3 |
| Coleoptera | Cerambycidae | Cerambycinae | *Aphanosperma* | | 1418 | 1 |
| Coleoptera | Cerambycidae | Cerambycinae | *Aposites ?* | | 1917 | 7 |
| Coleoptera | Cerambycidae | Cerambycinae | *Aposites ?* | | 2960 | 1 |
| Coleoptera | Cerambycidae | Cerambycinae | *Coptocercus* | *rubripes* | 654 | 5 |
| Coleoptera | Cerambycidae | Cerambycinae | *Coptocercus ?* | | 2941 | 1 |
| Coleoptera | Cerambycidae | Cerambycinae | *Phoracantha* | | 1067 | 1 |
| Coleoptera | Cerambycidae | Cerambycinae | *Scolecobrotus* | | 1041 | 6 |
| Coleoptera | Cerambycidae | Cerambycinae | *Scolecobrotus* | *westwoodi ?* | 1040 | 2 |
| Coleoptera | Cerambycidae | Cerambycinae | *Stenoderus* | *suturalis* | 673 | 3 |
| Coleoptera | Cerambycidae | Cerambycinae | *Uracanthus* | | 1033 | 7 |
| Coleoptera | Cerambycidae | Cerambycinae | *Uracanthus* | *triangularis* | 351 | 3 |
| Coleoptera | Cerambycidae | Lamiinae | *Ancita* | | 476 | 3 |
| Coleoptera | Cerambycidae | Prioninae | *Sceleocantha* | | 1082 | 3 |
| Coleoptera | Chrysomelidae | | | | 2992 | 1 |
| Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta* | | 112 | 4 |
| Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta* | | 463 | 7 |
| Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta* | | 465 | 1 |
| Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta* | | 665 | 3 |
| Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta* | | 677 | 8 |
| Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta* | | 786 | 5 |
| Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta* | | 800 | 1 |
| Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta* | | 805 | 1 |
| Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta* | | 808 | 1 |
| Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta* | | 1329 | 1 |
| Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta* | | 1540 | 1 |
| Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta* | | 175 | 1 |
| Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta?* | | 248 | 1 |
| Coleoptera | Chrysomelidae | Chrysomelinae | *Chrysophtharta?* | | 471 | 2 |
| Coleoptera | Chrysomelidae | Chrysomelinae | *Paropsis* | | 307 | 1 |
| Coleoptera | Chrysomelidae | Chrysomelinae | *Paropsis* | | 667 | 13 |
| Coleoptera | Chrysomelidae | Chrysomelinae | *Paropsis* | | 913 | 4 |
| Coleoptera | Chrysomelidae | Chrysomelinae | *Paropsis* | | 1554 | 2 |
| Coleoptera | Chrysomelidae | Chrysomelinae | *Paropsis* | | 1825 | 1 |

| Order | Family | Taxon 3 | Genus | Species | Msp ID # | Abun. |
|---|---|---|---|---|---|---|
| Coleoptera | Chrysomelidae | Chrysomelinae | *Paropsis* | | 1827 | 1 |
| Coleoptera | Chrysomelidae | Chrysomelinae | *Paropsis* | | 2034 | 1 |
| Coleoptera | Chrysomelidae | Chrysomelinae | *Paropsisterna* | | 308 | 2 |
| Coleoptera | Chrysomelidae | Chrysomelinae | *Paropsisterna* | | 803 | 7 |
| Coleoptera | Chrysomelidae | Chrysomelinae | *Paropsisterna* | | 804 | 18 |
| Coleoptera | Chrysomelidae | Chrysomelinae | *Paropsisterna* | | 1092 | 2 |
| Coleoptera | Chrysomelidae | Chrysomelinae | *Trachymela* | | 1444 | 1 |
| Coleoptera | Chrysomelidae | Chrysomelinae | *Trachymela* | | 2651 | 2 |
| Coleoptera | Chrysomelidae | Cryptocephalinae | *Aprocera* | | 807 | 1 |
| Coleoptera | Chrysomelidae | Eumolpinae | *Eboo?* | | 182 | 1 |
| Coleoptera | Chrysomelidae | Eumolpinae | *Edusella?* | | 56 | 1 |
| Coleoptera | Chrysomelidae | Eumolpinae | *Edusella?* | | 101 | 4 |
| Coleoptera | Chrysomelidae | Eumolpinae | *Edusella?* | | 115 | 1 |
| Coleoptera | Chrysomelidae | Eumolpinae | *Edusella?* | | 155 | 4 |
| Coleoptera | Cleridae | Clerinae | *Eunatalis* | *spinicornis* | 1103 | 2 |
| Coleoptera | Coccinellidae | | | | 2595 | 1 |
| Coleoptera | Coccinellidae | Chilocorinae | *Parapriasus* | | 912 | 1 |
| Coleoptera | Coccinellidae | Coccinellinae | *Coccinella* | *repanda* | 193 | 13 |
| Coleoptera | Curculionidae | | | | 843 | 2 |
| Coleoptera | Curculionidae | | | | 852 | 8 |
| Coleoptera | Curculionidae | | | | 911 | 1 |
| Coleoptera | Curculionidae | | | | 1110 | 2 |
| Coleoptera | Curculionidae | | | | 1438 | 1 |
| Coleoptera | Curculionidae | | | | 1505 | 1 |
| Coleoptera | Curculionidae | | | | 2967 | 1 |
| Coleoptera | Curculionidae | | | | 2973 | 1 |
| Coleoptera | Curculionidae | | | | 368 | 2 |
| Coleoptera | Curculionidae | | | | 102 | 1 |
| Coleoptera | Curculionidae | | | | 114 | 1 |
| Coleoptera | Curculionidae | | | | 156 | 1 |
| Coleoptera | Curculionidae | | | | 169 | 1 |
| Coleoptera | Curculionidae | | | | 199 | 1 |
| Coleoptera | Curculionidae | | | | 214 | 1 |
| Coleoptera | Curculionidae | | | | 244 | 14 |
| Coleoptera | Curculionidae | | | | 514 | 2 |
| Coleoptera | Curculionidae | Adelognatha | *Catasarcus* | | 2051 | 1 |
| Coleoptera | Curculionidae | Adelognatha | *Catasarcus* | | 2698 | 5 |
| Coleoptera | Curculionidae | Adelognatha | *Psapharus* | *inconspicuus* | 1183 | 1 |
| Coleoptera | Curculionidae | Amycterinae | | | 2696 | 2 |
| Coleoptera | Curculionidae | Amycterinae | | | 2975 | 2 |
| Coleoptera | Curculionidae | Amycterinae | | | 744 | 5 |
| Coleoptera | Curculionidae | Amycterinae | *Acantholophus* | | 496 | 5 |
| Coleoptera | Curculionidae | Amycterinae | *Acantholophus* | | 869 | 10 |
| Coleoptera | Curculionidae | Amycterinae | *Acantholophus* | | 970 | 2 |
| Coleoptera | Curculionidae | Amycterinae | *Acantholophus* | | 1215 | 1 |
| Coleoptera | Curculionidae | Amycterinae | *Acantholophus* | | 1409 | 1 |
| Coleoptera | Curculionidae | Amycterinae | *Acantholophus* | | 1486 | 2 |
| Coleoptera | Curculionidae | Amycterinae | *Acantholophus* | | 1523 | 3 |
| Coleoptera | Curculionidae | Amycterinae | *Acantholophus* | | 1775 | 2 |
| Coleoptera | Curculionidae | Amycterinae | *Acantholophus* | | 2091 | 5 |
| Coleoptera | Curculionidae | Amycterinae | *Acantholophus* | | 3000 | 1 |
| Coleoptera | Curculionidae | Amycterinae | *Aedriodes* | | 1596 | 1 |

| Order | Family | Taxon 3 | Genus | Species | Msp ID # | Abun. |
|---|---|---|---|---|---|---|
| Coleoptera | Curculionidae | Amycterinae | *Aedriodes* | | 1597 | 1 |
| Coleoptera | Curculionidae | Amycterinae | *Aedriodes* | *fastigiatus* | 1014 | 4 |
| Coleoptera | Curculionidae | Amycterinae | *Cucullothorax* | *horridus* | 1571 | 1 |
| Coleoptera | Curculionidae | Amycterinae | *Hyborrhinus ?* | | 934 | 3 |
| Coleoptera | Curculionidae | Amycterinae | *Parahyborrhynchus* | *convexiuculus* | 2090 | 1 |
| Coleoptera | Curculionidae | Amycterinae | *Sclerorinus ?* | | 1789 | 1 |
| Coleoptera | Curculionidae | Amycterinae | *Talaurinus* | | 910 | 1 |
| Coleoptera | Curculionidae | Amycterinae | *Talaurinus* | | 1461 | 7 |
| Coleoptera | Curculionidae | Amycterinae | *Talaurinus* | | 817 | 2 |
| Coleoptera | Curculionidae | Amycterinae | *Talaurinus* | *roei ?* | 906 | 3 |
| Coleoptera | Curculionidae | Aterpinae | *Aades* | | 2418 | 2 |
| Coleoptera | Curculionidae | Aterpinae | *Pelororhinus* | | 1182 | 9 |
| Coleoptera | Curculionidae | Aterpinae | *Pelororhinus* | *stellio* | 349 | 2 |
| Coleoptera | Curculionidae | Aterpinae | *Pelororhinus* | *sulcirostris* | 1050 | 3 |
| Coleoptera | Curculionidae | Aterpinae | *Rhinaria* | *aberrans ?* | 103 | 2 |
| Coleoptera | Curculionidae | Aterpinae | *Rhinaria ?* | | 209 | 16 |
| Coleoptera | Curculionidae | Entiminae | *Aesolithna* | | 210 | 10 |
| Coleoptera | Curculionidae | Entiminae | *Leptopius* | | 1225 | 6 |
| Coleoptera | Curculionidae | Entiminae | *Leptopius* | | 2678 | 1 |
| Coleoptera | Curculionidae | Entiminae | *Mandalotus ?* | | 2088 | 3 |
| Coleoptera | Curculionidae | Entiminae | *Polyphrades* | *aesalon ?* | 113 | 34 |
| Coleoptera | Curculionidae | Gonipterinae | *Gonipterus* | | 488 | 2 |
| Coleoptera | Curculionidae | Gonipterinae | *Oxyops* | | 160 | 1 |
| Coleoptera | Curculionidae | Gonipterinae | *Oxyops* | | 462 | 1 |
| Coleoptera | Curculionidae | Gonipterinae | *Oxyops* | *fasciata* | 161 | 192 |
| Coleoptera | Curculionidae | Gonipterinae | *Oxyops* | *pictipennis* | 98 | 47 |
| Coleoptera | Curculionidae | Molytinae | *Melanotranes* | *roei* | 290 | 44 |
| Coleoptera | Curculionidae | Molytinae | *Tranes* | *vigorsii* | 291 | 33 |
| Coleoptera | Curculionidae | Rhadinosominae | *Rhadinosomus* | *lacordaire* | 157 | 45 |
| Coleoptera | Dermestidae | Dermestini | *Dermestes* | | 865 | 2 |
| Coleoptera | Dytiscidae | | | | 2624 | 1 |
| Coleoptera | Dytiscidae | | | | 13 | 61 |
| Coleoptera | Dytiscidae | Colymbetinae | *Rhantus* | | 13 | 17 |
| Coleoptera | Dytiscidae | Colymbetinae | *Rhantus* | | 447 | 3 |
| Coleoptera | Dytiscidae | Colymbetinae | *Rhantus* | | 2143 | 1 |
| Coleoptera | Dytiscidae | Colymbetinae | *Rhantus* | | 2870 | 2 |
| Coleoptera | Dytiscidae | Dytiscinae | *Eretes* | | 774 | 1 |
| Coleoptera | Dytiscidae | Lancetinae | *Lancetes* | | 651 | 161 |
| Coleoptera | Dytiscidae | Lancetinae | *Lancetes* | | 850 | 69 |
| Coleoptera | Elateridae | | | | 989 | 2 |
| Coleoptera | Elateridae | | | | 1083 | 62 |
| Coleoptera | Elateridae | | | | 1817 | 17 |
| Coleoptera | Elateridae | | | | 1914 | 3 |
| Coleoptera | Elateridae | | | | 2442 | 7 |
| Coleoptera | Elateridae | | | | 15 | 4 |
| Coleoptera | Elateridae | | | | 220 | 1 |
| Coleoptera | Elateridae | | | | 621 | 2 |
| Coleoptera | Elateridae | | | | 636 | 4 |
| Coleoptera | Elateridae | Agrypninae | *Chrostyus ?* | | 1121 | 2 |
| Coleoptera | Elateridae | Agrypninae | *Conoderus* | | 595 | 2 |
| Coleoptera | Elateridae | Agrypninae | *Conoderus* | | 909 | 10 |
| Coleoptera | Elateridae | Agrypninae | *Conoderus* | | 1062 | 13 |

| Order | Family | Taxon 3 | Genus | Species | Msp ID # | Abun. |
|---|---|---|---|---|---|---|
| Coleoptera | Elateridae | Agrypninae | *Conoderus* | | 1109 | 20 |
| Coleoptera | Elateridae | Agrypninae | *Conoderus* | | 1818 | 28 |
| Coleoptera | Elateridae | Agrypninae | *Conoderus* | | 1819 | 9 |
| Coleoptera | Elateridae | Agrypninae | *Conoderus* | | 2711 | 1 |
| Coleoptera | Elateridae | Agrypninae | *Conoderus* | | 26 | 184 |
| Coleoptera | Elateridae | Agrypninae | *Conoderus* | | 135 | 80 |
| Coleoptera | Elateridae | Agrypninae | *Conoderus* | | 444 | 178 |
| Coleoptera | Elateridae | Agrypninae | *Drasterius ?* | | 1120 | 15 |
| Coleoptera | Elateridae | Agrypninae | *Pseudaeolus* | | 997 | 17 |
| Coleoptera | Elateridae | Agrypninae | *Pseudotetralobus* | | 2674 | 1 |
| Coleoptera | Geotrupidae | | | | 2625 | 2 |
| Coleoptera | Geotrupidae | Bolboceratidae | *Blackbolbus* | | 831 | 2 |
| Coleoptera | Gyrinidae | | *Macrogyrus* | | 440 | 9 |
| Coleoptera | Histeridae | | | | 959 | 1 |
| Coleoptera | Hydrophilidae | | | | 14 | 25424 |
| Coleoptera | Hydrophilidae | Hydrophilinae | *Hydrophilus* | *triangulans* | 1123 | 2 |
| Coleoptera | Lucanidae | | | | 3005 | 1 |
| Coleoptera | Lucanidae | Syndesinae | *Syndesus* | | 437 | 8 |
| Coleoptera | Lucanidae | Syndesinae | *Syndesus* | | 1640 | 1 |
| Coleoptera | Lucanidae | Syndesinae | *Syndesus* | | 1932 | 3 |
| Coleoptera | Lucanidae | Syndesinae | *Syndesus ?* | | 1629 | 2 |
| Coleoptera | Lycidae | | | | 1994 | 4 |
| Coleoptera | Lycidae | Metriorrhynchinae | *Metriorrhynchus* | | 99 | 18 |
| Coleoptera | Lycidae | Metriorrhynchinae | *Metriorrhynchus* | | 208 | 9 |
| Coleoptera | Lycidae | Metriorrhynchinae | *Metriorrhynchus* | | 802 | 1 |
| Coleoptera | Lycidae | Metriorrhynchinae | *Metriorrhynchus* | | 1992 | 1 |
| Coleoptera | Lycidae | Metriorrhynchinae | *Metriorrhynchus* | | 2000 | 3 |
| Coleoptera | Lycidae | Metriorrhynchinae | *Metriorrhynchus* | | 2643 | 1 |
| Coleoptera | Lycidae | Metriorrhynchinae | *Metriorrhynchus* | | 2644 | 1 |
| Coleoptera | Oedemeridae | Odemerinae | *Copidita* | | 1958 | 1 |
| Coleoptera | Oedemeridae | Odemerinae | *Copidita* | | 1962 | 1 |
| Coleoptera | Phycosecidae | Phycosecis | | | 191 | 2 |
| Coleoptera | Rhipiphoridae | Ptilophorinae | | | 2052 | 1 |
| Coleoptera | Scarabaeidae | | | | 1836 | 1 |
| Coleoptera | Scarabaeidae | | | | 1838 | 2 |
| Coleoptera | Scarabaeidae | | | | 2068 | 1 |
| Coleoptera | Scarabaeidae | | | | 2076 | 2 |
| Coleoptera | Scarabaeidae | | | | 2180 | 3 |
| Coleoptera | Scarabaeidae | | | | 2872 | 1 |
| Coleoptera | Scarabaeidae | | | | 2945 | 9 |
| Coleoptera | Scarabaeidae | | | | 2995 | 1 |
| Coleoptera | Scarabaeidae | | *Metanastes* | | 1945 | 4 |
| Coleoptera | Scarabaeidae | Dynastinae | *Cryptodus* | | 189 | 28 |
| Coleoptera | Scarabaeidae | Dynastinae | *Cryptodus* | | 1160 | 7 |
| Coleoptera | Scarabaeidae | Dynastinae | *Semanopterus* | | 824 | 10 |
| Coleoptera | Scarabaeidae | Dynastinae | *Semanopterus* | | 1021 | 1 |
| Coleoptera | Scarabaeidae | Dynastinae | *Semanopterus* | | 1846 | 3 |
| Coleoptera | Scarabaeidae | Dynastinae | *Trissodon* | | 1562 | 1 |
| Coleoptera | Scarabaeidae | Dynastinae | *Trissodon* | | 2084 | 1 |
| Coleoptera | Scarabaeidae | Melolonthinae | | | 347 | 65 |
| Coleoptera | Scarabaeidae | Melolonthinae | | | 1843 | 7 |
| Coleoptera | Scarabaeidae | Melolonthinae | | | 1847 | 30 |

| Order | Family | Taxon 3 | Genus | Species | Msp ID # | Abun. |
|---|---|---|---|---|---|---|
| Coleoptera | Scarabaeidae | Melolonthinae | | | 1853 | 50 |
| Coleoptera | Scarabaeidae | Melolonthinae | | | 1863 | 1 |
| Coleoptera | Scarabaeidae | Melolonthinae | | | 1904 | 15 |
| Coleoptera | Scarabaeidae | Melolonthinae | | | 1905 | 4 |
| Coleoptera | Scarabaeidae | Melolonthinae | | | 1911 | 1 |
| Coleoptera | Scarabaeidae | Melolonthinae | | | 1915 | 8 |
| Coleoptera | Scarabaeidae | Melolonthinae | | | 1922 | 151 |
| Coleoptera | Scarabaeidae | Melolonthinae | | | 1925 | 1 |
| Coleoptera | Scarabaeidae | Melolonthinae | | | 1926 | 1 |
| Coleoptera | Scarabaeidae | Melolonthinae | | | 1948 | 1 |
| Coleoptera | Scarabaeidae | Melolonthinae | | | 2652 | 14 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Automolus ?* | | 212 | 1 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Colpochila* | | 1823 | 1 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Colpochila* | | 1866 | 2 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Colpochila* | | 2006 | 2 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Colpochila* | *antennalis* | 846 | 63 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Colpochila* | *bogaria ?* | 1063 | 1 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Colpochila* | *major* | 353 | 9 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Colymbomorpha* | *vittata* | 55 | 21 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Diphucephala* | | 1889 | 1 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Diphucephala* | | 1985 | 1 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | 28 | 50 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | 29 | 2 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | 70 | 31 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | 94 | 68 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | 154 | 2 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | 171 | 1 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | 172 | 1 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | 289 | 42 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | 347 | 21 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | 363 | 133 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | 418 | 1 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | 951 | 32 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | 991 | 1 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | 1073 | 3 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | 1116 | 4 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | 1133 | 34 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | 1192 | 48 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | 1566 | 3 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | 1660 | 1 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | 1820 | 8 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | 1822 | 4 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | 1856 | 11 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | 1863 | 10 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | 1923 | 82 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | 2727 | 1 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | 347 | 56 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Heteronyx* | | 359 | 17 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Liparetrus* | *jenkinsi* | 162 | 2 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Maechidius* | | 287 | 19 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Maechidius* | | 826 | 2 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Maechidus* | | 287 | 12 |

| Order | Family | Taxon 3 | Genus | Species | Msp ID # | Abun. |
|---|---|---|---|---|---|---|
| Coleoptera | Scarabaeidae | Melolonthinae | *Maechidus* | | 1136 | 2 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Maechidus ?* | | 1388 | 2 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Maechidus?* | | 1189 | 3 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Maechidus?* | | 1871 | 18 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Maechidus?* | | 2738 | 1 |
| Coleoptera | Scarabaeidae | Melolonthinae | *Scitalini* | | 1813 | 4 |
| Coleoptera | Scarabaeidae | Scarabaeinae | *Onthophagus* | | 1824 | 1 |
| Coleoptera | Scarabaeidae | Scarabaeinae | *Onthophagus* | | 511 | 1 |
| Coleoptera | Scarabaeidae | Scarabaeinae | *Onthophagus* | *ferox* | 17 | 34 |
| Coleoptera | Silphidae | Silphinae | *Ptomaphila* | | 1656 | 3 |
| Coleoptera | Silphidae | Silphinae | *Ptomaphila* | *lacrymosa* | 924 | 6 |
| Coleoptera | Staphylinidae | | | | 2094 | 2 |
| Coleoptera | Staphylinidae | | | | 2666 | 2 |
| Coleoptera | Staphylinidae | | | | 628 | 15 |
| Coleoptera | Tenebrionidae | Alleculinae | *Homotrysis* | | 2153 | 6 |
| Coleoptera | Tenebrionidae | Alleculinae | *Metistete* | | 340 | 29 |
| Coleoptera | Tenebrionidae | Alleculinae | *Metistete* | | 839 | 18 |
| Coleoptera | Tenebrionidae | Alleculinae | *Metistete* | | 995 | 1 |
| Coleoptera | Tenebrionidae | Alleculinae | *Metistete* | | 1104 | 7 |
| Coleoptera | Tenebrionidae | Alleculinae | *Tanychilus* | | 340 | 1 |
| Coleoptera | Tenebrionidae | Alleculinae | *Tanychilus* | | 348 | 2 |
| Coleoptera | Tenebrionidae | Amarygmini | *Chalcopteroides* | | 930 | 18 |
| Coleoptera | Tenebrionidae | Heleini | *Helea* | | 1012 | 7 |
| Coleoptera | Tenebrionidae | Heleini | *Helea* | | 1392 | 6 |
| Coleoptera | Tenebrionidae | Heleini | *Helea* | *perforata?* | 1389 | 5 |
| Coleoptera | Tenebrionidae | Lagriinae | *Adelium* | | 904 | 7 |
| Coleoptera | Tenebrionidae | Lagriinae | *Adelium* | | 1246 | 1 |
| Coleoptera | Tenebrionidae | Lagriinae | *Adelium* | | 1536 | 1 |
| Coleoptera | Tenebrionidae | Lagriinae | *Adelium* | | 2681 | 1 |
| Coleoptera | Tenebrionidae | Lagriinae | *Adelium* | | 288 | 1 |
| Coleoptera | Tenebrionidae | Lagriinae | *Metriolagria* | | 192 | 53 |
| Coleoptera | Tenebrionidae | Stenochiinae | *Oectosis* | | 711 | 1 |
| Coleoptera | Tenebrionidae | Titaenini | *Titaena* | | 2708 | 1 |
| Coleoptera | Trogidae | | | | 1949 | 1 |
| Coleoptera | Trogidae | | | | 2706 | 1 |
| Coleoptera | Trogidae | | *Omorgus* | | 825 | 12 |
| Coleoptera | Trogidae | | *Omorgus* | | 848 | 2 |
| Coleoptera | Trogidae | | *Omorgus* | | 935 | 1 |
| Coleoptera | Trogidae | | *Omorgus* | | 1086 | 1 |
| Coleoptera | Trogidae | | *Omorgus* | | 1097 | 5 |
| Dermaptera | | | | | 1538 | 8 |
| Dermaptera | | | | | 1790 | 1 |
| Dermaptera | | | | | 484 | 11 |
| Dermaptera | | | | | 491 | 3 |
| Dermaptera | | | | | 492 | 10 |
| Dermaptera | | | | | 734 | 1 |
| Dermaptera | Anisolabididae | | | | 1433 | 1 |
| Dermaptera | Anisolabididae | | | | 123 | 9 |
| Dermaptera | Anisolabididae | | | | 258 | 46 |
| Dermaptera | Anisolabididae | | | | 263 | 1 |
| Dermaptera | Anisolabididae | Anisolabidinae | | | 257 | 19 |
| Dermaptera | Anisolabididae | Anisolabidinae | | | 484 | 14 |

| Order | Family | Taxon 3 | Genus | Species | Msp ID # | Abun. |
|---|---|---|---|---|---|---|
| Dermaptera | Anisolabididae | Isolabelli | | | 682 | 1 |
| Dermaptera | Labiduridae | Labidurinae | | | 999 | 11 |
| Dermaptera | Labiduridae | Labidurinae | | | 1112 | 2 |
| Dermaptera | Labiduridae | Labidurinae | | | 1390 | 2 |
| Dermaptera | Labiduridae ? | | | | 2991 | 2 |
| Dermaptera | Labidurinae | Labidurinae | | | 1919 | 2 |
| Dermaptera | Spongiphoridae | Nesogastriinae | *Nesogaster?* | | 1113 | 8 |
| Dermaptera | Spongiphoridae | Nesogastriinae | *Nesogaster?* | | 1951 | 4 |
| Diplopoda | Craspedosomatida | | | | 2070 | 1 |
| Diplopoda | Julida | | | | 876 | 2 |
| Diplopoda | Julida | | | | 966 | 3 |
| Diplopoda | Julida | | | | 1526 | 1 |
| Diplopoda | Julida | | | | 1546 | 2 |
| Diplopoda | Julida | | | | 259 | 14 |
| Diplopoda | Julida | | | | 260 | 10 |
| Diplopoda | Julida | | | | 717 | 8 |
| Diplopoda | Siphonophorida | | | | 2074 | 2 |
| Diptera | | | | | 3002 | 1 |
| Diptera | Acroceridae | | | | 1472 | 1 |
| Diptera | Anthomyiidae | | | | 127 | 2 |
| Diptera | Asilidae | | | | 1232 | 1 |
| Diptera | Asilidae | | | | 1424 | 4 |
| Diptera | Asilidae | | | | 1478 | 1 |
| Diptera | Asilidae | | | | 1529 | 1 |
| Diptera | Asilidae | | | | 1842 | 3 |
| Diptera | Asilidae | | | | 1869 | 1 |
| Diptera | Asilidae | | | | 2647 | 14 |
| Diptera | Asilidae | | | | 2648 | 5 |
| Diptera | Asilidae | | | | 2650 | 2 |
| Diptera | Asilidae | | | | 2709 | 1 |
| Diptera | Asilidae | | | | 564 | 3 |
| Diptera | Asilidae | | | | 165 | 2 |
| Diptera | Asilidae | | | | 204 | 3 |
| Diptera | Asilidae | | | | 217 | 6 |
| Diptera | Asilidae | | | | 312 | 14 |
| Diptera | Asilidae | | | | 313 | 44 |
| Diptera | Asilidae | | | | 541 | 2 |
| Diptera | Asilidae | | | | 810 | 1 |
| Diptera | Athericidae? | | | | 2670 | 1 |
| Diptera | Bombylidae | | | | 1988 | 1 |
| Diptera | Bombyliidae | | | | 683 | 10 |
| Diptera | Bombyliidae | | | | 907 | 7 |
| Diptera | Bombyliidae | | | | 1053 | 2 |
| Diptera | Bombyliidae | | | | 1542 | 1 |
| Diptera | Bombyliidae | | | | 2063 | 1 |
| Diptera | Bombyliidae | | | | 2996 | 1 |
| Diptera | Bombyliidae | | | | 245 | 1 |
| Diptera | Bombyliidae | | | | 506 | 1 |
| Diptera | Bombyliidae | | | | 719 | 1 |
| Diptera | Calliphoridae | | | | 929 | 3 |
| Diptera | Calliphoridae | | | | 1398 | 1 |
| Diptera | Calliphoridae | | | | 1561 | 2 |

| Order | Family | Taxon 3 | Genus | Species | Msp ID # | Abun. |
|---|---|---|---|---|---|---|
| Diptera | Calliphoridae | | | | 1634 | 1 |
| Diptera | Calliphoridae | | | | 2080 | 1 |
| Diptera | Calliphoridae | Calliphorinae | *Calliphora* | | 53 | 11 |
| Diptera | Calliphoridae | Calliphorinae | *Calliphora* | | 480 | 2 |
| Diptera | Calliphoridae ? | poor specimen | | | 1419 | 3 |
| Diptera | Conopidae | | | | 1987 | 1 |
| Diptera | Lauxaniidae | | | | 1725 | 1 |
| Diptera | Lauxaniidae | | | | 2014 | 1 |
| Diptera | Lauxaniidae | | | | 125 | 4 |
| Diptera | Lauxaniidae | | | | 179 | 5 |
| Diptera | Muscidae | | | | 1961 | 1 |
| Diptera | Muscidae | | | | 205 | 1 |
| Diptera | Muscidae | | | | 68 | 16 |
| Diptera | Pyrgotidae | | | | 1850 | 3 |
| Diptera | Pyrgotidae | | | | 1940 | 1 |
| Diptera | Pyrgotidae | | | | 2638 | 1 |
| Diptera | Pyrgotidae | | | | 2736 | 1 |
| Diptera | Pyrgotidae | | | | 88 | 4 |
| Diptera | Sarcophagidae | | | | 128 | 4 |
| Diptera | Sarcophagidae | | | | 579 | 3 |
| Diptera | Sarcophagidae ? | | | | 575 | 1 |
| Diptera | Stratiomyidae | | | | 2044 | 1 |
| Diptera | Syrphidae | | | | 54 | 50 |
| Diptera | Syrphidae | | | | 130 | 11 |
| Diptera | Syrphidae | | | | 143 | 3 |
| Diptera | Syrphidae | | | | 569 | 1 |
| Diptera | Syrphidae | | | | 572 | 2 |
| Diptera | Syrphidae | | | | 1203 | 1 |
| Diptera | Syrphidae | | | | 1421 | 36 |
| Diptera | Syrphidae | | | | 1422 | 5 |
| Diptera | Syrphidae | | | | 1425 | 2 |
| Diptera | Syrphidae | | | | 1983 | 1 |
| Diptera | Syrphidae | | | | 2128 | 3 |
| Diptera | Syrphidae | | | | 129 | 9 |
| Diptera | Syrphidae | | | | 206 | 16 |
| Diptera | Tabanidae | | | | 473 | 34 |
| Diptera | Tabanidae | | | | 884 | 1 |
| Diptera | Tabanidae | | | | 901 | 2 |
| Diptera | Tabanidae | | | | 1297 | 3 |
| Diptera | Tabanidae | | | | 1440 | 1 |
| Diptera | Tabanidae | | | | 1548 | 6 |
| Diptera | Tabanidae | | | | 1630 | 3 |
| Diptera | Tabanidae | | | | 1950 | 1 |
| Diptera | Tabanidae | | | | 2922 | 2 |
| Diptera | Tabanidae | | | | 2983 | 1 |
| Diptera | Tabanidae | | | | 126 | 31 |
| Diptera | Tabanidae | | | | 178 | 15 |
| Diptera | Tabanidae | | | | 466 | 10 |
| Diptera | Tabanidae | | | | 467 | 15 |
| Diptera | Tabanidae | | | | 495 | 56 |
| Diptera | Tachinidae | | | | 1151 | 2 |
| Diptera | Tachinidae | | | | 2048 | 1 |

| Order | Family | Taxon 3 | Genus | Species | Msp ID # | Abun. |
|---|---|---|---|---|---|---|
| Diptera | Tachinidae | | | | 2058 | 2 |
| Diptera | Tachinidae | | | | 2075 | 3 |
| Diptera | Tachinidae | | | | 51 | 1 |
| Diptera | Tachinidae | | | | 498 | 3 |
| Diptera | Tachinidae | | | | 136 | 1 |
| Diptera | Tachinidae | | | | 464 | 1 |
| Diptera | Tachinidae | | | | 675 | 2 |
| Diptera | Therevidae | | | | 2646 | 7 |
| Diptera | Therevidae | | | | 142 | 3 |
| Diptera | Therevidae | | | | 532 | 6 |
| Diptera | Tipulidae | | | | 16 | 2499 |
| Diptera | Tipulidae | | | | 792 | 2 |
| Diptera | Tipulidae | Limoniinae | | | 2649 | 2 |
| Gastropoda | | | | | 969 | 5 |
| Gastropoda | | | | | 1431 | 6 |
| Gastropoda | | | | | 1527 | 6 |
| Gastropoda | | | | | 1565 | 1 |
| Gastropoda | | | | | 1590 | 1 |
| Hemiptera | Alydidae | | | | 1683 | 2 |
| Hemiptera | Alydidae | | | | 2020 | 4 |
| Hemiptera | Alydidae | | | | 2021 | 3 |
| Hemiptera | Cicadellidae | | | | 1072 | 1 |
| Hemiptera | Cicadellidae | | | | 1239 | 2 |
| Hemiptera | Cicadellidae | | | | 1934 | 2 |
| Hemiptera | Cicadellidae | | | | 2036 | 1 |
| Hemiptera | Cicadellidae | | | | 107 | 17 |
| Hemiptera | Cicadellidae | | | | 166 | 1 |
| Hemiptera | Cicadellidae | | | | 170 | 2 |
| Hemiptera | Cicadellidae | | | | 177 | 5 |
| Hemiptera | Cicadellidae | | | | 187 | 2 |
| Hemiptera | Cicadellidae | | | | 200 | 2 |
| Hemiptera | Cicadellidae | | | | 239 | 1 |
| Hemiptera | Cicadellidae | | | | 787 | 4 |
| Hemiptera | Cicadellidae ? | | | | 241 | 5 |
| Hemiptera | Cicadidae | | | | 916 | 2 |
| Hemiptera | Cicadidae | | | | 1851 | 1 |
| Hemiptera | Cicadidae | | | | 1873 | 1 |
| Hemiptera | Cicadidae | | | | 2078 | 1 |
| Hemiptera | Cicadidae | | | | 2087 | 1 |
| Hemiptera | Cicadidae | Tibicininae | *Cicadetta* | | 49 | 5 |
| Hemiptera | Coccoidea | | | | 164 | 1 |
| Hemiptera | Coreidae | Coreinae | *Amorbus* | *bispinus* | 700 | 20 |
| Hemiptera | Dictyopharidae | | | | 1524 | 3 |
| Hemiptera | Eurymelidae | Eurymelinae | *Pogonoscopus* | | 503 | 7 |
| Hemiptera | Flatidae | | | | 1415 | 7 |
| Hemiptera | Fulgoridae | | | | 1090 | 3 |
| Hemiptera | Fulgoridae | | | | 764 | 1 |
| Hemiptera | Gelastocoridae | Nerthrinae | *Nerthra* | | 1567 | 9 |
| Hemiptera | Gelastocoridae | Nerthrinae | *Nerthra* | | 2689 | 5 |
| Hemiptera | Gelastocoridae | Nerthrinae | *Nerthra* | | 2694 | 1 |
| Hemiptera | Hyocephalidae | | *Hyocephalus* | *auprugnus* | 482 | 10 |
| Hemiptera | Lygaeidae | | | | 1445 | 2 |

| Order | Family | Taxon 3 | Genus | Species | Msp ID # | Abun. |
|---|---|---|---|---|---|---|
| Hemiptera | Lygaeidae | | | | 213 | 1 |
| Hemiptera | Lygaeidae ? | | | | 885 | 1 |
| Hemiptera | Membracidae | | | | 108 | 4 |
| Hemiptera | Membracidae | | | | 109 | 1 |
| Hemiptera | Membracidae | | | | 110 | 4 |
| Hemiptera | Membracidae | | | | 301 | 2 |
| Hemiptera | Membracidae | | | | 302 | 1 |
| Hemiptera | Miridae | | | | 188 | 1 |
| Hemiptera | Nabidae | | | | 964 | 1 |
| Hemiptera | Pentatomidae | | | | 221 | 31 |
| Hemiptera | Pentatomidae | | | | 838 | 3 |
| Hemiptera | Pentatomidae | | | | 960 | 5 |
| Hemiptera | Pentatomidae | | | | 962 | 15 |
| Hemiptera | Pentatomidae | | | | 963 | 1 |
| Hemiptera | Pentatomidae | | | | 1049 | 3 |
| Hemiptera | Pentatomidae | | | | 1195 | 2 |
| Hemiptera | Pentatomidae | | | | 1227 | 2 |
| Hemiptera | Pentatomidae | | | | 1302 | 4 |
| Hemiptera | Pentatomidae | | | | 1466 | 1 |
| Hemiptera | Pentatomidae | | | | 1697 | 2 |
| Hemiptera | Pentatomidae | | | | 1993 | 1 |
| Hemiptera | Pentatomidae | | | | 1995 | 1 |
| Hemiptera | Pentatomidae | | | | 2476 | 2 |
| Hemiptera | Pentatomidae | | | | 2998 | 1 |
| Hemiptera | Pentatomidae | | | | 678 | 4 |
| Hemiptera | Pentatomidae | | | | 105 | 10 |
| Hemiptera | Pentatomidae | | | | 117 | 1 |
| Hemiptera | Pentatomidae | | | | 153 | 9 |
| Hemiptera | Pentatomidae | | | | 176 | 1 |
| Hemiptera | Pentatomidae | | | | 240 | 1 |
| Hemiptera | Pentatomidae | | | | 251 | 28 |
| Hemiptera | Pentatomidae | | | | 475 | 4 |
| Hemiptera | Pentatomidae | | | | 513 | 2 |
| Hemiptera | Pentatomidae | | | | 599 | 1 |
| Hemiptera | Pentatomidae | | | | 670 | 2 |
| Hemiptera | Pentatomidae | | | | 680 | 5 |
| Hemiptera | Pentatomidae | Pentatominae | *Platycoris* | *brunneus* | 2066 | 2 |
| Hemiptera | Pentotomidae | | | | 669 | 7 |
| Hemiptera | Reduvidae | | | | 2930 | 3 |
| Hemiptera | Reduviidae | | | | 270 | 2 |
| Hemiptera | Reduviidae | | | | 863 | 3 |
| Hemiptera | Reduviidae | | | | 886 | 6 |
| Hemiptera | Reduviidae | | | | 1024 | 1 |
| Hemiptera | Reduviidae | | | | 1122 | 1 |
| Hemiptera | Reduviidae | | | | 1647 | 2 |
| Hemiptera | Reduviidae | | | | 1954 | 1 |
| Hemiptera | Reduviidae | | | | 2049 | 1 |
| Hemiptera | Reduviidae | | | | 2089 | 1 |
| Hemiptera | Reduviidae | | | | 150 | 35 |
| Hemiptera | Reduviidae | | | | 163 | 20 |
| Hemiptera | Reduviidae | | | | 196 | 4 |
| Hemiptera | Reduviidae | | | | 284 | 2 |

| Order | Family | Taxon 3 | Genus | Species | Msp ID # | Abun. |
|---|---|---|---|---|---|---|
| Hemiptera | Reduviidae | | | | 311 | 11 |
| Hemiptera | Reduviidae | | | | 512 | 1 |
| Hemiptera | Reduviidae | | | | 714 | 11 |
| Hemiptera | Reduviidae | Emesinae | | | 433 | 9 |
| Hemiptera | Reduviidae | Emesinae | | | 1102 | 3 |
| Hemiptera | Reduviidae | Emesinae | | | 2016 | 2 |
| Hemiptera | Reduviidae | Emesinae | | | 2065 | 1 |
| Hemiptera | Reduviidae | Emesinae | | | 2079 | 1 |
| Hemiptera | Reduviidae | Emesinae | | | 489 | 10 |
| Hemiptera | Reduviidae | Saicinae | | | 2677 | 1 |
| Hymenoptera | | | | | 504 | 3 |
| Hymenoptera | Anthophoridae | | | | 2018 | 1 |
| Hymenoptera | Anthophoridae | | | | 186 | 4 |
| Hymenoptera | Anthophoridae | | | | 203 | 46 |
| Hymenoptera | Anthrophoridae | | | | 2984 | 1 |
| Hymenoptera | Apidae | | *Apis* | *melifera* | 52 | 54 |
| Hymenoptera | Braconidae | | | | 1258 | 1 |
| Hymenoptera | Braconidae | | | | 1467 | 1 |
| Hymenoptera | Braconidae | | | | 1525 | 1 |
| Hymenoptera | Braconidae | | | | 1528 | 1 |
| Hymenoptera | Braconidae | | | | 2057 | 1 |
| Hymenoptera | Braconidae | | | | 2927 | 1 |
| Hymenoptera | Braconidae | | | | 184 | 1 |
| Hymenoptera | Braconidae | | | | 493 | 1 |
| Hymenoptera | Chrysididae | Chrysidinae ? | | | 1552 | 1 |
| Hymenoptera | Colletidae | | | | 1977 | 2 |
| Hymenoptera | Colletidae | | | | 2028 | 1 |
| Hymenoptera | Colletidae | | | | 2095 | 1 |
| Hymenoptera | Colletidae | | | | 2980 | 1 |
| Hymenoptera | Colletidae | | | | 2989 | 2 |
| Hymenoptera | Colletidae | | | | 696 | 1 |
| Hymenoptera | Colletidae | Euryglossinae | | | 2056 | 1 |
| Hymenoptera | Colletidae | Euryglossinae | | | 2665 | 3 |
| Hymenoptera | Colletidae ? | | | | 2001 | 12 |
| Hymenoptera | Evaniidae | | | | 1553 | 1 |
| Hymenoptera | Evaniidae | | | | 2069 | 1 |
| Hymenoptera | Evaniidae | | | | 2103 | 1 |
| Hymenoptera | Evaniidae | | | | 243 | 1 |
| Hymenoptera | Evaniidae | | | | 500 | 1 |
| Hymenoptera | Formicidae | | | | 888 | 9 |
| Hymenoptera | Formicidae | | | | 889 | 1 |
| Hymenoptera | Formicidae | | | | 952 | 1 |
| Hymenoptera | Formicidae | | | | 1006 | 1 |
| Hymenoptera | Formicidae | | | | 1011 | 2 |
| Hymenoptera | Formicidae | | | | 1495 | 2 |
| Hymenoptera | Formicidae | | | | 1496 | 1 |
| Hymenoptera | Formicidae | | | | 1497 | 14 |
| Hymenoptera | Formicidae | | | | 1507 | 3 |
| Hymenoptera | Formicidae | | | | 1537 | 1 |
| Hymenoptera | Formicidae | | | | 2951 | 1 |
| Hymenoptera | Formicidae | | | | 510 | 1 |
| Hymenoptera | Formicidae | Cerapachyinae | | | 1569 | 1 |

| Order | Family | Taxon 3 | Genus | Species | Msp ID # | Abun. |
|---|---|---|---|---|---|---|
| Hymenoptera | Formicidae | Dolichoderinae | *Iridomyrmex* | | 535 | 19 |
| Hymenoptera | Formicidae | Formicinae | | | 1912 | 2 |
| Hymenoptera | Formicidae | Formicinae | *Camponotus* | | 275 | 3 |
| Hymenoptera | Formicidae | Formicinae | *Camponotus* | | 423 | 259 |
| Hymenoptera | Formicidae | Formicinae | *Camponotus* | | 1585 | 9 |
| Hymenoptera | Formicidae | Formicinae | *Camponotus* | | 1594 | 1 |
| Hymenoptera | Formicidae | Formicinae | *Camponotus* | | 1602 | 2 |
| Hymenoptera | Formicidae | Formicinae | *Camponotus* | | 1661 | 4 |
| Hymenoptera | Formicidae | Formicinae | *Polyrhachis ?* | | 1969 | 1 |
| Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | 222 | 9 |
| Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | 252 | 11 |
| Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | 279 | 5 |
| Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | 281 | 8 |
| Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | 343 | 19 |
| Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | 486 | 4 |
| Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | 487 | 9 |
| Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | 552 | 1 |
| Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | 945 | 2 |
| Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | 974 | 4 |
| Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | 998 | 20 |
| Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | 1280 | 1 |
| Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | 1391 | 1 |
| Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | 1457 | 1 |
| Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | 1473 | 3 |
| Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | 1534 | 1 |
| Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | 1535 | 1 |
| Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | 1577 | 1 |
| Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | 1668 | 2 |
| Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | 1686 | 1 |
| Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | 1718 | 1 |
| Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | 1795 | 4 |
| Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | 1879 | 1 |
| Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | 1880 | 1 |
| Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | 1886 | 1 |
| Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | 1918 | 2 |
| Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | 2011 | 2 |
| Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | 2046 | 6 |
| Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | 2514 | 1 |
| Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | 2691 | 1 |
| Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | 2702 | 1 |
| Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | 2746 | 11 |
| Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | 408 | 27 |
| Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | 409 | 13 |
| Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | | 664 | 1 |
| Hymenoptera | Formicidae | Myrmeciinae | *Myrmecia* | *callima* | 477 | 12 |
| Hymenoptera | Formicidae | Myrmecinae | | | 2952 | 49 |
| Hymenoptera | Formicidae | Myrmecinae | *Myrmecia* | | 2920 | 120 |
| Hymenoptera | Formicidae | Ponerinae | | | 2104 | 2 |
| Hymenoptera | Formicidae | Ponerinae | *Pachycondyla* | | 737 | 11 |
| Hymenoptera | Formicidae | Ponerinae | *Rhytidoponera* | | 543 | 34 |
| Hymenoptera | Formicidae | Ponerinae | *Rhytidoponera* | | 1575 | 1 |
| Hymenoptera | Gasteruptiidae | | | | 2002 | 1 |

| Order | Family | Taxon 3 | Genus | Species | Msp ID # | Abun. |
|---|---|---|---|---|---|---|
| Hymenoptera | Gasteruptiidae | | | | 2972 | 1 |
| Hymenoptera | Halictidae | | | | 2982 | 1 |
| Hymenoptera | Ichneumonidae | | | | 1037 | 7 |
| Hymenoptera | Ichneumonidae | | | | 1038 | 14 |
| Hymenoptera | Ichneumonidae | | | | 1055 | 19 |
| Hymenoptera | Ichneumonidae | | | | 1077 | 1 |
| Hymenoptera | Ichneumonidae | | | | 1079 | 8 |
| Hymenoptera | Ichneumonidae | | | | 1089 | 1 |
| Hymenoptera | Ichneumonidae | | | | 1105 | 14 |
| Hymenoptera | Ichneumonidae | | | | 1146 | 2 |
| Hymenoptera | Ichneumonidae | | | | 1153 | 2 |
| Hymenoptera | Ichneumonidae | | | | 1164 | 1 |
| Hymenoptera | Ichneumonidae | | | | 1165 | 1 |
| Hymenoptera | Ichneumonidae | | | | 1436 | 1 |
| Hymenoptera | Ichneumonidae | | | | 1637 | 6 |
| Hymenoptera | Ichneumonidae | | | | 1771 | 2 |
| Hymenoptera | Ichneumonidae | | | | 1947 | 1 |
| Hymenoptera | Ichneumonidae | | | | 1953 | 1 |
| Hymenoptera | Ichneumonidae | | | | 1970 | 1 |
| Hymenoptera | Ichneumonidae | | | | 2004 | 1 |
| Hymenoptera | Ichneumonidae | | | | 2099 | 1 |
| Hymenoptera | Ichneumonidae | | | | 2152 | 1 |
| Hymenoptera | Ichneumonidae | | | | 2626 | 8 |
| Hymenoptera | Ichneumonidae | | | | 2660 | 1 |
| Hymenoptera | Ichneumonidae | | | | 2863 | 1 |
| Hymenoptera | Ichneumonidae | | | | 2864 | 1 |
| Hymenoptera | Ichneumonidae | | | | 2966 | 1 |
| Hymenoptera | Ichneumonidae | | | | 2997 | 1 |
| Hymenoptera | Ichneumonidae | | | | 515 | 1 |
| Hymenoptera | Ichneumonidae | Ophioninae | *Ophion* | | 87 | 46 |
| Hymenoptera | Megachilidae | | | | 893 | 1 |
| Hymenoptera | Megachilidae | | | | 183 | 6 |
| Hymenoptera | Mutillidae | | | | 2093 | 1 |
| Hymenoptera | Mutillidae | | | | 2096 | 1 |
| Hymenoptera | Mutillidae | | | | 2100 | 2 |
| Hymenoptera | Mutillidae | | | | 2101 | 1 |
| Hymenoptera | Mutillidae | | | | 580 | 3 |
| Hymenoptera | Pergidae | | | | 2680 | 2 |
| Hymenoptera | Pergidae | | | | 2712 | 1 |
| Hymenoptera | Pergidae | | | | 195 | 1 |
| Hymenoptera | Pergidae | Perginae | *Perga* | | 1550 | 1 |
| Hymenoptera | Pompilidae | | | | 1002 | 2 |
| Hymenoptera | Pompilidae | | | | 1017 | 1 |
| Hymenoptera | Pompilidae | | | | 1591 | 1 |
| Hymenoptera | Pompilidae | | | | 1598 | 1 |
| Hymenoptera | Pompilidae | | | | 1601 | 1 |
| Hymenoptera | Pompilidae | | | | 1788 | 1 |
| Hymenoptera | Pompilidae | | | | 2102 | 1 |
| Hymenoptera | Pompilidae | | | | 2105 | 1 |
| Hymenoptera | Pompilidae | | | | 584 | 1 |
| Hymenoptera | Pompilidae | | | | 611 | 1 |
| Hymenoptera | Pompilidae | | | | 813 | 1 |

| Order | Family | Taxon 3 | Genus | Species | Msp ID # | Abun. |
|---|---|---|---|---|---|---|
| Hymenoptera | Pompilidae | Pepsinae | *Chirodamini ?* | | 1781 | 1 |
| Hymenoptera | Pompillidae | | | | 2661 | 1 |
| Hymenoptera | Scoliidae | Scoliinae | | | 1859 | 1 |
| Hymenoptera | Scoliidae | Scoliinae | | | 2030 | 1 |
| Hymenoptera | Sphecidae | | | | 1212 | 1 |
| Hymenoptera | Sphecidae | | | | 1344 | 1 |
| Hymenoptera | Sphecidae | | | | 505 | 6 |
| Hymenoptera | Tiphiidae | | | | 1071 | 2 |
| Hymenoptera | Tiphiidae | | | | 1458 | 10 |
| Hymenoptera | Tiphiidae | | | | 1479 | 1 |
| Hymenoptera | Tiphiidae | | | | 1848 | 1 |
| Hymenoptera | Tiphiidae | | | | 1891 | 1 |
| Hymenoptera | Tiphiidae | | | | 1892 | 2 |
| Hymenoptera | Tiphiidae | | | | 1893 | 1 |
| Hymenoptera | Tiphiidae | | | | 1894 | 1 |
| Hymenoptera | Tiphiidae | | | | 1971 | 1 |
| Hymenoptera | Tiphiidae | | | | 1972 | 1 |
| Hymenoptera | Tiphiidae | | | | 2012 | 1 |
| Hymenoptera | Tiphiidae | | | | 2024 | 1 |
| Hymenoptera | Tiphiidae | | | | 2026 | 1 |
| Hymenoptera | Tiphiidae | | | | 2060 | 2 |
| Hymenoptera | Tiphiidae | | | | 2062 | 1 |
| Hymenoptera | Tiphiidae | | | | 2990 | 1 |
| Hymenoptera | Tiphiidae | | | | 2994 | 1 |
| Hymenoptera | Tiphiidae | | | | 295 | 2 |
| Hymenoptera | Tiphiidae | | | | 699 | 3 |
| Hymenoptera | Tiphiidae | | | | 796 | 2 |
| Hymenoptera | Tiphiidae | | | | 806 | 6 |
| Hymenoptera | Tiphiidae | Thyninnae | | | 2023 | 1 |
| Hymenoptera | Tiphiidae | Thyninnae | | | 2025 | 2 |
| Hymenoptera | Tiphiidae | Thyninnae | | | 2064 | 11 |
| Hymenoptera | Tiphiidae | Thyninnae | | | 2508 | 2 |
| Hymenoptera | Tiphiidae | Thyninnae | | | 2668 | 1 |
| Hymenoptera | Tiphiidae | Thyninnae | | | 2867 | 5 |
| Hymenoptera | Tiphiidae | Thynninae | | | 1325 | 1 |
| Hymenoptera | Tiphiidae | Thynninae | | | 1530 | 1 |
| Hymenoptera | Tiphiidae | Thynninae | | | 1861 | 1 |
| Hymenoptera | Tiphiidae | Thynninae | | | 1982 | 5 |
| Hymenoptera | Tiphiidae | Thynninae | | | 481 | 1 |
| Hymenoptera | Tiphiidae | Thynninae | | | 494 | 2 |
| Hymenoptera | Tiphiidae | Thynninae | | | 516 | 1 |
| Hymenoptera | Tiphiidae | Thynninae | | | 801 | 7 |
| Hymenoptera | Tiphiidae ? | | | | 3003 | 1 |
| Hymenoptera | Vespidae | | | | 894 | 1 |
| Hymenoptera | Vespidae | Polistinae | *Polistes* | | 2029 | 2 |
| Isopoda | | | | | 267 | 1 |
| Isopoda | | | | | 544 | 187 |
| Isopoda | | | | | 549 | 25 |
| Isopoda | | | | | 1305 | 5 |
| Isopoda | | | | | 1430 | 8 |
| Isopoda | | | | | 1586 | 7 |
| Isopoda | | | | | 2053 | 2 |

| Order | Family | Taxon 3 | Genus | Species | Msp ID # | Abun. |
|---|---|---|---|---|---|---|
| Isopoda | | | | | 2416 | 2 |
| Isopoda | | | | | 2675 | 1 |
| Isopoda | | | | | 2676 | 15 |
| Isopoda | | | | | 2968 | 1 |
| Isopoda | | collective | | | 519 | 6 |
| Isopoda | | | | | 262 | 7 |
| Isopoda | | | | | 539 | 5 |
| Isopoda | | | | | 544 | 1 |
| Lepidoptera | | | | | 63 | 597 |
| Lepidoptera | | | | | 316 | 242 |
| Lepidoptera | | | | | 344 | 1 |
| Lepidoptera | | | | | 366 | 61 |
| Lepidoptera | | | | | 559 | 1 |
| Lepidoptera | | | | | 583 | 1 |
| Lepidoptera | | | | | 797 | 50 |
| Lepidoptera | | | | | 828 | 1 |
| Lepidoptera | | | | | 829 | 1 |
| Lepidoptera | | | | | 840 | 3 |
| Lepidoptera | | | | | 849 | 1 |
| Lepidoptera | | | | | 866 | 1 |
| Lepidoptera | | | | | 900 | 4 |
| Lepidoptera | | | | | 921 | 7 |
| Lepidoptera | | | | | 944 | 1 |
| Lepidoptera | | | | | 950 | 1 |
| Lepidoptera | | | | | 954 | 4 |
| Lepidoptera | | | | | 983 | 9 |
| Lepidoptera | | | | | 984 | 1 |
| Lepidoptera | | | | | 985 | 2 |
| Lepidoptera | | | | | 1019 | 1 |
| Lepidoptera | | | | | 1031 | 119 |
| Lepidoptera | | | | | 1032 | 1 |
| Lepidoptera | | | | | 1047 | 252 |
| Lepidoptera | | | | | 1060 | 1 |
| Lepidoptera | | | | | 1070 | 1 |
| Lepidoptera | | | | | 1075 | 4 |
| Lepidoptera | | | | | 1078 | 1 |
| Lepidoptera | | | | | 1081 | 7 |
| Lepidoptera | | | | | 1085 | 13 |
| Lepidoptera | | | | | 1095 | 1 |
| Lepidoptera | | | | | 1129 | 1 |
| Lepidoptera | | | | | 1140 | 2 |
| Lepidoptera | | | | | 1149 | 2 |
| Lepidoptera | | | | | 1161 | 1 |
| Lepidoptera | | | | | 1169 | 5 |
| Lepidoptera | | | | | 1488 | 8 |
| Lepidoptera | | | | | 1490 | 46 |
| Lepidoptera | | | | | 1492 | 4 |
| Lepidoptera | | | | | 1493 | 4 |
| Lepidoptera | | | | | 1499 | 1 |
| Lepidoptera | | | | | 1504 | 2 |
| Lepidoptera | | | | | 1506 | 1 |
| Lepidoptera | | | | | 1510 | 1 |

| Order | Family | Taxon 3 | Genus | Species | Msp ID # | Abun. |
|---|---|---|---|---|---|---|
| Lepidoptera | | | | | 1513 | 25 |
| Lepidoptera | | | | | 1519 | 3 |
| Lepidoptera | | | | | 1628 | 105 |
| Lepidoptera | | | | | 1655 | 1 |
| Lepidoptera | | | | | 1659 | 1 |
| Lepidoptera | | | | | 1829 | 1 |
| Lepidoptera | | | | | 1854 | 7 |
| Lepidoptera | | | | | 1860 | 1 |
| Lepidoptera | | | | | 1862 | 2 |
| Lepidoptera | | | | | 1865 | 6 |
| Lepidoptera | | | | | 1870 | 3 |
| Lepidoptera | | | | | 1874 | 1 |
| Lepidoptera | | | | | 1875 | 1 |
| Lepidoptera | | | | | 1896 | 1 |
| Lepidoptera | | | | | 1900 | 1 |
| Lepidoptera | | | | | 1907 | 4 |
| Lepidoptera | | | | | 1910 | 2 |
| Lepidoptera | | | | | 1913 | 1 |
| Lepidoptera | | | | | 1924 | 15 |
| Lepidoptera | | | | | 1937 | 4 |
| Lepidoptera | | | | | 1942 | 1 |
| Lepidoptera | | | | | 1952 | 1 |
| Lepidoptera | | | | | 1963 | 1 |
| Lepidoptera | | | | | 1966 | 1 |
| Lepidoptera | | | | | 1967 | 1 |
| Lepidoptera | | | | | 2022 | 2 |
| Lepidoptera | | | | | 2109 | 1 |
| Lepidoptera | | | | | 2113 | 1 |
| Lepidoptera | | | | | 2126 | 2 |
| Lepidoptera | | | | | 2185 | 2 |
| Lepidoptera | | | | | 2446 | 3 |
| Lepidoptera | | | | | 2628 | 1 |
| Lepidoptera | | | | | 2631 | 1 |
| Lepidoptera | | | | | 2637 | 4 |
| Lepidoptera | | | | | 2645 | 1 |
| Lepidoptera | | | | | 2654 | 2 |
| Lepidoptera | | | | | 2657 | 2 |
| Lepidoptera | | | | | 2713 | 1 |
| Lepidoptera | | | | | 2717 | 1 |
| Lepidoptera | | | | | 2888 | 2 |
| Lepidoptera | | | | | 2909 | 1 |
| Lepidoptera | | | | | 2914 | 1 |
| Lepidoptera | | | | | 2915 | 1 |
| Lepidoptera | | | | | 2917 | 1 |
| Lepidoptera | | | | | 2923 | 1 |
| Lepidoptera | | | | | 2924 | 1 |
| Lepidoptera | | | | | 2928 | 1 |
| Lepidoptera | | | | | 2929 | 5 |
| Lepidoptera | | | | | 2932 | 20 |
| Lepidoptera | | | | | 2933 | 2 |
| Lepidoptera | | | | | 2934 | 1 |
| Lepidoptera | | | | | 2938 | 5 |

| Order | Family | Taxon 3 | Genus | Species | Msp ID # | Abun. |
|---|---|---|---|---|---|---|
| Lepidoptera | | | | | 2948 | 4 |
| Lepidoptera | | | | | 2949 | 1 |
| Lepidoptera | | | | | 2950 | 1 |
| Lepidoptera | | | | | 2958 | 2 |
| Lepidoptera | | | | | 2962 | 1 |
| Lepidoptera | | | | | 2963 | 4 |
| Lepidoptera | | | | | 2965 | 1 |
| Lepidoptera | | | *the dart* | | 322 | 184 |
| Lepidoptera | | | | | 48 | 743 |
| Lepidoptera | | | | | 76 | 65 |
| Lepidoptera | | | | | 197 | 1 |
| Lepidoptera | | | | | 238 | 1 |
| Lepidoptera | | | | | 315 | 1 |
| Lepidoptera | | | | | 367 | 7 |
| Lepidoptera | | | | | 376 | 314 |
| Lepidoptera | | | | | 399 | 1 |
| Lepidoptera | | | | | 411 | 150 |
| Lepidoptera | | | | | 420 | 45 |
| Lepidoptera | | | | | 428 | 5 |
| Lepidoptera | | | | | 430 | 59 |
| Lepidoptera | | | | | 456 | 1 |
| Lepidoptera | | | | | 459 | 13 |
| Lepidoptera | | | | | 657 | 8 |
| Lepidoptera | | | | | 760 | 10 |
| Lepidoptera | Aganaidae | | | | 946 | 1 |
| Lepidoptera | Anthelidae | | | | 1627 | 20 |
| Lepidoptera | Anthelidae | Anthelinae | *Anthela* | | 352 | 5 |
| Lepidoptera | Anthelidae | Anthelinae ? | *Anthela ?* | | 381 | 21 |
| Lepidoptera | Anthelidae | Anthelinae ? | *Anthela ?* | | 457 | 273 |
| Lepidoptera | Arctiidae | | | | 6 | 470 |
| Lepidoptera | Arctiidae | | | | 25 | 1 |
| Lepidoptera | Arctiidae | Arctiinae | | | 2112 | 1 |
| Lepidoptera | Arctiidae | Arctiinae | *Nyctemera* | *amica* | 1091 | 2 |
| Lepidoptera | Arctiidae | Arctiinae | *Spilosoma* | | 445 | 53 |
| Lepidoptera | Arctiidae | Arctiinae | *Spilosoma* | | 2111 | 1 |
| Lepidoptera | Arctiidae | Arctiinae | *Utetheisa* | *pulchelloides* | 987 | 5 |
| Lepidoptera | Bombycidae | | | | 749 | 61 |
| Lepidoptera | Carposinidae | | | | 917 | 2 |
| Lepidoptera | Carthaeidae | | *Carthaea* | *saturnioides* | 1 | 95 |
| Lepidoptera | Cossidae | | | | 2959 | 1 |
| Lepidoptera | Cossidae | | *Culama* | *australis ?* | 2957 | 1 |
| Lepidoptera | Depressariidae | | | | 324 | 23 |
| Lepidoptera | Depressariidae | | *Thalamarchella* | *alveola* | 141 | 165 |
| Lepidoptera | Gelechioidea | Gelechiidae ? | | | 658 | 49 |
| Lepidoptera | Geometridae | | | | 77 | 46 |
| Lepidoptera | Geometridae | | | | 323 | 4 |
| Lepidoptera | Geometridae | | | | 358 | 4 |
| Lepidoptera | Geometridae | | | | 652 | 1 |
| Lepidoptera | Geometridae | | | | 821 | 24 |
| Lepidoptera | Geometridae | | | | 827 | 2 |
| Lepidoptera | Geometridae | | | | 836 | 1 |
| Lepidoptera | Geometridae | | | | 855 | 35 |

| Order | Family | Taxon 3 | Genus | Species | Msp ID # | Abun. |
|---|---|---|---|---|---|---|
| Lepidoptera | Geometridae | | | | 856 | 1 |
| Lepidoptera | Geometridae | | | | 861 | 57 |
| Lepidoptera | Geometridae | | | | 915 | 1 |
| Lepidoptera | Geometridae | | | | 919 | 138 |
| Lepidoptera | Geometridae | | | | 923 | 7 |
| Lepidoptera | Geometridae | | | | 925 | 5 |
| Lepidoptera | Geometridae | | | | 942 | 1 |
| Lepidoptera | Geometridae | | | | 977 | 2 |
| Lepidoptera | Geometridae | | | | 978 | 6 |
| Lepidoptera | Geometridae | | | | 986 | 2 |
| Lepidoptera | Geometridae | | | | 1003 | 1 |
| Lepidoptera | Geometridae | | | | 1028 | 2 |
| Lepidoptera | Geometridae | | | | 1034 | 32 |
| Lepidoptera | Geometridae | | | | 1036 | 2 |
| Lepidoptera | Geometridae | | | | 1098 | 1 |
| Lepidoptera | Geometridae | | | | 1106 | 3 |
| Lepidoptera | Geometridae | | | | 1128 | 3 |
| Lepidoptera | Geometridae | | | | 1132 | 1 |
| Lepidoptera | Geometridae | | | | 1137 | 1 |
| Lepidoptera | Geometridae | | | | 1155 | 1 |
| Lepidoptera | Geometridae | | | | 1503 | 30 |
| Lepidoptera | Geometridae | | | | 1509 | 1 |
| Lepidoptera | Geometridae | | | | 1514 | 1 |
| Lepidoptera | Geometridae | | | | 1515 | 1 |
| Lepidoptera | Geometridae | | | | 1516 | 4 |
| Lepidoptera | Geometridae | | | | 1517 | 2 |
| Lepidoptera | Geometridae | | | | 1625 | 1 |
| Lepidoptera | Geometridae | | | | 1828 | 2 |
| Lepidoptera | Geometridae | | | | 1831 | 10 |
| Lepidoptera | Geometridae | | | | 1835 | 1 |
| Lepidoptera | Geometridae | | | | 1857 | 1 |
| Lepidoptera | Geometridae | | | | 1876 | 1 |
| Lepidoptera | Geometridae | | | | 1908 | 4 |
| Lepidoptera | Geometridae | | | | 1955 | 1 |
| Lepidoptera | Geometridae | | | | 1957 | 1 |
| Lepidoptera | Geometridae | | | | 1964 | 3 |
| Lepidoptera | Geometridae | | | | 2123 | 6 |
| Lepidoptera | Geometridae | | | | 2190 | 1 |
| Lepidoptera | Geometridae | | | | 2633 | 2 |
| Lepidoptera | Geometridae | | | | 2634 | 1 |
| Lepidoptera | Geometridae | | | | 2639 | 3 |
| Lepidoptera | Geometridae | | | | 2640 | 1 |
| Lepidoptera | Geometridae | | | | 2653 | 1 |
| Lepidoptera | Geometridae | | | | 2705 | 1 |
| Lepidoptera | Geometridae | | | | 2925 | 3 |
| Lepidoptera | Geometridae | | | | 2926 | 1 |
| Lepidoptera | Geometridae | | | | 2931 | 1 |
| Lepidoptera | Geometridae | | | | 2937 | 1 |
| Lepidoptera | Geometridae | | | | 2956 | 2 |
| Lepidoptera | Geometridae | | *Poecilasthena* | | 2630 | 7 |
| Lepidoptera | Geometridae | | | | 417 | 38 |
| Lepidoptera | Geometridae | | | | 20 | 24 |

| Order | Family | Taxon 3 | Genus | Species | Msp ID # | Abun. |
|---|---|---|---|---|---|---|
| Lepidoptera | Geometridae | | | | 24 | 62 |
| Lepidoptera | Geometridae | | | | 41 | 15 |
| Lepidoptera | Geometridae | | | | 47 | 68 |
| Lepidoptera | Geometridae | | | | 50 | 50 |
| Lepidoptera | Geometridae | | | | 61 | 21 |
| Lepidoptera | Geometridae | | | | 66 | 89 |
| Lepidoptera | Geometridae | | | | 67 | 648 |
| Lepidoptera | Geometridae | | | | 82 | 12 |
| Lepidoptera | Geometridae | | | | 85 | 1 |
| Lepidoptera | Geometridae | | | | 86 | 15 |
| Lepidoptera | Geometridae | | | | 95 | 46 |
| Lepidoptera | Geometridae | | | | 96 | 6 |
| Lepidoptera | Geometridae | | | | 97 | 1 |
| Lepidoptera | Geometridae | | | | 317 | 29 |
| Lepidoptera | Geometridae | | | | 318 | 1 |
| Lepidoptera | Geometridae | | | | 326 | 538 |
| Lepidoptera | Geometridae | | | | 338 | 1 |
| Lepidoptera | Geometridae | | | | 339 | 21 |
| Lepidoptera | Geometridae | | | | 350 | 6 |
| Lepidoptera | Geometridae | | | | 362 | 3 |
| Lepidoptera | Geometridae | | | | 369 | 3 |
| Lepidoptera | Geometridae | | | | 375 | 12 |
| Lepidoptera | Geometridae | | | | 382 | 28 |
| Lepidoptera | Geometridae | | | | 387 | 2 |
| Lepidoptera | Geometridae | | | | 389 | 8 |
| Lepidoptera | Geometridae | | | | 392 | 72 |
| Lepidoptera | Geometridae | | | | 395 | 6 |
| Lepidoptera | Geometridae | | | | 402 | 1 |
| Lepidoptera | Geometridae | | | | 403 | 20 |
| Lepidoptera | Geometridae | | | | 407 | 51 |
| Lepidoptera | Geometridae | | | | 422 | 50 |
| Lepidoptera | Geometridae | | | | 424 | 311 |
| Lepidoptera | Geometridae | | | | 425 | 42 |
| Lepidoptera | Geometridae | | | | 431 | 4 |
| Lepidoptera | Geometridae | | | | 434 | 2 |
| Lepidoptera | Geometridae | | | | 436 | 413 |
| Lepidoptera | Geometridae | | | | 438 | 8 |
| Lepidoptera | Geometridae | | | | 442 | 1 |
| Lepidoptera | Geometridae | | | | 451 | 4 |
| Lepidoptera | Geometridae | | | | 517 | 3 |
| Lepidoptera | Geometridae | | | | 638 | 33 |
| Lepidoptera | Geometridae | | | | 639 | 1 |
| Lepidoptera | Geometridae | | | | 646 | 12 |
| Lepidoptera | Geometridae | | | | 655 | 1 |
| Lepidoptera | Geometridae | | | | 691 | 144 |
| Lepidoptera | Geometridae | | | | 694 | 2 |
| Lepidoptera | Geometridae | | | | 754 | 230 |
| Lepidoptera | Geometridae | | | | 756 | 1 |
| Lepidoptera | Geometridae | | | | 757 | 46 |
| Lepidoptera | Geometridae | | | | 758 | 173 |
| Lepidoptera | Geometridae | | | | 776 | 22 |
| Lepidoptera | Geometridae | Ennominae | | | 83 | 20 |

| Order | Family | Taxon 3 | Genus | Species | Msp ID # | Abun. |
|---|---|---|---|---|---|---|
| Lepidoptera | Geometridae | Ennominae | *Ciampa* | *arietaria* | 1518 | 14 |
| Lepidoptera | Geometridae | Ennominae | *Ectropis ?* | | 23 | 97 |
| Lepidoptera | Geometridae | Ennominae | *Ectropis ?* | | 46 | 2 |
| Lepidoptera | Geometridae | Ennominae | *Pholodes* | | 384 | 50 |
| Lepidoptera | Geometridae | Ennominae | *Plesanemma* | | 2116 | 1 |
| Lepidoptera | Geometridae | Ennominae | *Stibaroma* | *melanotoxa* | 858 | 112 |
| Lepidoptera | Geometridae | Ennominae | *Stibaroma* | *melanotoxa* | 920 | 1 |
| Lepidoptera | Geometridae | Ennominae | *Thalaina* | *clara* | 450 | 3 |
| Lepidoptera | Geometridae | Geometrinae | *Chlorocoma* | | 22 | 174 |
| Lepidoptera | Geometridae | Geometrinae | *Chlorocoma* | *dicloraria* | 19 | 60 |
| Lepidoptera | Geometridae | Geometrinae | *Crypsiphona* | *ocultaria* | 330 | 38 |
| Lepidoptera | Geometridae | Geometrinae | *Eucyclodes* | *buprestaria* | 357 | 10 |
| Lepidoptera | Geometridae | Geometrinae | *Euloxia* | | 1179 | 8 |
| Lepidoptera | Geometridae | Geometrinae | *Heliomystis* | | 663 | 6 |
| Lepidoptera | Geometridae | Geometrinae | *Hypobapta* | | 955 | 9 |
| Lepidoptera | Geometridae | Geometrinae | *Hypobapta* | *barnardi* | 835 | 9 |
| Lepidoptera | Geometridae | Geometrinae | *Prasinocyma ?* | | 393 | 6 |
| Lepidoptera | Geometridae | Larentiina | *Xanthorhoe* | | 455 | 14 |
| Lepidoptera | Geometridae | Larentiinae | | | 1029 | 6 |
| Lepidoptera | Geometridae | Larentiinae | *Xanthorhoe* | | 42 | 211 |
| Lepidoptera | Geometridae | Oenochrominae | | | 2171 | 1 |
| Lepidoptera | Geometridae | Oenochrominae | | | 2754 | 1 |
| Lepidoptera | Geometridae | Oenochrominae | | | 72 | 36 |
| Lepidoptera | Geometridae | Oenochrominae | | | 355 | 3 |
| Lepidoptera | Geometridae | Oenochrominae | *Arcina* | *fulgorigera* | 631 | 43 |
| Lepidoptera | Geometridae | Oenochrominae | *Arhodia* | | 2 | 133 |
| Lepidoptera | Geometridae | Oenochrominae | *Arhodia* | | 79 | 12 |
| Lepidoptera | Geometridae | Oenochrominae | *Arhodia* | | 320 | 80 |
| Lepidoptera | Geometridae | Oenochrominae | *Dichromodes* | *personalis* | 321 | 13 |
| Lepidoptera | Geometridae | Oenochrominae | *Hypographa ?* | | 1521 | 1 |
| Lepidoptera | Geometridae | Oenochrominae | *Lissomma* | *serpentaria* | 832 | 5 |
| Lepidoptera | Geometridae | Oenochrominae | *Oenochroma* | | 31 | 61 |
| Lepidoptera | Geometridae | Oenochrominae | *Oenochroma* | | 976 | 1 |
| Lepidoptera | Geometridae | Oenochrominae | *Oenochroma* | *cerasiplaga* | 59 | 5 |
| Lepidoptera | Geometridae | Oenochrominae | *Oenochroma* | *vinaria* | 1045 | 6 |
| Lepidoptera | Geometridae | Oenochrominae | *Phallaria* | *ophiusaria* | 377 | 62 |
| Lepidoptera | Geometridae ? | | | | 625 | 1 |
| Lepidoptera | Geometridae ? | | | | 830 | 2 |
| Lepidoptera | Geometridae ? | | | | 862 | 7 |
| Lepidoptera | Geometridae ? | | | | 896 | 9 |
| Lepidoptera | Geometridae ? | | | | 918 | 6 |
| Lepidoptera | Geometridae ? | | | | 1022 | 17 |
| Lepidoptera | Geometridae ? | | | | 1056 | 2 |
| Lepidoptera | Geometridae ? | | | | 1099 | 1 |
| Lepidoptera | Geometridae ? | | | | 1494 | 8 |
| Lepidoptera | Geometridae ? | | | | 1965 | 1 |
| Lepidoptera | Geometridae ? | | | | 2635 | 1 |
| Lepidoptera | Geometridae ? | | | | 2703 | 6 |
| Lepidoptera | Geometridae ? | | | | 2714 | 1 |
| Lepidoptera | Geometridae ? | | | | 406 | 3 |
| Lepidoptera | Geometridae ? | | | | 421 | 29 |
| Lepidoptera | Geometridae ? | | | | 441 | 25 |

| Order | Family | Taxon 3 | Genus | Species | Msp ID # | Abun. |
|---|---|---|---|---|---|---|
| Lepidoptera | Geometridae ? | | | | 641 | 13 |
| Lepidoptera | Geometridae ? | | | | 652 | 57 |
| Lepidoptera | Geometridae ? | | | | 753 | 40 |
| Lepidoptera | Hepialidae | | *Abantiades* | | 958 | 6 |
| Lepidoptera | Hepialidae | | *Abantiades* | | 761 | 21 |
| Lepidoptera | Hepialidae | | *Abantiades* | *hydrographis* | 372 | 7 |
| Lepidoptera | Hepialidae | | *Abantiades* | *ocellatus* | 373 | 66 |
| Lepidoptera | Lasiocampidae | | | | 1657 | 6 |
| Lepidoptera | Lasiocampidae | | | | 1832 | 38 |
| Lepidoptera | Lasiocampidae | | | | 90 | 11 |
| Lepidoptera | Lasiocampidae | | | | 380 | 13 |
| Lepidoptera | Lasiocampidae | | | | 693 | 1 |
| Lepidoptera | Lasiocampidae | | | | 755 | 21 |
| Lepidoptera | Lasiocampidae | Lasiocampinae | *Entometa* | | 426 | 29 |
| Lepidoptera | Lasiocampidae | Lasiocampinae | *Entometa* | *fervens* | 91 | 11 |
| Lepidoptera | Limacodidae | | *Doratifera* | | 895 | 1 |
| Lepidoptera | Limacodidae | | *Doratifera* | | 1625 | 15 |
| Lepidoptera | Limacodidae | | *Doratifera* | *quadriguttata* | 551 | 6 |
| Lepidoptera | Limacodidae | | *Doratifera* | | 81 | 39 |
| Lepidoptera | Limacodidae | | *Doratifera* | | 332 | 11 |
| Lepidoptera | Limacodidae | | *Doratifera* | | 398 | 32 |
| Lepidoptera | Lycaenidae | | | | 296 | 1 |
| Lepidoptera | Lycaenidae | | | | 2067 | 1 |
| Lepidoptera | Lycaenidae | Polyommatinae | *Neolucia* | *agricola* | 296 | 5 |
| Lepidoptera | Lycaenidae | Polyommatinae | *Zizina* | *labradus* | 1341 | 1 |
| Lepidoptera | Lymantriidae | | *Teia* | *athlophora* | 2961 | 1 |
| Lepidoptera | Lymantriidae | | *Teia* | *athlophora* | 34 | 62 |
| Lepidoptera | Noctuidae | | | | 241 | 18 |
| Lepidoptera | Noctuidae | | | | 345 | 15 |
| Lepidoptera | Noctuidae | | | | 413 | 11 |
| Lepidoptera | Noctuidae | | | | 556 | 1 |
| Lepidoptera | Noctuidae | | | | 563 | 4 |
| Lepidoptera | Noctuidae | | | | 626 | 2 |
| Lepidoptera | Noctuidae | | | | 656 | 3 |
| Lepidoptera | Noctuidae | | | | 833 | 6 |
| Lepidoptera | Noctuidae | | | | 847 | 1 |
| Lepidoptera | Noctuidae | | | | 853 | 5 |
| Lepidoptera | Noctuidae | | | | 859 | 2 |
| Lepidoptera | Noctuidae | | | | 996 | 31 |
| Lepidoptera | Noctuidae | | | | 1046 | 12 |
| Lepidoptera | Noctuidae | | | | 1088 | 1 |
| Lepidoptera | Noctuidae | | | | 1139 | 22 |
| Lepidoptera | Noctuidae | | | | 1501 | 1 |
| Lepidoptera | Noctuidae | | | | 1502 | 3 |
| Lepidoptera | Noctuidae | | | | 1511 | 1 |
| Lepidoptera | Noctuidae | | | | 1658 | 13 |
| Lepidoptera | Noctuidae | | | | 1858 | 1 |
| Lepidoptera | Noctuidae | | | | 1872 | 1 |
| Lepidoptera | Noctuidae | | | | 1899 | 44 |
| Lepidoptera | Noctuidae | | | | 1944 | 50 |
| Lepidoptera | Noctuidae | | | | 1956 | 2 |
| Lepidoptera | Noctuidae | | | | 2117 | 2 |

| Order | Family | Taxon 3 | Genus | Species | Msp ID # | Abun. |
|---|---|---|---|---|---|---|
| Lepidoptera | Noctuidae | | | | 2122 | 1 |
| Lepidoptera | Noctuidae | | | | 2441 | 26 |
| Lepidoptera | Noctuidae | | | | 2627 | 14 |
| Lepidoptera | Noctuidae | | | | 2641 | 1 |
| Lepidoptera | Noctuidae | | | | 2704 | 1 |
| Lepidoptera | Noctuidae | | | | 2944 | 5 |
| Lepidoptera | Noctuidae | | | | 2953 | 5 |
| Lepidoptera | Noctuidae | | | | 336 | 7 |
| Lepidoptera | Noctuidae | | | | 25 | 88 |
| Lepidoptera | Noctuidae | | | | 33 | 35 |
| Lepidoptera | Noctuidae | | | | 38 | 133 |
| Lepidoptera | Noctuidae | | | | 75 | 66 |
| Lepidoptera | Noctuidae | | | | 133 | 5 |
| Lepidoptera | Noctuidae | | | | 137 | 94 |
| Lepidoptera | Noctuidae | | | | 138 | 1 |
| Lepidoptera | Noctuidae | | | | 139 | 2 |
| Lepidoptera | Noctuidae | | | | 140 | 84 |
| Lepidoptera | Noctuidae | | | | 344 | 10 |
| Lepidoptera | Noctuidae | | | | 364 | 3 |
| Lepidoptera | Noctuidae | | | | 383 | 22 |
| Lepidoptera | Noctuidae | | | | 386 | 160 |
| Lepidoptera | Noctuidae | | | | 391 | 48 |
| Lepidoptera | Noctuidae | | | | 394 | 21 |
| Lepidoptera | Noctuidae | | | | 405 | 16 |
| Lepidoptera | Noctuidae | | | | 412 | 8 |
| Lepidoptera | Noctuidae | | | | 419 | 24 |
| Lepidoptera | Noctuidae | | | | 435 | 3 |
| Lepidoptera | Noctuidae | | | | 443 | 4 |
| Lepidoptera | Noctuidae | | | | 446 | 4 |
| Lepidoptera | Noctuidae | | | | 449 | 6 |
| Lepidoptera | Noctuidae | | | | 454 | 23 |
| Lepidoptera | Noctuidae | | | | 640 | 7 |
| Lepidoptera | Noctuidae | | | | 642 | 6 |
| Lepidoptera | Noctuidae | | | | 648 | 6 |
| Lepidoptera | Noctuidae | | | | 649 | 8 |
| Lepidoptera | Noctuidae | | | | 694 | 1 |
| Lepidoptera | Noctuidae | | | | 750 | 93 |
| Lepidoptera | Noctuidae | | | | 765 | 2 |
| Lepidoptera | Noctuidae | | | | 770 | 59 |
| Lepidoptera | Noctuidae | | | | 771 | 3 |
| Lepidoptera | Noctuidae | | | | 799 | 4 |
| Lepidoptera | Noctuidae | Acronictinae | *Peripyra* | *sanguinipucta* | 379 | 32 |
| Lepidoptera | Noctuidae | Agaristinae | *Periscepta* | *polysticta* | 185 | 7 |
| Lepidoptera | Noctuidae | Amphipyrinae | | | 523 | 30 |
| Lepidoptera | Noctuidae | Amphipyrinae | | | 1020 | 4 |
| Lepidoptera | Noctuidae | Amphipyrinae | | | 1150 | 11 |
| Lepidoptera | Noctuidae | Amphipyrinae | | | 1512 | 1 |
| Lepidoptera | Noctuidae | Amphipyrinae | | | 1898 | 2 |
| Lepidoptera | Noctuidae | Amphipyrinae | | | 1909 | 30 |
| Lepidoptera | Noctuidae | Amphipyrinae | | | 414 | 90 |
| Lepidoptera | Noctuidae | Amphipyrinae | | | 452 | 6 |
| Lepidoptera | Noctuidae | Amphipyrinae | *Proteuxoa* | *pissonephra* | 39 | 1099 |

| Order | Family | Taxon 3 | Genus | Species | Msp ID # | Abun. |
|---|---|---|---|---|---|---|
| Lepidoptera | Noctuidae | Amphipyrinae | *Proteuxoa?* | | 2752 | 3 |
| Lepidoptera | Noctuidae | Catocalinae | *Dasypodia* | *selenophora* | 30 | 5 |
| Lepidoptera | Noctuidae | Catocalinae | *Lyncestis* | *melanoschista* | 415 | 38 |
| Lepidoptera | Noctuidae | Catocalinae | *Ophiusa* | | 1054 | 1 |
| Lepidoptera | Noctuidae | Catocalinae | *Pantydia* | | 5 | 82 |
| Lepidoptera | Noctuidae | Catocalinae | *Pantydia* | | 329 | 53 |
| Lepidoptera | Noctuidae | Catocalinae | *Pantydia* | | 388 | 172 |
| Lepidoptera | Noctuidae | Hadeninae | *Persectania* | *ewingii* | 40 | 160 |
| Lepidoptera | Noctuidae | Hypeninae | *Sandava* | *scitisigna* | 43 | 85 |
| Lepidoptera | Noctuidae | Noctuinae | *Agrotis* | | 844 | 2 |
| Lepidoptera | Noctuidae | Noctuinae | *Agrotis* | *munda* | 18 | 894 |
| Lepidoptera | Noctuidae | Nolinae | *Uraba* | *lugens* | 686 | 1 |
| Lepidoptera | Noctuidae | Plusiinae | *Chrysodeixis* | | 2114 | 1 |
| Lepidoptera | Noctuidae | Plusiinae | *Chrysodeixis* | *argentifera* | 659 | 4 |
| Lepidoptera | Noctuidae | Plusiinae | *Chrysodeixis* | *eriosoma* | 346 | 1 |
| Lepidoptera | Noctuidae | unknown battered noctuid | | | 1927 | 10 |
| Lepidoptera | Noctuidae | unknown battered noctuid | | | 1928 | 8 |
| Lepidoptera | Noctuidae | battered noctuid | | | 1929 | 5 |
| Lepidoptera | Noctuidae | battered noctuid | | | 1930 | 5 |
| Lepidoptera | Noctuidae ? | | | | 1094 | 1 |
| Lepidoptera | Noctuidae ? | | | | 2939 | 1 |
| Lepidoptera | Noctuidae ? | | | | 766 | 13 |
| Lepidoptera | Notodontidae | | *Destolmia* | | 4 | 67 |
| Lepidoptera | Notodontidae | | *Destolmia* | | 1839 | 1 |
| Lepidoptera | Notodontidae | | | | 80 | 35 |
| Lepidoptera | Notodontidae | | | | 374 | 322 |
| Lepidoptera | Notodontidae | | *Danima* | *banksiae* | 57 | 20 |
| Lepidoptera | Notodontidae | | *Hylaeora* | *dilucida* | 370 | 38 |
| Lepidoptera | Notodontidae | | *Sorama* | *bicolor* | 58 | 28 |
| Lepidoptera | Nymphalidae | Nymphalinae | *Vanessa* | *kershawi* | 1201 | 3 |
| Lepidoptera | Nymphalidae | Nymphalinae | *Vanessa* | *kershawi* | 1202 | 1 |
| Lepidoptera | Nymphalidae | Satyrinae | *Geitoneura* | *klugii* | 306 | 2 |
| Lepidoptera | Nymphalidae | Satyrinae | *Heteronympha* | *merope dub* | 298 | 5 |
| Lepidoptera | Oecophoridae | | | | 1833 | 525 |
| Lepidoptera | Oecophoridae | | | | 1840 | 86 |
| Lepidoptera | Oecophoridae | | | | 1895 | 8 |
| Lepidoptera | Oecophoridae | | | | 1903 | 33 |
| Lepidoptera | Oecophoridae | | | | 2623 | 2 |
| Lepidoptera | Oecophoridae | | | | 2940 | 1 |
| Lepidoptera | Oecophoridae | | | | 64 | 22 |
| Lepidoptera | Oecophoridae | | | | 65 | 15 |
| Lepidoptera | Oecophoridae | | | | 104 | 6 |
| Lepidoptera | Oecophoridae | | | | 396 | 49 |
| Lepidoptera | Oecophoridae | Oecophorinae | *Euchaetis* | | 2642 | 1 |
| Lepidoptera | Oecophoridae | Oecophorinae | *Philobota* | *xanthastis* | 111 | 1 |
| Lepidoptera | Oecophoridae | Oecophorinae | *Wingia* | | 1654 | 1 |
| Lepidoptera | Oecophoridae | Oecophorinae | *Wingia* | *aurata* | 331 | 4 |
| Lepidoptera | Oecophoridae | Oecophorinae | *Wingia* | *lambertella* | 2632 | 1 |
| Lepidoptera | Oecophoridae | Oecophorinae | *Zonopetala* | *clerota* | 325 | 2 |
| Lepidoptera | Oecophoridae ? | | | | 1626 | 9 |
| Lepidoptera | Oecophoridae ? | | | | 236 | 6 |
| Lepidoptera | Oecophoridae? | | | | 62 | 75 |

| Order | Family | Taxon 3 | Genus | Species | Msp ID # | Abun. |
|---|---|---|---|---|---|---|
| Lepidoptera | Oenosandridae | | *Discophlebia* | *lucasii* | 518 | 2 |
| Lepidoptera | Psychidae | Taleporiinae | *Iphierga* | | 1454 | 2 |
| Lepidoptera | Pyralidae | | | | 333 | 261 |
| Lepidoptera | Pyralidae | | | | 337 | 1 |
| Lepidoptera | Pyralidae | | | | 948 | 4 |
| Lepidoptera | Pyralidae | | | | 953 | 2 |
| Lepidoptera | Pyralidae | | | | 982 | 1 |
| Lepidoptera | Pyralidae | | | | 1051 | 894 |
| Lepidoptera | Pyralidae | | | | 1134 | 6 |
| Lepidoptera | Pyralidae | | | | 1135 | 3 |
| Lepidoptera | Pyralidae | | | | 1181 | 1 |
| Lepidoptera | Pyralidae | | | | 1489 | 85 |
| Lepidoptera | Pyralidae | | | | 1491 | 56 |
| Lepidoptera | Pyralidae | | | | 1834 | 15 |
| Lepidoptera | Pyralidae | | | | 1837 | 8 |
| Lepidoptera | Pyralidae | | | | 1864 | 3 |
| Lepidoptera | Pyralidae | | | | 2115 | 76 |
| Lepidoptera | Pyralidae | | | | 2440 | 7 |
| Lepidoptera | Pyralidae | | | | 2462 | 2 |
| Lepidoptera | Pyralidae | | | | 2946 | 2 |
| Lepidoptera | Pyralidae | | | | 342 | 67 |
| Lepidoptera | Pyralidae | | | | 356 | 48 |
| Lepidoptera | Pyralidae | | | | 365 | 8 |
| Lepidoptera | Pyralidae | | | | 397 | 101 |
| Lepidoptera | Pyralidae | | | | 401 | 5 |
| Lepidoptera | Pyralidae | Crambinae | *Hednota* | *hoplitella* | 979 | 2 |
| Lepidoptera | Pyralidae | Crambinae | *Hednota* | *recurvella* | 922 | 8 |
| Lepidoptera | Pyralidae | Epipaschiinae | | | 460 | 37 |
| Lepidoptera | Pyralidae | Epipaschiinae | | | 1126 | 30 |
| Lepidoptera | Pyralidae | Epipaschiinae ? | | | 73 | 77 |
| Lepidoptera | Pyralidae | Epipaschiinae ? | | | 1025 | 1 |
| Lepidoptera | Pyralidae | Pyraustinae | *Uresiphita* | *ornithopteralis* | 84 | 159 |
| Lepidoptera | Pyralidae ? | | | | 837 | 24 |
| Lepidoptera | Pyralidae ? | | | | 928 | 2 |
| Lepidoptera | Pyralidae ? | | | | 947 | 62 |
| Lepidoptera | Pyralidae ? | | | | 957 | 37 |
| Lepidoptera | Pyralidae ? | | | | 1166 | 1 |
| Lepidoptera | Pyralidae ? | | | | 1170 | 1 |
| Lepidoptera | Pyralidae ? | | | | 1633 | 1 |
| Lepidoptera | Pyralidae ? | | | | 12 | 55 |
| Lepidoptera | Pyralidae ? | | | | 661 | 33 |
| Lepidoptera | Pyralidae? | | | | 2110 | 2 |
| Lepidoptera | Saturniidae | | *Opodiphthera* | *helena* | 328 | 647 |
| Lepidoptera | Thaumetopoeidae | | | | 32 | 32 |
| Lepidoptera | Thaumetopoeidae | | | | 71 | 4 |
| Lepidoptera | Thaumetopoeidae | | | | 1068 | 4 |
| Lepidoptera | Thaumetopoeidae | | *Ochrogaster* | | 10 | 312 |
| Lepidoptera | Thaumetopoeidae | | *Ochrogaster* | | 2655 | 1 |
| Lepidoptera | Thaumetopoeidae | | *Tanystola* | | 1158 | 1 |
| Lepidoptera | Thaumetopoeidae | | | | 60 | 13 |
| Lepidoptera | Thaumetopoeidae | | | | 692 | 13 |
| Lepidoptera | Thaumetopoeidae | | *Epicoma* | *melanostica* | 3 | 174 |

| Order | Family | Taxon 3 | Genus | Species | Msp ID # | Abun. |
|---|---|---|---|---|---|---|
| Lepidoptera | Thaumetopoeidae | | *Ochrogaster* | | 7 | 208 |
| Lepidoptera | Thaumetopoeidae | | *Oenosandra* | *boisduvalii* | 404 | 7 |
| Lepidoptera | Thaumetopoeidae ? | | | | 864 | 53 |
| Lepidoptera | Thaumetopoeidae ? | | | | 1084 | 2 |
| Lepidoptera | Tineidae | | *Moerarchis* | *clathrella* | 319 | 75 |
| Lepidoptera | Tortricidae | | | | 943 | 6 |
| Lepidoptera | Tortricidae | | | | 92 | 28 |
| Lepidoptera | Tortricidae? | | | | 2716 | 4 |
| Lepidoptera | UNIDENTIFIABLE | | *unidentifiable* | *unidentifiable* | 1172 | 448 |
| Lepidoptera | Zygaenidae | | *Pollanisus* | | 78 | 123 |
| Lepidoptera | Zygaenidae | | *Pollanisus* | *cupreus* | 45 | 72 |
| Mantodea | Amorphoscelidae | | | | 1959 | 1 |
| Mantodea | Amorphoscelidae | | | | 2444 | 1 |
| Mantodea | Amorphoscelidae | | | | 2723 | 3 |
| Mantodea | Amorphoscelidae | Paraoxypilinae | | | 132 | 95 |
| Mantodea | Amorphoscelidae | Paraoxypilinae | *Paraoxypilus* | *tasmaniensis ?* | 739 | 3 |
| Mantodea | Mantidae | | | | 1459 | 5 |
| Mantodea | Mantidae | | | | 1541 | 4 |
| Mantodea | Mantidae | | | | 2107 | 1 |
| Mantodea | Mantidae | | | | 309 | 4 |
| Mantodea | Mantidae | | | | 674 | 1 |
| Mantodea | Mantidae | | | | 718 | 5 |
| Mantodea | Mantidae | | | | 784 | 3 |
| Mantodea | Mantidae | | *Hierodula* | | 767 | 4 |
| Mantodea | Mantidae | Mantinae | | | 981 | 1 |
| Mantodea | Mantidae | Mantinae | | | 1001 | 1 |
| Mecoptera | Bittacidae | | | | 1453 | 3 |
| Mecoptera | Bittacidae | | | | 1456 | 1 |
| Mecoptera | Bittacidae | | | | 1463 | 1 |
| Mecoptera | Bittacidae | | *Harpobittacus* | | 908 | 7 |
| Mecoptera | Bittacidae | | *Harpobittacus* | | 250 | 24 |
| Mecoptera | Meropeidae | | *Austromerope* | *poultoni* | 89 | 10 |
| Megaloptera | Corydalidae | Chauliodinae | *Archichauliodes* | | 1901 | 2 |
| Mygalomorphae | Barychelidae | | | | 1532 | 1 |
| Mygalomorphae | Barychelidae ? | | | | 497 | 1 |
| Mygalomorphae | Nemesiidae | | | | 887 | 4 |
| Mygalomorphae | Nemesiidae | | | | 1367 | 3 |
| Mygalomorphae | Nemesiidae | | | | 1401 | 2 |
| Mygalomorphae | Nemesiidae | | | | 1560 | 6 |
| Mygalomorphae | Nemesiidae | | | | 1792 | 5 |
| Mygalomorphae | Nemesiidae | | | | 1887 | 1 |
| Mygalomorphae | Nemesiidae | | | | 2042 | 3 |
| Mygalomorphae | Nemesiidae | | *Chenistonia* | | 567 | 1 |
| Mygalomorphae | Nemesiidae | | *Chenistonia* | | 581 | 12 |
| Mygalomorphae | Nemesiidae | | | | 538 | 4 |
| Mygalomorphae | Nemesiidae | | | | 585 | 2 |
| Mygalomorphae | Nemesiidae | | | | 283 | 2 |
| Mygalomorphae | Nemesiidae | | | | 502 | 1 |
| Mygalomorphae | Nemesiidae | | *Chenistonia* | | 721 | 29 |
| Neuroptera | Chrysopidae | | | | 949 | 1 |
| Neuroptera | Chrysopidae | | | | 1057 | 75 |
| Neuroptera | Chrysopidae | | | | 2047 | 3 |

| Order | Family | Taxon 3 | Genus | Species | Msp ID # | Abun. |
|---|---|---|---|---|---|---|
| Neuroptera | Chrysopidae | | | | 2054 | 3 |
| Neuroptera | Chrysopidae | | | | 2710 | 21 |
| Neuroptera | Chrysopidae | | | | 2715 | 1 |
| Neuroptera | Chrysopidae | | *Chrysopa* | | 822 | 81 |
| Neuroptera | Chrysopidae | | *Chrysopa* | | 361 | 15 |
| Neuroptera | Hemerobiidae | | | | 131 | 15 |
| Neuroptera | Hemerobiidae | | | | 360 | 75 |
| Neuroptera | Mantispidae | | | | 1315 | 1 |
| Neuroptera | Mantispidae | | | | 1921 | 2 |
| Neuroptera | Mantispidae | | | | 2010 | 1 |
| Neuroptera | Mantispidae | | | | 2215 | 1 |
| Neuroptera | Mantispidae | | | | 2935 | 1 |
| Neuroptera | Mantispidae | | | | 687 | 1 |
| Neuroptera | Myrmeleontidae | | | | 1906 | 10 |
| Neuroptera | Myrmeleontidae | | | | 1946 | 1 |
| Neuroptera | Myrmeleontidae | | | | 2742 | 2 |
| Neuroptera | Myrmeleontidae | | | | 305 | 2 |
| Neuroptera | Myrmeleontidae | | | | 400 | 88 |
| Neuroptera | Osmylidae | | | | 1920 | 2 |
| Neuroptera | Osmylidae | | | | 1938 | 60 |
| Odonata | | | | | 2987 | 1 |
| Odonata | Zygoptera | | | | 1005 | 1 |
| Odonata | Zygoptera | | | | 1758 | 1 |
| Odonata | Zygoptera | | | | 1996 | 1 |
| Odonata | Zygoptera | Lestoidea | | | 1004 | 1 |
| Odonata | Zygoptera | Lestoidea | | | 237 | 2 |
| Oligochaeta | | | | | 2663 | 1 |
| Oligochaeta | | | | | 2971 | 2 |
| Oligochaeta | Megascloecidae | | | | 2671 | 1 |
| Oligochaeta | Megascolecidae | | | | 1475 | 8 |
| Oligochaeta | Megascolecidae | | | | 1482 | 1 |
| Oligochaeta | Megascolecidae | | | | 1484 | 1 |
| Oligochaeta | Megascolecidae | | | | 1556 | 5 |
| Oligochaeta | Megascolecidae | | | | 2072 | 3 |
| Oligochaeta | Megascolecidae | | | | 2077 | 2 |
| Oligochaeta | Megascolecidae | | | | 2082 | 1 |
| Oligochaeta | Megascolecidae | | | | 2679 | 1 |
| Oligochaeta | Megascolecidae | | | | 2690 | 1 |
| Oligochaeta | Megascolecidae | | | | 2697 | 4 |
| Oligochaeta | Megascolecidae | | | | 2700 | 3 |
| Oligochaeta | Megascolecidae | collective | | | 520 | 1 |
| Onychophora | | | | | 937 | 1 |
| Onychophora | | | | | 1481 | 1 |
| Onychophora | | | | | 2999 | 3 |
| Opilionida | | | | | 1447 | 1 |
| Orthoptera | Acrididae | | | | 1210 | 4 |
| Orthoptera | Acrididae | | | | 1372 | 1 |
| Orthoptera | Acrididae | | | | 1452 | 2 |
| Orthoptera | Acrididae | | | | 1465 | 2 |
| Orthoptera | Acrididae | | | | 1498 | 1 |
| Orthoptera | Acrididae | | | | 1533 | 1 |
| Orthoptera | Acrididae | | | | 1545 | 1 |

| Order | Family | Taxon 3 | Genus | Species | Msp ID # | Abun. |
|---|---|---|---|---|---|---|
| Orthoptera | Acrididae | | | | 1549 | 1 |
| Orthoptera | Acrididae | | | | 1599 | 1 |
| Orthoptera | Acrididae | | | | 1666 | 2 |
| Orthoptera | Acrididae | | | | 1677 | 3 |
| Orthoptera | Acrididae | | | | 1976 | 8 |
| Orthoptera | Acrididae | | | | 2009 | 1 |
| Orthoptera | Acrididae | | | | 2031 | 2 |
| Orthoptera | Acrididae | | | | 2032 | 1 |
| Orthoptera | Acrididae | | | | 2045 | 1 |
| Orthoptera | Acrididae | | | | 2061 | 4 |
| Orthoptera | Acrididae | | | | 2086 | 1 |
| Orthoptera | Acrididae | | | | 2131 | 1 |
| Orthoptera | Acrididae | | | | 2133 | 1 |
| Orthoptera | Acrididae | | | | 2921 | 1 |
| Orthoptera | Acrididae | | | | 2954 | 1 |
| Orthoptera | Acrididae | | | | 2985 | 1 |
| Orthoptera | Acrididae | | | | 3004 | 1 |
| Orthoptera | Acrididae | | | | 174 | 18 |
| Orthoptera | Acrididae | | | | 294 | 1 |
| Orthoptera | Acrididae | | | | 501 | 5 |
| Orthoptera | Acrididae | | | | 738 | 1 |
| Orthoptera | Acrididae | | | | 782 | 4 |
| Orthoptera | Acrididae | Catantopinae | *Adreppus* | | 868 | 11 |
| Orthoptera | Acrididae | Catantopinae | *Adreppus* | | 1323 | 1 |
| Orthoptera | Acrididae | Catantopinae | *Cedarinia* | | 726 | 2 |
| Orthoptera | Acrididae | Catantopinae | *Cedarinia* | | 890 | 5 |
| Orthoptera | Acrididae | Catantopinae | *Cedarinia* | | 892 | 8 |
| Orthoptera | Acrididae | Catantopinae | *Cedarinia* | | 1572 | 1 |
| Orthoptera | Acrididae | Catantopinae | *Coryphistes* | | 231 | 28 |
| Orthoptera | Acrididae | Catantopinae | *Ecphantus* | | 1010 | 1 |
| Orthoptera | Acrididae | Catantopinae | *Ecphantus* | *sp nova* | 713 | 1 |
| Orthoptera | Acrididae | Catantopinae | *Goniaea* | | 232 | 10 |
| Orthoptera | Acrididae | Catantopinae | *Goniaea* | | 233 | 18 |
| Orthoptera | Acrididae | Catantopinae | *Goniaea* | | 255 | 8 |
| Orthoptera | Acrididae | Catantopinae | *Goniaea* | | 871 | 6 |
| Orthoptera | Acrididae | Catantopinae | *Goniaea* | | 872 | 41 |
| Orthoptera | Acrididae | Catantopinae | *Goniaea* | | 1441 | 2 |
| Orthoptera | Acrididae | Catantopinae | *Goniaea* | | 1470 | 6 |
| Orthoptera | Acrididae | Catantopinae | *Goniaea* | | 1547 | 3 |
| Orthoptera | Acrididae | Catantopinae | *Goniaea* | | 1984 | 3 |
| Orthoptera | Acrididae | Catantopinae | *Goniaea* | | 2019 | 1 |
| Orthoptera | Acrididae | Catantopinae | *Goniaea* | | 2664 | 1 |
| Orthoptera | Acrididae | Catantopinae | *Goniaea* | | 2682 | 1 |
| Orthoptera | Acrididae | Catantopinae | *Goniaea* | | 235 | 16 |
| Orthoptera | Acrididae | Catantopinae | *Goniaea* | | 272 | 8 |
| Orthoptera | Acrididae | Catantopinae | *Goniaea* | | 304 | 7 |
| Orthoptera | Acrididae | Catantopinae | *Goniaea ?* | | 273 | 2 |
| Orthoptera | Acrididae | Catantopinae | *Phaulacridium* | | 293 | 5 |
| Orthoptera | Acrididae | Catantopini | *Goniaeoidea* | | 2977 | 1 |
| Orthoptera | Eumastacidae | | | | 1345 | 2 |
| Orthoptera | Eumastacidae | | | | 1469 | 1 |
| Orthoptera | Gryllacrididae ? | super f Gryllacridoidea | | | 1935 | 1 |

| Order | Family | Taxon 3 | Genus | Species | Msp ID # | Abun. |
|---|---|---|---|---|---|---|
| Orthoptera | Gryllidae | | | | 834 | 5 |
| Orthoptera | Gryllidae | | | | 857 | 43 |
| Orthoptera | Gryllidae | | | | 994 | 1 |
| Orthoptera | Gryllidae | | | | 1349 | 1 |
| Orthoptera | Gryllidae | | | | 1508 | 1 |
| Orthoptera | Gryllidae | | | | 1604 | 1 |
| Orthoptera | Gryllidae | | | | 1981 | 1 |
| Orthoptera | Gryllidae | | *Teleogryllus* | *commodus* | 1916 | 13 |
| Orthoptera | Gryllidae | | | | 180 | 13 |
| Orthoptera | Gryllidae | | | | 216 | 1 |
| Orthoptera | Gryllidae | | | | 608 | 21 |
| Orthoptera | Gryllidae | | | | 609 | 2 |
| Orthoptera | Gryllidae | | | | 618 | 6 |
| Orthoptera | Gryllidae | | | | 809 | 1 |
| Orthoptera | Gryllidae | Brachytrupinae | *Apterogryllus* | | 811 | 3 |
| Orthoptera | Gryllotalpidae | | *Gryllotalpa* | | 1936 | 1 |
| Orthoptera | Gryllotalpidae | | *Gryllotalpa* | | 2092 | 1 |
| Orthoptera | Pyrgomorphidae | | | | 883 | 2 |
| Orthoptera | Stenopelmatidae | | | | 524 | 3 |
| Orthoptera | Stenopelmatidae | | | | 931 | 1 |
| Orthoptera | Stenopelmatidae | | | | 1008 | 6 |
| Orthoptera | Stenopelmatidae | | | | 1557 | 3 |
| Orthoptera | Stenopelmatidae | | | | 1582 | 1 |
| Orthoptera | Stenopelmatidae | Henicinae | *Onosandrus* | | 526 | 203 |
| Orthoptera | Stenopelmatidae ? | | | | 2097 | 1 |
| Orthoptera | Tetigoniidae | | | | 2129 | 2 |
| Orthoptera | Tettigoniidae | | | | 106 | 6 |
| Orthoptera | Tettigoniidae | | | | 578 | 1 |
| Orthoptera | Tettigoniidae | | | | 873 | 3 |
| Orthoptera | Tettigoniidae | | | | 881 | 6 |
| Orthoptera | Tettigoniidae | | | | 882 | 5 |
| Orthoptera | Tettigoniidae | | | | 902 | 1 |
| Orthoptera | Tettigoniidae | | | | 903 | 3 |
| Orthoptera | Tettigoniidae | | | | 980 | 3 |
| Orthoptera | Tettigoniidae | | | | 988 | 4 |
| Orthoptera | Tettigoniidae | | | | 1013 | 1 |
| Orthoptera | Tettigoniidae | | | | 1026 | 21 |
| Orthoptera | Tettigoniidae | | | | 1043 | 2 |
| Orthoptera | Tettigoniidae | | | | 1224 | 1 |
| Orthoptera | Tettigoniidae | | | | 1342 | 1 |
| Orthoptera | Tettigoniidae | | | | 1420 | 1 |
| Orthoptera | Tettigoniidae | | | | 1426 | 1 |
| Orthoptera | Tettigoniidae | | | | 1485 | 4 |
| Orthoptera | Tettigoniidae | | | | 1487 | 1 |
| Orthoptera | Tettigoniidae | | | | 1539 | 1 |
| Orthoptera | Tettigoniidae | | | | 1675 | 1 |
| Orthoptera | Tettigoniidae | | | | 1931 | 1 |
| Orthoptera | Tettigoniidae | | | | 2041 | 1 |
| Orthoptera | Tettigoniidae | | | | 2130 | 4 |
| Orthoptera | Tettigoniidae | | | | 2659 | 1 |
| Orthoptera | Tettigoniidae | | | | 2936 | 1 |
| Orthoptera | Tettigoniidae | | | | 2988 | 1 |

| Order | Family | Taxon 3 | Genus | Species | Msp ID # | Abun. |
|---|---|---|---|---|---|---|
| Orthoptera | Tettigoniidae | | | | 118 | 1 |
| Orthoptera | Tettigoniidae | | | | 149 | 2 |
| Orthoptera | Tettigoniidae | | | | 167 | 5 |
| Orthoptera | Tettigoniidae | | | | 202 | 1 |
| Orthoptera | Tettigoniidae | | | | 218 | 1 |
| Orthoptera | Tettigoniidae | | | | 246 | 1 |
| Orthoptera | Tettigoniidae | | | | 268 | 2 |
| Orthoptera | Tettigoniidae | | | | 276 | 1 |
| Orthoptera | Tettigoniidae | | | | 278 | 1 |
| Orthoptera | Tettigoniidae | | | | 310 | 1 |
| Orthoptera | Tettigoniidae | | | | 314 | 1 |
| Orthoptera | Tettigoniidae | | | | 688 | 3 |
| Orthoptera | Tettigoniidae | | | | 715 | 1 |
| Orthoptera | Tettigoniidae | | | | 791 | 2 |
| Orthoptera | Tettigoniidae | Phaneropterinae | *Caedicia* | | 485 | 6 |
| Orthoptera | Tettigoniidae | Phasmatidinae | | | 1997 | 2 |
| Orthoptera | Tettigoniidae | Phasmodinae | | | 1039 | 2 |
| Orthoptera | Tettigoniidae | Phasmodinae | | | 1052 | 2 |
| Orthoptera | Tettigoniidae | Phasmodinae | | | 1080 | 1 |
| Phasmatodea | Phasmatidae | | | | 973 | 2 |
| Phasmatodea | Phasmatidae | | | | 1520 | 1 |
| Phasmatodea | Phasmatidae | | | | 1968 | 2 |
| Phasmatodea | Phasmatidae | | | | 2005 | 1 |
| Phasmatodea | Phasmatidae | | | | 2043 | 1 |
| Phasmatodea | Phasmatidae | | | | 303 | 6 |
| Phasmatodea | Phasmatidae | | | | 458 | 5 |
| Phasmatodea | Phasmatidae | | | | 785 | 5 |
| Platyhelminthes | Tricladida | | | | 1385 | 1 |
| Platyhelminthes | Tricladida | | | | 1404 | 6 |
| Platyhelminthes | Tricladida | | | | 1568 | 2 |
| Platyhelminthes | Tricladida | | | | 521 | 3 |
| Scorpionida | | | | | 879 | 3 |
| Scorpionida | | | | | 880 | 47 |
| Scorpionida | | | | | 965 | 1 |
| Scorpionida | | | | | 1451 | 9 |
| Scorpionida | | | | | 1592 | 1 |
| Scorpionida | | | | | 1600 | 1 |
| Scorpionida | | | | | 2683 | 1 |
| Scorpionida | | | | | 2693 | 11 |
| Scorpionida | | | | | 469 | 29 |
| Scorpionida | | | | | 568 | 7 |
| Trichoptera | | | | | 1042 | 39 |
| Trichoptera | | | | | 1849 | 28 |
| Trichoptera | | | | | 1852 | 57 |
| Trichoptera | | | | | 2447 | 2 |
| Trichoptera | | | | | 2448 | 12 |
| Trichoptera | | | | | 2903 | 39 |
| Trichoptera | | | | | 69 | 1 |
| Trichoptera | | | | | 144 | 1034 |
| Trichoptera | | | | | 145 | 225 |
| Trichoptera | | | | | 146 | 60 |
| Trichoptera | | | | | 151 | 5 |

## DIURNAL BIRDS

G.L.Liddelow and Verna Tunsell

### Introduction

Donnelly FORESTCHECK grids were monitored for diurnal birds in the spring of 2007. 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 (external reference, coupe buffer, shelterwood and gap release)
- Comparing species richness and abundance between each treatment
- Analyzing trends within species between treatments

### Monitoring

Science Division personnel were able to undertake all the diurnal bird census work in 2007 and did not have to engage any outside assistance. Both sight and sound are used to identify the birds and the census technique (area search) is stated in the FORESTCHECK Operating Plan. However, due to unavailability of personnel, nocturnal bird surveys were not conducted in 2007.

There are ten FORESTCHECK grids in the Donnelly region which include three external references, three coupe buffers, one shelterwood and three gap release treatments.

### Preliminary Results and Discussion

A total of 35 species of birds, comprising of 667 individuals, were recorded across all ten grids (Table 1). There were 25 species and 205 individuals in the external reference treatment, 27 species and 184 individuals in coupe buffers, 19 species and 74 individuals in the single shelterwood and 29 species and 204 individuals in the gap release treatment grids.

Nineteen of the 35 species recorded during this survey had 10 or more individuals. These included the forest red-tailed black cockatoo (*Calyptorhynchus banksii naso*), three 'broad-tailed' parrots in the western rosella (*Platycercus icterotis*), red-capped (*Platycercus spuruius*) and twenty-eight Parrot (*Barnardius zonarius semitorquatus*), one upper canopy bird in the striated pardalote (*Pardalotus striatus*), one insectivorous arboreal bird in the black-faced cuckoo-shrike (*Coracina novaehollandiae*), the splendid (*Malurus splendens*) and red-winged (*M. elegans*) fairy wrens, the western white-naped honeyeater(*Melithreptus chloropsis*), six excellent songsters in the grey fantail (*Rhipidura fuliginosa*), scarlet robin (*Petroica multicolor*), white-breasted robin (*Eopsaltria georgiana*),western yellow robin (*E. griseogularis*), golden whistler (*Pachycephala pectoralis*) and the grey shrike-thrush (*Colluricincla harmonica*) and four small, mainly ground-dwelling or foliage-foraging, insectivorous birds in the western gerygone (*Gerygone fusca*), western thornbill (*Acanthiza inornata*), broad-tailed thornbill (*A. apicalis*) and the white-browed scrubwren (*Sericornis frontalis*).

**Table 1**. Bird species and number of individuals recorded in each treatment in the Donnelly FORESTCHECK grids in 2007 (RAOU = Royal Australian Ornithology Union number).

| RAOU | Scientific name | Common name | Total | External reference | Coupe buffer | Shelter-wood | Gap release |
|---|---|---|---|---|---|---|---|
| 1 | *Dromaius novaehollandiae* | Emu | **1** | | | | 1 |
| 34 | *Phaps chalcoptera* | Common Bronzewing | **1** | 1 | | | |
| 35 | *Phaps elegans* | Brush Bronzewing | **2** | | 1 | | 1 |
| 264 | *Calyptorhynchus banksii naso* | Forest Red-tailed Black Cockatoo | **19** | 9 | | 3 | 7 |
| 289 | *Platycercus icterotis* | Western Rosella | **21** | 6 | 7 | 1 | 7 |
| 290 | *Platycercus spurius* | Red-capped Parrot | **17** | 6 | 7 | 1 | 3 |
| 294 | *Barnardius zonarius semitorquatus* | Twenty-eight Parrot | **21** | 6 | 7 | 1 | 7 |
| 322 | *Dacelo novaeguineae* | Laughing Kookaburra | **7** | | 5 | 1 | 1 |
| 338 | *Cacomantis flabelliformis* | Fan-tailed Cuckoo | **3** | 1 | 2 | | |
| 342 | *Chrysococcyx basalis* | Horsefield's Bronze-cuckoo | **2** | | 2 | | |
| 361 | *Rhipidura fuliginosa* | Grey Fantail | **11** | 3 | 3 | 2 | 3 |
| 380 | *Petroica multicolor* | Scarlet Robin | **19** | 10 | 5 | 1 | 3 |
| 387 | *Eopsaltria georgiana* | White-breasted Robin | **13** | 7 | 5 | | 1 |
| 394 | *Eopsaltria australis griseogularis* | Western Yellow Robin | **18** | 9 | 4 | 4 | 1 |
| 398 | *Pachycephala pectoralis* | Golden Whistler | **44** | 14 | 7 | 8 | 15 |
| 408 | *Colluricincla harmonica* | Grey Shrike-thrush | **22** | 8 | 6 | 2 | 6 |
| 424 | *Coracina novaehollandiae* | Black-faced Cuckoo shrike | **10** | 3 | 3 | 3 | 1 |
| 430 | *Lalage tricolor* | White-winged Triller | **1** | 1 | | | |
| 463 | *Gerygone fusca* | Western Gerygone | **56** | 22 | 15 | 7 | 12 |
| 472 | *Acanthiza inornata* | Western Thornbill | **23** | 7 | 2 | 8 | 6 |
| 476 | *Acanthiza apicalis* | Broad-tailed (Inland) Thornbill | **135** | 27 | 46 | 18 | 44 |
| 486 | *Acanthiza chrysorrhoa* | Yellow-rumped Thornbill | **2** | | | 2 | |
| 488 | *Sericornis frontalis* | White-browed Scrubwren | **42** | 11 | 12 | | 19 |
| 532 | *Malurus splendens* | Splendid Fairy-wren | **29** | 12 | 3 | 2 | 12 |
| 538 | *Malurus elegans* | Red-winged Fairy-wren | **13** | | 6 | | 7 |
| 556 | *Climacteris rufa* | Rufous Treecreeper | **6** | 3 | 1 | 1 | 1 |
| 565 | *Pardalotus punctatus* | Spotted Pardalote | **1** | | | | 1 |
| 574 | *Zosterops lateralis lateralis* | Silvereye | **6** | | | | 6 |
| 578 | *Melithreptus chloropsis* | Western White-naped Honeyeater | **39** | 13 | 7 | 5 | 14 |
| 592 | *Acanthorhynchus superciliosus* | Western Spinebill | **6** | 2 | 1 | | 3 |
| 638 | *Anthochaera carunculata* | Red Wattlebird | **6** | 3 | 3 | | |
| 697 | *Sterpera versicolor* | Grey Currawong | **5** | | 4 | | 1 |
| 710 | *Anthochaera lunulata* | Western Little Wattlebird | **2** | | | | 2 |
| 930 | *Corvus coronoides* | Australian Raven | **4** | 1 | 1 | | 2 |
| 976 | *Pardalotus striatus* | Striated Pardalote | **60** | 20 | 19 | 4 | 17 |
| | | **Total Individuals** | **667** | 205 | 184 | 74 | 204 |
| | | **Birds/ha** | **13.3** | 13.7 | 12.3 | 14.8 | 13.6 |
| | | **Total Species** | **35** | 25 | 27 | 19 | 29 |

The density of birds was similar in each treatment, with the external reference having 13.6 birds $ha^{-1}$, coupe buffers had 12.2 $ha^{-1}$, the shelterwood 14.8 $ha^{-1}$and the gap release 13.6 $ha^{-1}$. Over all the treatments the density of birds was 13.3 birds $ha^{-1}$. The Kingston Bird Study which has been following the effects of logging in the southern forest since 1996 has bird densities in all treatments varying from 10.4 - 13.4 $ha^{-1}$.

In 2001 the Donnelly FORESTCHECK grids had 10.7 birds $ha^{-1}$; in 2002 the Wellington grids had 15.4 $ha^{-1}$, in 2003 the Perth Hills grids had 9.7 $ha^{-1}$, in 2004 the Wellington East grids had 9.7 $ha^{-1}$ and in 2005 Blackwood grids had 8.9 birds $ha^{-1}$.

Eight species of birds were recorded as occurring in only one treatment (either external reference, coupe buffer, shelterwood or gap release) (Table 1). However, none of these would be expected to be restricted to that treatment. Of these eight species, four had only one individual, three had two individuals and one had six individuals.

The most commonly recorded bird was the broad-tailed (inland) thornbill with 135 records. Even though this species enjoys the re-growth following regeneration it was observed in all treatments with the coupe buffer and gap release being the most productive (46 and 44 records). This was followed by the upper canopy, insectivorous striated pardalote with 60 records, of which 20 came from the external reference grids, 19 from coupe buffers, 17 from gap release grids and only 4 from the single shelterwood grid. The western gerygone had 56 records, the golden whistler 44 and the white-browed scrubwren with 42 records (Fig 1). Surprisingly, the white-browed scrubwren was not recorded in the shelterwood grid.

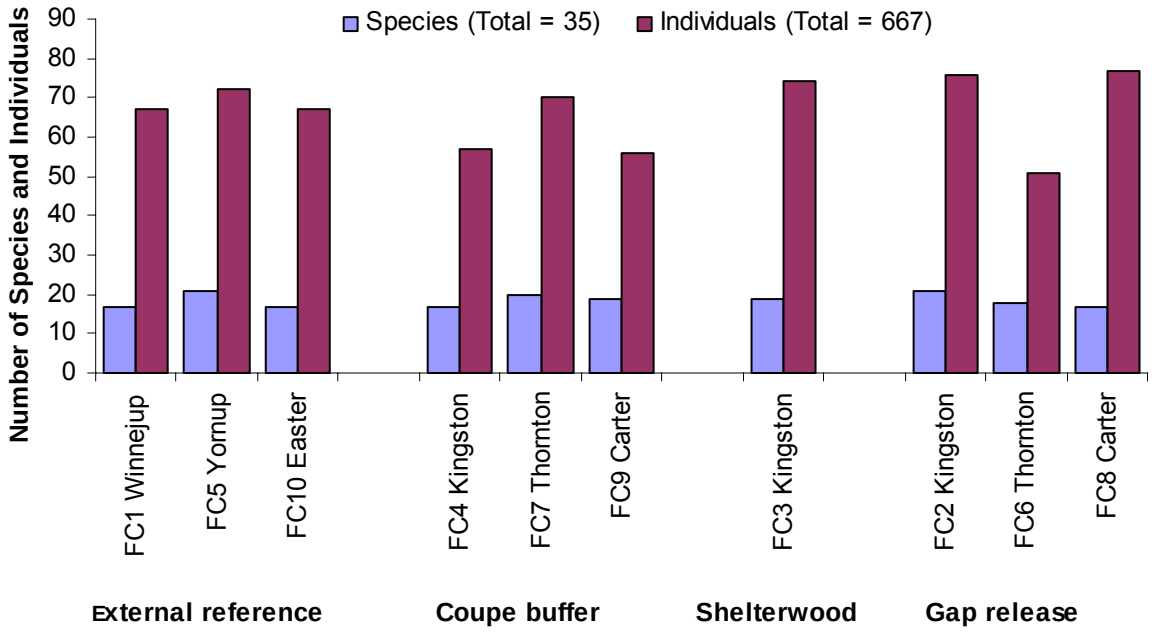


**Figure 1**. The number of bird species and individuals recorded in each Donnelly FORESTCHECK grid.

Other species of interest included the forest red-tailed cockatoo which was not recorded in the coupe buffer treatment and the scarlet robin which was most frequent in the external reference treatment.

There were six more species and 133 more individuals recorded at Donnelly in 2007 than in 2001. The density of birds per hectare has increased from 10.7 in 2001 to 13.3 in 2007. There were six species in 2001 that were not recorded in 2007 and 12 species in 2007 not recorded in 2001 (Table 2).

Are forest red-tailed black cockatoos on the increase in the south west forests? None were recorded during the 2001 survey and 19 individuals were recorded in 2007. Western yellow robins and splendid fairy-wrens were also recorded in all treatments in 2007, but were not seen or heard in 2001. It is perhaps understandable that they were not recorded in the shelterwood and gap treatments in 2001 as the re-growth may have been too dense for them, but it is surprising that they were not recorded in the external reference and coupe buffers.

It is not unusual that purple-crowned lorikeets were not recorded in 2007 as they are usually associated with over-storey species flowering and this did not occur during the 2007 survey.

**Table 2**. Comparison between the 2001 and 2007 surveys for birds at Donnelly FORESTCHECK grids (RAOU = Royal Australian Ornithology Union number) ER = external reference, CB = coupe buffer, SW = shelterwood, GR = gap release).

| | | 2001 | | | | | 2007 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **RAOU** | **Common name** | **Total** | **ER** | **CB** | **SW** | **GR** | **Total** | **ER** | **CB** | **SW** | **GR** |
| 1 | Emu | **1** | | | | 1 | **1** | | | | 1 |
| 34 | Common Bronzewing | **8** | | | 1 | 7 | **1** | 1 | | | |
| 35 | Brush Bronzewing | | | | | | **2** | | 1 | | 1 |
| 259 | Purple-crowned Lorikeet | **14** | 5 | | | 9 | | | | | |
| 264 | Forest Red-tailed Black Cockatoo | | | | | | **19** | 9 | | 3 | 7 |
| 266 | Baudins Cockatoo | **2** | 1 | 1 | | | | | | | |
| 289 | Western Rosella | **5** | | 1 | 3 | 1 | **21** | 6 | 7 | 1 | 7 |
| 290 | Red-capped Parrot | **8** | 5 | 2 | | 1 | **17** | 6 | 7 | 1 | 3 |
| 294 | Twenty-eight Parrot | **7** | 1 | 6 | | | **21** | 6 | 7 | 1 | 7 |
| 322 | Laughing Kookaburra | **2** | 2 | | | | **7** | | 5 | 1 | 1 |
| 338 | Fan-tailed Cuckoo | **8** | 1 | 5 | | 2 | **3** | 1 | 2 | | |
| 342 | Horsefield's Bronze-cuckoo | | | | | | **2** | | 2 | | |
| 344 | Shining Bronze-Cuckoo | **4** | | 4 | | | | | | | |
| 359 | Tree Martin | **26** | | 15 | | 11 | | | | | |
| 361 | Grey Fantail | **37** | 14 | 14 | 4 | 5 | **11** | 3 | 3 | 2 | 3 |
| 380 | Scarlet Robin | **5** | 4 | | | 1 | **19** | 10 | 5 | 1 | 3 |
| 387 | White-breasted Robin | **3** | 3 | | | | **13** | 7 | 5 | | 1 |
| 394 | Western Yellow Robin | | | | | | **18** | 9 | 4 | 4 | 1 |
| 398 | Golden Whistler | **43** | 15 | 15 | 7 | 6 | **44** | 14 | 7 | 8 | 15 |
| 408 | Grey Shrike-thrush | **6** | 3 | 3 | | | **22** | 8 | 6 | 2 | 6 |
| 424 | Black-faced Cuckoo shrike | **7** | 3 | 1 | | 3 | **10** | 3 | 3 | 3 | 1 |
| 430 | White-winged Triller | | | | | | **1** | 1 | | | |
| 463 | Western Gerygone | **58** | 24 | 24 | 5 | 5 | **56** | 22 | 15 | 7 | 12 |
| 472 | Western Thornbill | **30** | 6 | 16 | 4 | 4 | **23** | 7 | 2 | 8 | 6 |
| 476 | Broad-tailed (Inland) Thornbill | **85** | 17 | 28 | 9 | 31 | **135** | 27 | 46 | 18 | 44 |
| 486 | Yellow-rumped Thornbill | | | | | | **2** | | | 2 | |
| 488 | White-browed Scrubwren | **36** | 7 | 7 | 2 | 16 | **42** | 11 | 12 | | 19 |
| 532 | Splendid Fairy-wren | | | | | | **29** | 12 | 3 | 2 | 12 |
| 538 | Red-winged Fairy-wren | **32** | 5 | 8 | 4 | 15 | **13** | | 6 | | 7 |
| 549 | Varied Sitella | **7** | | 1 | 6 | | | | | | |
| 556 | Rufous Treecreeper | **6** | 4 | 2 | | | **6** | 3 | 1 | 1 | 1 |
| 565 | Spotted Pardalote | | | | | | **1** | | | | 1 |
| 574 | Silvereye | **11** | 4 | 2 | 2 | 3 | **6** | | | | 6 |
| 578 | Western White-naped Honeyeater | **23** | 13 | 7 | 3 | | **39** | 13 | 7 | 5 | 14 |
| 592 | Western Spinebill | | | | | | **6** | 2 | 1 | | 3 |
| 597 | Brown Honeyeater | **2** | 2 | | | | | | | | |
| 638 | Red Wattlebird | | | | | | **6** | 3 | 3 | | |
| 697 | Grey Currawong | | | | | | **5** | | 4 | | 1 |
| 710 | Western Little Wattlebird | | | | | | **2** | | | | 2 |
| 930 | Australian Raven | **2** | | 2 | | | **4** | 1 | 1 | | 2 |
| 976 | Striated Pardalote | **56** | 25 | 16 | 6 | 9 | **60** | 20 | 19 | 4 | 17 |
| | **Total Individuals** | **534** | 164 | 180 | 56 | 130 | **667** | 205 | 184 | 74 | 204 |
| | **Density - Birds/ha** | **10.7** | 10.9 | 12.0 | 11.2 | 8.7 | **13.3** | 13.7 | 12.3 | 14.8 | 13.6 |
| | **Total Species** | **29** | 22 | 22 | 13 | 18 | **35** | 25 | 27 | 19 | 29 |

**Conclusions**

Bird species composition and abundances change continuously as the understorey density and fuel ages vary. These changes occur in harvested areas as the vegetation structure changes over time through crown separation in regrowth trees and understorey shrubs, and in uncut forest as structural and successional changes occur in the understorey with time since fire. Changes in population also occur with variation in flowering cycles in plant species. Observations in 2007 related to these changes are:

- Purple crowned lorikeets and tree martins were not recorded in 2007 – likely related to lack of overstorey flowering
- Red-winged fairy wrens lower in number in 2007 – likely related to opening up of understorey with time since fire
- "Broad-tailed' parrots all increased in numbers in 2007, especially noticeable in the gap release treatment

Is the forest red-tailed black cockatoo population increasing? Results from the 2008 FORESTCHECK census at Donnelly and opportunistic observations reported to DEC suggest it is.

## FORESTCHECK MAMMALS AND HERPETOFAUNA

G.L.Liddelow and Verna Tunsell

### 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 grids and treatments at each location and between FORESTCHECK locations
- Recording the presence of the larger mammals along set transects that cover all treatments of the FORESTCHECK location on a landscape basis
- Recording the presence of nocturnal mammals by spotlighting along set transects that cover all the treatments of the FORESTCHECK location
- Recording feral animal species and abundance using sand pads placed at regular intervals along pre-determined tracks and roads within each FORESTCHECK location.

### Monitoring

In the 2007-08 monitoring period, due to constraints on personnel surveys along road transects for large mammals, spotlighting for nocturnal mammals and the use of sand pads to record feral animals were not carried out.

Trapping was carried out on all ten grids for one week in spring 2007 and autumn 2008 and the program went according to plan with no interruption to any activities due to inclement weather. The week of trapping in spring 2007 was cool.

### Voucher Specimens

No specimens were lodged with the Western Australian Museum from this trapping session.

### Preliminary Results

A total of 368 individuals were trapped (Table 1) with 161 individuals trapped in spring and 207 captures in autumn.

One hundred and three mammals, 45 reptiles, 12 amphibians and 1 bird were trapped in spring and 183 mammals, 22 reptiles and 2 amphibian trapped in autumn (Tables 1 & 2, Figs 1 & 2). Both trapping sessions recorded low numbers of reptile and amphibian captures. These results may be attributed to the cool temperatures that were experienced

during the trapping period. There were 72 brushtail possums (*Trichosurus vulpecula*) and 19 woylies (*Bettongia penicillata*) trapped in spring and 138 brushtails and 29 Woylies trapped in autumn.

The highest total numbers of captures occurred in the shelterwood (96), followed by the external reference (92) and then the coupe buffers and gap release (90) (Table 1).

**Table l**: The number of animals captured in spring and autumn on the Donnelly FORESTCHECK grids.

| | **External reference** | | **Coupe buffer** | | **Shelterwood** | | **Gap release** | |
|---|---|---|---|---|---|---|---|---|
| **Species** | **Spring** | **Autumn** | **Spring** | **Autumn** | **Spring** | **Autumn** | **Spring** | **Autumn** |
| **MAMMALS** | | | | | | | | |
| *Bettongia penicillata* | 1 | 2 | 2 | 4 | 13 | 19 | 3 | 4 |
| *Cercartetus concinnus* | 1 | | | | | | | |
| *Dasyurus geoffroii* | | | 1 | | | | | |
| *Phascogale tapoatafa tapoatafa* | 1 | | | | | | | |
| *Rattus fuscipes* | | 1 | | | | | | |
| *Rattus rattus* | 1 | 8 | | | | | 1 | |
| *Sminthopsis* sp. | 1 | | | 2 | | 3 | 6 | 2 |
| *Trichosurus vulpecula* | 17 | 35 | 18 | 44 | 20 | 25 | 17 | 34 |
| **REPTILES** | | | | | | | | |
| *Ctenotus labillardieri* | | | | 1 | | | | 1 |
| *Egernia kingii* | | | | | 2 | | 1 | 2 |
| *Egernia napoleonis* | 1 | 1 | 1 | | 2 | 1 | 1 | 2 |
| *Hemiergis peroni* | 4 | | 4 | 1 | 3 | | 3 | 2 |
| *Lerista distinguenda* | 3 | 1 | 2 | 4 | 4 | | 1 | |
| *Menetia greyii* | | 3 | | 1 | | | 1 | |
| *Morethia obscura* | 1 | | | | | | 3 | 1 |
| *Parasuta gouldi* | | | | | | 1 | | |
| *Tiliqua rugosa* | 4 | | | | | | 2 | |
| *Varanus rosenbergi* | 2 | | | | | | | |
| **AMPHIBIANS** | | | | | | | | |
| *Crinia georgiana* | 2 | | 1 | 1 | 1 | | 2 | |
| *Heleioporus eyrei* | | | 2 | | 2 | | | |
| *Limnodynastes dorsalis* | | | | 1 | | | | |
| *Metacrinia nichollsi* | 2 | | | | | | | |
| **BIRDS** | | | | | | | | |
| *Eopsaltria georgiana* | | | | | | | 1 | |
| **Total (368)** | **41** | **51** | **31** | **59** | **47** | **49** | **42** | **48** |

**Table 2**. Comparison of trapping results by forest block.

| | Kingston | | | | Yornup/Thornton | | | Carter/Easter | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Species** | **External Reference** | **Coupe Buffer** | **Shelterwood** | **Gap Release** | **External Reference** | **Coupe Buffer** | **Gap Release** | **Coupe Buffer** | **Gap Release** | **External Reference** | **TOTAL** |
| **MAMMALS** | | | | | | | | | | | |
| *Bettongia penicillata* | 3 | 6 | 32 | 7 | | | | | | | 48 |
| *Cercartetus concinnus* | | | | | 1 | | | | | | 1 |
| *Dasyurus geoffroii* | | 1 | | | | | | | | | 1 |
| *Phascogale tapoatafa tapoatafa* | | | | | 1 | | | | | | 1 |
| *Rattus fuscipes* | | | | | | | | | | 1 | 1 |
| *Rattus rattus* | | | | | | | 1 | | | 9 | 10 |
| *Sminthopsis* sp. | | | 3 | 7 | 1 | 2 | | | 1 | | 14 |
| *Trichosurus vulpecula* | 47 | 48 | 45 | 48 | 4 | 12 | 3 | 2 | | 1 | 210 |
| **REPTILES** | | | | | | | | | | | |
| *Ctenotus labillardieri* | | | | 1 | | 1 | | | | | 2 |
| *Egernia kingii* | | | 2 | 3 | | | | | | | 5 |
| *Egernia napoleonis* | | | 3 | 1 | 1 | 1 | 1 | | 1 | 1 | 9 |
| *Hemiergis peroni* | 2 | 1 | 3 | 2 | 2 | 4 | 1 | | 2 | | 17 |
| *Lerista distinguenda* | 4 | 3 | 4 | 1 | | 2 | | 1 | | | 15 |
| *Menetia greyii* | | | | | 3 | 1 | 1 | | | | 5 |
| *Morethia obscura* | | | | 1 | 1 | | 3 | | | | 5 |
| *Parasuta gouldi* | | | 1 | | | | | | | | 1 |
| *Tiliqua rugosa* | 3 | | | 2 | 1 | | | | | | 6 |
| *Varanus rosenbergi* | 1 | | | | | | | | | 1 | 2 |
| **AMPHIBIANS** | | | | | | | | | | | |
| *Crinia georgiana* | | | 1 | | 1 | 1 | 2 | 1 | | 1 | 7 |
| *Heleioporus eyrei* | | 2 | 2 | | | | | | | | 4 |
| *Limnodynastes dorsalis* | | | | | | 1 | | | | | 1 |
| *Metacrinia nichollsi* | | | | | | | | | | 2 | 2 |
| **BIRDS** | | | | | | | | | | | |
| *Eopsaltria georgiana* | | | | | | | | | 1 | | 1 |
| **Total** | **60** | **61** | **96** | **73** | **16** | **25** | **12** | **4** | **5** | **16** | **368** |

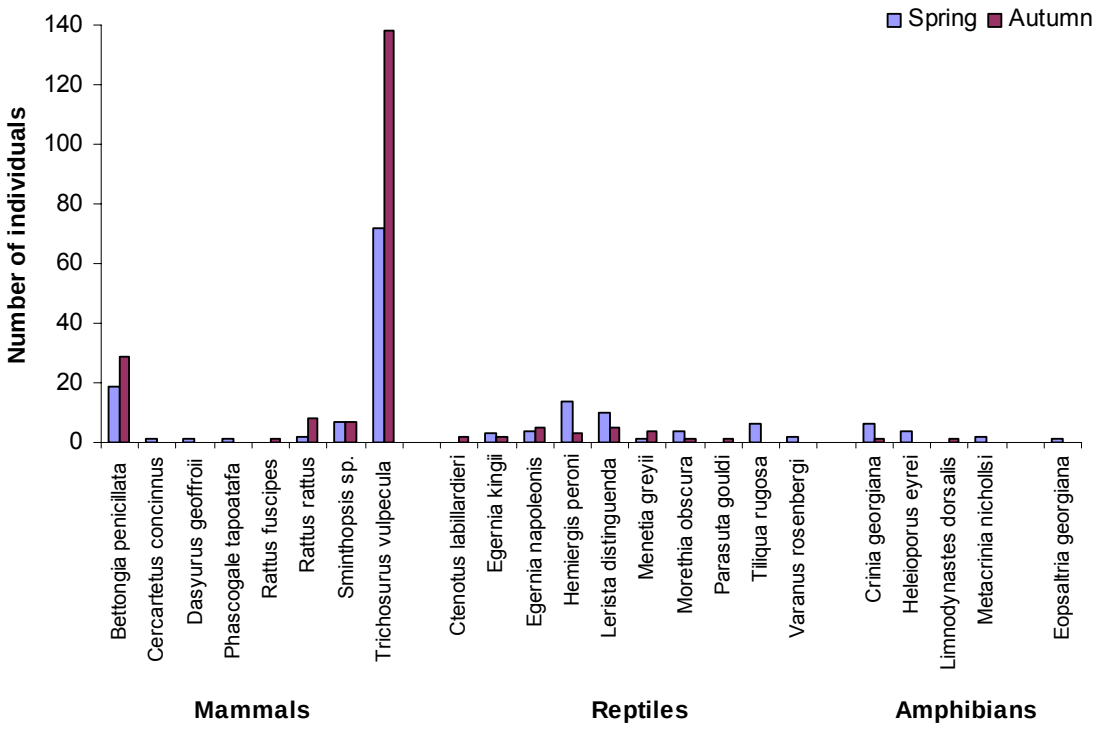
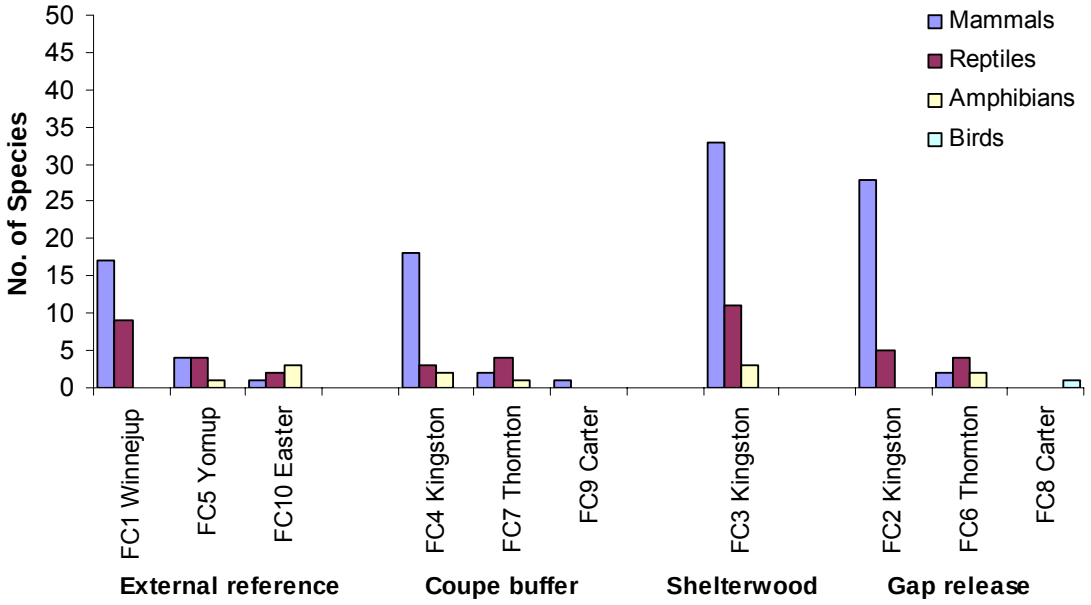



**Figure 1**. The number of animals captured in spring and autumn on Donnelly FORESTCHECK grids.

(a) Spring




(b) Autumn

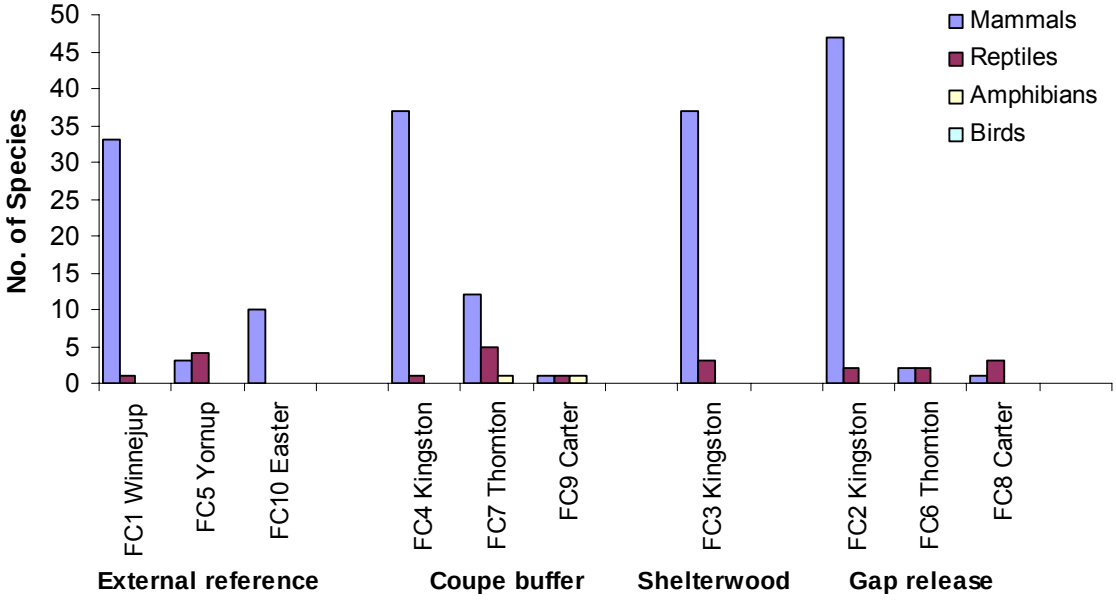


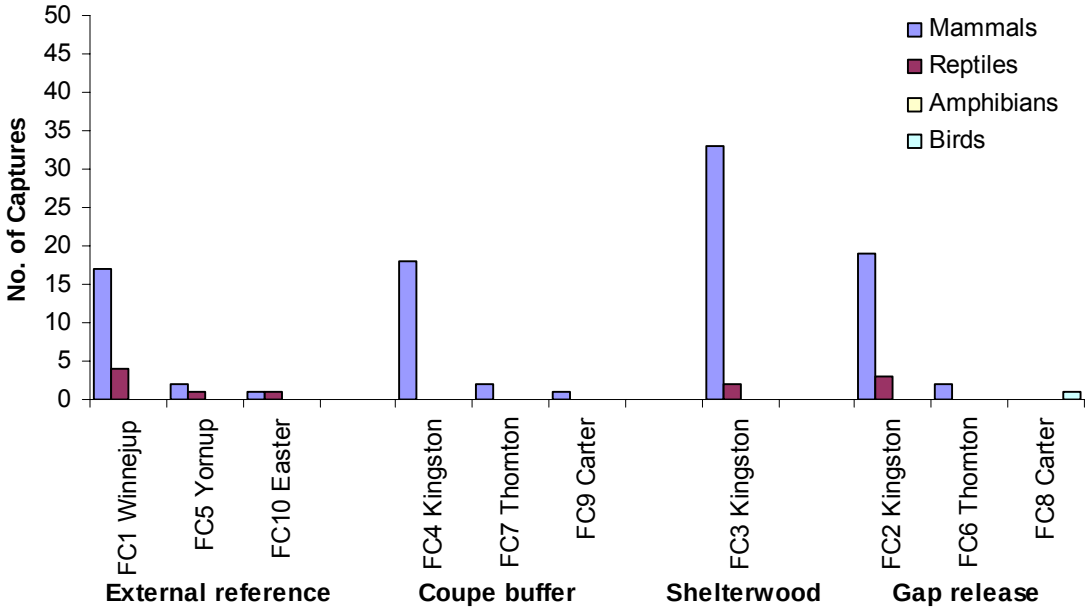

**Figure 2**. The number of mammals, reptiles and amphibians recorded in traps in spring (a) and autumn (b) on the Donnelly FORESTCHECK grids.

Wire cage traps were very successful and resulted in 285 of the 368 or 77% of all captures being in this trap type (Table 3, Fig. 3). Brushtail possums accounted for 57% or 210 of all captures in the wire cage traps and almost 3 out of 4 animals captured were this species. Despite the decline that has occurred in the woylie population in the southern forests, they were the second most abundant animal with a total of 48 captures, 19 in spring and 29 in autumn.

**Table 3**. The species and abundance of mammals, reptiles and amphibians recorded by trap type on the Donnelly Forestcheck sites in 2007-2008.

| | **External reference** | | **Coupe buffer** | | **Shelterwood** | | **Gap release** | |
|---|---|---|---|---|---|---|---|---|
| **Species** | **Wire** | **Pit** | **Wire** | **Pit** | **Wire** | **Pit** | **Wire** | **Pit** |
| **MAMMALS** | | | | | | | | |
| *Bettongia penicillata* | 3 | | 6 | | 32 | | 7 | |
| *Cercartetus concinnus* | | 1 | | | | | | |
| *Dasyurus geoffroii* | | | 1 | | | | | |
| *Phascogale tapoatafa tapoatafa* | 1 | | | | | | | |
| *Rattus fuscipes* | 1 | | | | | | | |
| *Rattus rattus* | 9 | | | | | | 1 | |
| *Sminthopsis* sp. | | 1 | | 2 | | 3 | | 8 |
| *Trichosurus vulpecula* | 52 | | 62 | | 45 | | 51 | |
| **REPTILES** | | | | | | | | |
| *Ctenotus labillardieri* | | | | 1 | | | | 1 |
| *Egernia kingii* | | | | | 2 | | 3 | |
| *Egernia napoleonis* | | 2 | | 1 | | 3 | | 3 |
| *Hemiergis peroni* | | 4 | | 5 | | 3 | | 5 |
| *Lerista distinguenda* | | 4 | | 6 | | 4 | | 1 |
| *Menetia greyii* | | 3 | | 1 | | | | 1 |
| *Morethia obscura* | | 1 | | | | | | 4 |
| *Parasuta gouldi* | | | | | | 1 | | |
| *Tiliqua rugosa* | 4 | | | | | | 2 | |
| *Varanus rosenbergi* | 2 | | | | | | | |
| **AMPHIBIANS** | | | | | | | | |
| *Crinia georgiana* | | 2 | | 2 | | 1 | | 2 |
| *Heleioporus eyrei* | | | | 2 | | 2 | | |
| *Limnodynastes dorsalis* | | | | 1 | | | | |
| *Metacrinia nichollsi* | | 2 | | | | | | |
| **BIRDS** | | | | | | | | |
| *Eopsaltria georgiana* | | | | | | | 1 | |
| **Total (368)** | **72** | **20** | **69** | **21** | **79** | **17** | **65** | **25** |

(a) Spring – wire traps




(b) Autumn – wire traps

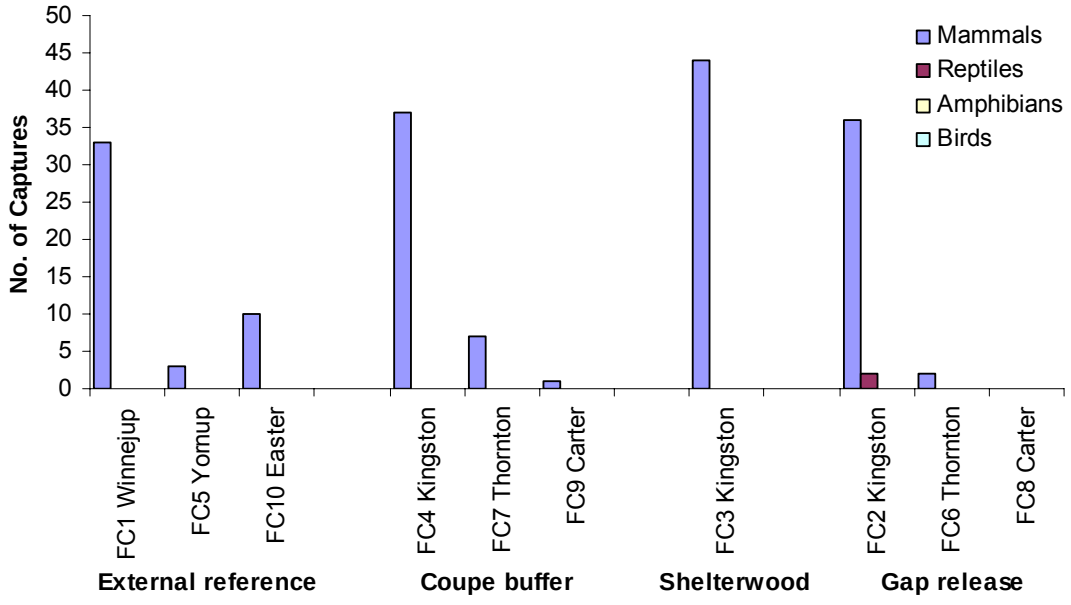



**Figure 3**. The number of individual mammals, reptiles and amphibians recorded in wire traps in the spring (a) and autumn (b) on the Donnelly FORESTCHECK grids.

Pit fall trapping was relatively successful for recording small mammal, reptile and amphibian species of the area. As stated earlier the cool conditions were not ideal for this type of trapping and only a total of 83 captures were recorded. There were 54 in spring and 29 in autumn (Table 2, Fig. 4). All treatments had similar numbers of captures with the gap release treatment had the highest numbers (25) followed by coupe buffer (21), external reference (20) and shelterwood (17). All reptiles apart from the bobtail (*Tiliqua rugosa*), the southern heath monitor (*Varanus rosenbergi*) and the king skink (*Egernia kingii*) were caught in pit traps.

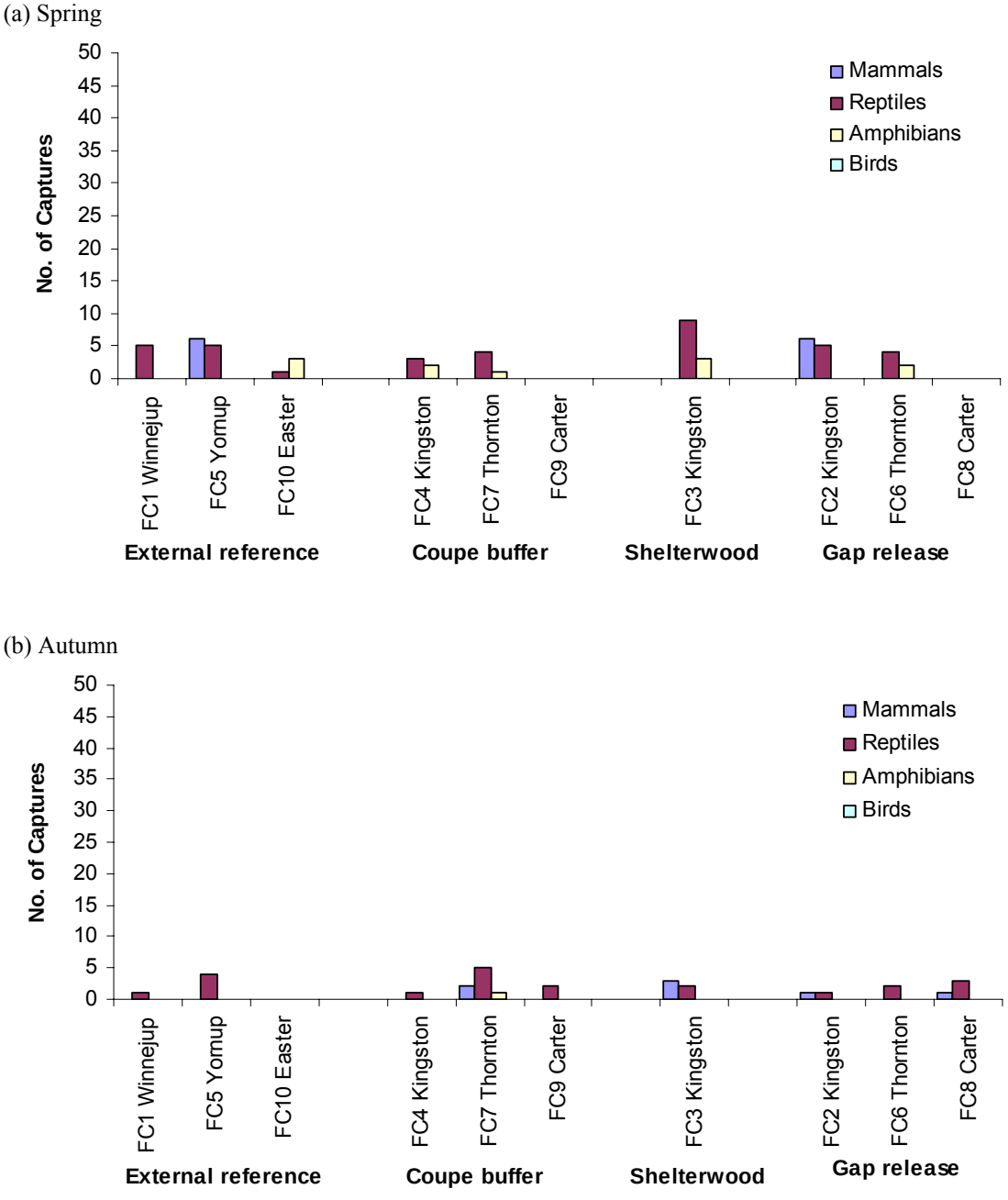



**Figure 4**. The number of individual mammals, reptiles and amphibians recorded in pit fall traps in the spring (a) and autumn (b) on the Donnelly FORESTCHECK sites.

There were only 15 small mammals captured, including one pygmy possum (*Cercartetus concinnus*) (external reference) and 14 dunnarts (*Sminthopsis* sp.) of which 11 were recorded in the logged areas (three in the shelterwood and 8 in the gap release treatments).

Reptile captures were 54 (34 in spring, 20 in autumn) made up of 6 species of skink and one snake. The two commonest skinks were *Hemiergis peroni* (17) and *Lerista distinguenda* (15). 12 reptile captures were in the external reference sites, 11 from shelterwood sites, 14 from the coupe buffers and 15 from gap release (Table 2, Fig. 3).

Winnejup and Kingston FORESTCHECK grids are situated east of the South Western Highway and Yornup, Thornton, Carter and Easter grids are west of the highway. The difference in trapping results was quite dramatic. Seventy nine percent of all captures in 2007-08 came from the four eastern grids based in the Kingston area and the remaining 21% from the six grids west of the highway (Table 4). All the woylies, 10 of 14 dunnarts and 188 of 210 (89%) brushtail possums come from the Kingston area grids.

When trapping was carried out with wire cages in autumn 2002 all 47 woylies and 103 of 109 (97%) of brushtail possums were in Kingston area grids.

The Kingston area has always been included in the Western Shield feral baiting program and the area to the west of the highway was not included until 2001. In 2007-08 woylies were still not recorded west of the highway but brushtail possums on the west increased from 3% to 11% of total captures.

Table 4 shows the difference in trapping results from the two sample sessions at Donnelly FORESTCHECK grids. Unfortunately at the beginning of FORESTCHECK we did not include the use of wire cage traps in the spring on 2001, these were introduced into the program in autumn 2002. Since 2002 the woylie population has suffered a major decline in the upper Warren catchment, and the 2007-08 trapping results mirror the decline showing a fall of almost 62% in captures. At the same time brushtail possums have increased by nearly 27%. There were more reptiles trapped in 2001-02 than 2007-08 but this would be because of the cool conditions experienced during this latest trapping period.

**Table 4**. Comparison between 2001-02 and 2007-08 trapping results at Donnelly grids.

| | 2001-02 | | | 2007-08 | | |
|---|---|---|---|---|---|---|
| **Species** | **Spring** | **Autumn** | **Total** | **Spring** | **Autumn** | **Total** |
| **MAMMALS** | | | | | | |
| *Bettongia penicillata* | | 47 | **47** | 19 | 29 | **48** |
| *Cercartetus concinnus* | 1 | | **1** | 1 | | **1** |
| *Dasyurus geoffroii* | | | | 1 | | **1** |
| *Isoodon obesulus* | | 1 | **1** | | | |
| *Mus musculus* | 1 | 8 | **9** | | | |
| *Phascogale tapoatafa tapoatafa* | | | | 1 | | **1** |
| *Rattus fuscipes* | | 1 | **1** | | 1 | **1** |
| *Rattus rattus* | | | | 2 | 8 | **10** |
| *Sminthopsis* sp. | 4 | 5 | **9** | 7 | 7 | **14** |
| *Trichosurus vulpecula* | | 109 | **109** | 72 | 138 | **210** |
| **REPTILES** | | | | | | |
| *Acritoscincus trilineatum* | 10 | | **10** | | | |
| *Aprasia pulchella* | 1 | | **1** | | | |
| *Christinus marmoratus* | 4 | | **4** | | | |
| *Ctenotus labillardieri* | 1 | 1 | **2** | | 2 | **2** |
| *Egernia kingii* | | | | 3 | 2 | **5** |
| *Egernia napoleonis* | 3 | | **3** | 5 | 4 | **9** |
| *Glaphyromorphus gracilipes* | | 1 | **1** | | | |
| *Hemiergis peroni* | 25 | 1 | **26** | 14 | 3 | **17** |
| *Lerista distinguenda* | 8 | 1 | **9** | 10 | 5 | **15** |
| *Menetia greyii* | 1 | 1 | **2** | 1 | 4 | **5** |
| *Morethia obscura* | 25 | 2 | **27** | 4 | 1 | **5** |
| *Parasuta gouldi* | | | | | 1 | **1** |
| *Tiliqua rugosa* | | | | 6 | | **6** |
| *Varanus rosenbergi* | | | | 2 | | **2** |
| **AMPHIBIANS** | | | | | | |
| *Crinia georgiana* | 7 | 6 | **13** | 6 | 1 | **7** |
| *Crinia glauerti* | | 1 | **1** | | | |
| *Heleioporus eyrei* | 1 | 5 | **6** | 4 | | **4** |
| *Limnodynastes dorsalis* | | 8 | **8** | | 1 | **1** |
| *Litoria adelaidensis* | 1 | | **1** | | | |
| *Litoria moorei* | | 1 | **1** | | | |
| *Metacrinia nichollsi* | | | | 2 | | **2** |
| *Pseudophryne guentheri* | 1 | | **1** | | | |
| **BIRDS** | | | | | | |
| *Eopsaltria georgiana* | | | | 1 | | **1** |
| **Total** | 94 | 199 | **293** | 161 | 207 | **368** |

**Conclusions**

- Woylies were again captured only on the eastern side of the South Western Highway (Kingston and Winnejup grids) in 2007-08 and their numbers were reduced by 62% when compared to the 2001-02 results. This is consistent with results from Warrup in the Woylie Decline Project (A. Wayne, pers. comm.).
- Numbers of brushtail possums west of the South Western Highway (Yornup, Thornton, Carter and Easter) increased from 3% of total captures in 2001-02 to be 11% in 2007-08, which coincides with the initiation of Western Shield baiting in 2001.
- Captures of reptiles and amphibians were reduced in 2007-08 due to cool weather during both the spring and autumn trapping periods.

**Acknowledgements**

I would like to thank Donnelly District Nature Conservation employees, Manjimup Science Division staff, Jamie Flett and Michael Voigt for their assistance with the trapping program.

## DATA MANAGEMENT AND STORAGE

Verna Tunsell and Amanda Mellican

### Introduction

The group is responsible for entering and storing the collected data for dirurnal and nocturnal birds, mammals and herpetofauna, vascular plants, macrofungi and cryptogams into electronic format, databasing collected voucher specimens (Flora, Cryptogams and Fungi) and storing the electronic data for invertebrates.

### Data entry

An excel program applying Visual Basic was developed for each of the survey sheets. There are two 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 for Donnelly have been completed. A Metadata form, as shown in Appendix A, is also completed.

### Data validation

Entered data for all the groups is validated. The validation date is 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 is 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 daily. The final version of the validated data is printed and kept in a filing cabinet and will be archived in the Forest Science library at the completion of the project.

### Voucher specimens

The 13 vascular plant, 214 fungi and 6 cryptogam specimens collected during the period, have been identified (as far as possible) and processed. The vascular plants have been lodged at the WA Herbarium (PERTH). The fungi and cryptogam collections are yet to be lodged at PERTH. The fungi are housed at the Tony Annels Herbarium in Manjimup to enable work on descriptions and identification to be completed. Lichens are housed at PERTH, except for a working (reference) set which is held at Manjimup. The low number of vouchers collected for the vascular flora is the result of only collecting species not yet vouchered on the Donnelly FORESTCHECK grids. The cryptogam collections are for photographic material and redetermination of unknown species. The fungi collections are new species and some for redetermination of previously collected species.

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, wrapped in greaseproof paper inside zip-lock bags, then put into boxes to prevent damage. Very large specimens remain unboxed.

Each voucher specimen is data based on the Max system and submitted electronically to the WA Herbarium for incorporation into the herbarium database. Max was developed by Simon Woodman and Paul Gioia (DEC, Kensington) and is used as the primary means of submitting specimen information to the WA Herbarium. While there are many facets to Max, the sections used for FORESTCHECK are the collecting book and reporting facilities.

**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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| | | | | | | |
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| | | | | | | |

**Appendix B:** Example of Specimen labels generated in Max-V3

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

***Cassytha racemosa*** forma ***pilosa*** (Benth.) J.Z.Weber

Lauraceae

Identified by:

Parastitic perennial climber frequent. Hill to plain; gravelly brown sandy clay. Forest with associated vegetation of Corymbia calophylla and Eucalyptus marginata.

**Loc.:** Forestcheck monitoring site 5, N side of Wagelup Road 1.4 km W of railway line, Yornup Forest block

**Lat.:** 34°6'24.0" S **Long.:** 116°8'33.0" E (WGS84)

**Coll.:** R.J. Cranfield 23238 **Date:** /09/2008

**Voucher:** Forestcheck Monitoring Program

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

***Lomandra nigricans*** T.Macfarlane

Dasypogonaceae

Identified by:

Height to 20 cm, width to 15 cm; flowers white. frequent. Hill to plain; gravelly brown sandy clay. Forest with associated vegetation of Corymbia calophylla and Eucalyptus marginata. Percentage of population flowering: 10

**Loc.:** Forestcheck monitoring site 5, N side of Wagelup Road 1.4 km W of railway line, Yornup Forest block

**Lat.:** 34°6'24.0" S **Long.:** 116°8'33.0" E (WGS84)

**Coll.:** R.J. Cranfield 23239 **Date:** /09/2008

**Voucher:** Forestcheck Monitoring Program

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

***Leucopogon capitellatus*** DC.

Epacridaceae

Identified by:

Shrub, height to 30 cm, width to 40 cm; growth phase is active with flower buds, vegetative buds and flowers, white frequent. Hill to plain; gravelly brown sandy clay. Forest with associated vegetation of Corymbia calophylla and Eucalyptus marginata. Percentage of population flowering: 30

**Loc.:** Forestcheck monitoring site 5, N side of Wagelup Road 1.4 km W of railway line, Yornup Forest block

**Lat.:** 34°6'24.0" S **Long.:** 116°8'33.0" E (WGS84)

**Coll.:** R.J. Cranfield 23240 **Date:** /09/2008

**Voucher:** Forestcheck Monitoring Program

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

***Leucopogon pulchellus*** Sond.

Epacridaceae

Identified by:

Erect compact perennial shrub, height to 40 cm, width to 40 cm; flower buds white and pink frequent. Hill to plain; gravelly brown sandy clay. Forest with associated vegetation of Corymbia calophylla and Eucalyptus marginata. Percentage of population flowering: 30

**Loc.:** Forestcheck monitoring site 5, N side of Wagelup Road 1.4 km W of railway line, Yornup Forest block

**Lat.:** 34°6'24.0" S **Long.:** 116°8'33.0" E (WGS84)

**Coll.:** R.J. Cranfield 23241 **Date:** /09/2008

**Voucher:** Forestcheck Monitoring Program

**Appendix C:** Example of report generated in Max V3.



| COLLECTOR_NO | SHEET_NO | GENUS | SPECIES | INFRA_RANK | INFRA_NAME |
|---|---|---|---|---|---|
| 23250 | 6666795 | Caladenia | arrecta | | |
| 23240 | 6666728 | Leucopogon | capitellatus | | |
| 23243 | 6666752 | Senecio | hispidulus | | |
| 23244 | 6666760 | Senecio | hispidulus | | |
| 23249 | 6666787 | Luzula | meridionalis | | |
| 23239 | 6666701 | Lomandra | nigricans | | |
| 23241 | 6666736 | Leucopogon | pulchellus | | |
| 23245 | 6666779 | Senecio | quadridentatus | | |
| 23238 | 6666698 | Cassytha | racemosa | forma | pilosa |
| 23133 | 6667031 | Cassytha | racemosa | | |
| 23251 | 6666809 | Caladenia | reptans | | |
| 23242 | 6666744 | Brachythecium | sp. FC5 (R.J. Cranfield 2324 | | |
| 23133 | 6667023 | Billardiera | variifolia | | |