THE EFFECT OF WILDFIRE ON THE FRUITING OF MACROFUNGI IN REGROWTH KARRI FORESTS III. RESULTS FROM THE THIRD YEAR OF MONITORING

SPP 98/0015 Progress Report

by

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Marasmius sp.(Species 326), x1

Clavaria (Species 349) x1

Thelephore (Species 332), x1

Burnt Plot, 3 years after fire

Cup Fungus (Species 370), x 0.8

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SUMMARY

In December 1997, a wildfire swept through a large tract of 20-25-year-old karri regrowth forest in the south-west of Western Australia. Immediately following the fire, plots were established in the burnt stands and in similarly aged unburnt stands. Over the next three years (from January 1998 to December 2000) the fungi fruiting in the plots were recorded. A total of 304 species of fungi, which produced 34,558 fruitbodies, were recorded in burnt and unburnt plots. The number of species recorded each year was 167, 177 and 193 respectively in 1998, 1999 and 2000.

In the first year, 68 species fruited on the burnt plots of which 81% occurred exclusively on the burnt plots. In 1999 and 2000 the species exclusive to the burnt sites reduced to 60% and 51% respectively. There was a noticeable change in the composition of the species recorded on the burnt plots each year. In 1999 there was a 71% change in species composition compared to 1998. In 2000 the change was 48% from that in 1999 and 81% change from that of 1998. Such changes were attributed to the process of species succession, occurring as the burnt sites recovered from the fire. However, part of the change may also be due to natural variation in fruiting patterns. On the unburnt sites, changes of 37% and 30% were observed in successive years and a 42% change in the species present in 2000 compared to those in 1998.

In each successive year there was an increase in the number of species recorded on both burnt and unburnt sites in the same year. In 1998 it was 8%. In 1999 and 2000 it was 21% and 28%. As the litter and trash built up on the burnt sites, more species previously found only on unburnt sites were recorded on the burnt sites. At the end of three years, the amount of litter on the burnt sites was approximately one-third and the amount of trash about one-half that measured on the unburnt sites.

The pyrophilous fungi, those species that appear to be exclusive to the burnt sites, fitted into four broad groups.

The first group consisting of those fungi that fruited from subterranean sclerotia and are stimulated by, and fruit within days of the fire, or in the first autumn or spring. These species are *Neolentinus dactyloides, Polyporus mylittae, P. tumulosa, P. sclerotinus* and *Morchella elata*. All five species were recorded only in the first year.

The second group is made up of species such as *Peziza tenacella, Geopyxis* aff. *carbonaria, Peziza* aff. *praetervisa, Peziza* spp. (Species 196 and 41), Species 64

(Agaric), *Coprinus* sp. (Species 73), Species 30 (LBM) and Species 60 ("lemon-yellow" Discomycete). All fruited exclusively on burnt soil in the first autumn following the fire and were not recorded in the second year.

The third group contains species such as *Anthrocobia muelleri, Coprinus* aff. *domesticus, Coprinus* spp. (Species 182 and 74) and *Peziza* sp. (Species 40) which fruited on the burnt soils in the first season following the fire and continued through the second year in smaller numbers.

The fourth group included *Pulvinula archerii, Coprinus* sp. (Species 73), *Inocybe* sp. (Species 128), *Marasmius* sp. (Species 243), *Ramaria ochraceosalmonicolor, Ramaria* sp. (Species 43) and *Daldinai eschscholzii*. All fruited on the burnt sites for three consecutive years. Generally they were recorded in large numbers in the first year then in low numbers in the following two years. Exceptions were *R. ochraceosalmonicolor* and *D. eschscholzii* which fruited in low numbers in the first year and in high numbers in the second and third years.

A number of fungi fruited for the first time on the burnt sites in 2000. These included *Marasmius* sp. (Species 326) which fruited on the burnt stumps of *Podocarpus drouynianus, Mycena* sp. (Species 334), Species 373 (Thelephore) which fruited on newly fallen marri twigs, Species 332 (Thelephore) which fruited amongst moss, Species 346 ("grey *Inocybe*-like agaric") and Species 349 ("small lemon club") which fruited on bare soil and Species 370 ("pale orange cup fungus") which fruited on the soil amongst well-rotted leaf litter. Further monitoring is necessary in order to ascertain whether their presence is truly reliant on fire.

The results show that to maximise fungal biodiversity in regrowth and natural eucalypt forests a mosaic of stands with different times since fire is needed.

INTRODUCTION

In forest ecosystems fungi play important roles in the decomposition of organic matter and nutrient cycling, and many species form intimate and essential associations with the roots of forest plants (mycorrhiza). At present very little is known regarding the fungal flora of karri regrowth forests and the role these fungi play in ecosystem sustainability. Any changes in species composition mediated by fire may well impact on the rehabilitation of burnt sites.

Early studies (Seaver 1909, Seaver and Clark 1910) showed that many species of fungi occur only on burnt sites. These species were referred to as "pyrophilous" fungi. In South Australia, Warcup (1990) recorded 14 species of discomycetes in the first year following a fire in dry sclerophyll eucalpt forest dominated by *Eucalyptus maculata*. The most common species Warcup recorded were *Anthracobia melaloma*, *Anthrocobia* cf. *maurilabra*, *Aleuria venestula*, *Pulvinula archerii* and *Lachnea vinosobrunnea*. Species of *Anthracobia* and *Pulvinua* are well known as pyrophilous species both in Australia and elsewhere (Arora 1986, May and Fuhrer 1989, Petersen 1970, Rifai 1968, Warcup 1981). El-Abyad and Webster (1968) concluded that so called "pyrophilous" fungi favour alkaline conditions, which are provided by the ash-bed effect following fire (Hatch 1960, Humphries and Craig 1981). Petersen (1970) showed that the species composition on a range of burnt sites in Denmark changes over time, and species of pyrophilous fungi are replaced, over time, by species more common on unburnt soil.

In December 1997, a wildfire swept through large tracts of karri regrowth forest in the southwest of Western Australia. In the first year following this fire, a distinct mycoflora was reported in burnt plots (Robinson 1999). Species diversity was higher on the unburnt (control) sites and at its maximum on both burnt and unburnt sites in the autumn. Fruitbody production was higher on the burnt sites with peaks of equal magnitude in both autumn and spring. On the unburnt sites, fruitbody production reached a peak in the autumn and gradually declined through the winter with a small peak in the spring.

On the burnt sites, *Polyporus mylittae*, *P. tumulosa* and *Neolentinus dactyloides* responded by developing large fruitbodies from subterranean sclerotia within days following the fire. In the autumn and spring, Ascomycetes dominated the fruiting. *Peziza tenacella* and *Anthrocobia muelleri*, fruited in large numbers from April to mid-June. *Morchella elata*, *Pulvinula* sp. and a small species of *Peziza* fruited in large numbers from July to late-October. As the result of animal activity on the burnt sites, several collections of *Mesophellia* sp. were recovered from mammal diggings and *Psilocybe coprophilla* was commonly collected fruiting on kangaroo droppings.

The high species diversity on the unburnt sites was attributed to litter decaying species such as *Mycena* and *Marasmius* which were recorded fruiting on leaf and twig litter. In addition several common genera of mycorrhizal fungi, including species of *Cortinarius* and *Russula*, found on the unburnt sites were not recorded on the burnt sites.

In the second year of monitoring, 1999, the number of species recorded on burnt plots increased, however, a 72% change in species composition was reported (Robinson

2000). On the unburnt sites, a 43% change in species composition was reported, despite the same number of species being recorded as the previous year. In 1998, 4.8% of the species were recorded in both burnt and unburnt plots. In 1999, this increased to 20%. The increase was attributed to accumulation of leaf, twig and small branch litter in the burnt plots over the two year period, on which saprophytic fungi was recorded.

The most common fungi recorded in the burnt plots were *Coprinus* aff. *domesticus*, *Inocybe* sp. (Species 128), *Ramaria ochraceosalmonicolor*, *Pulvinula archerii* and *Marasmius* sp. (Species243). Those fungi most often recorded on the unburnt plots were *Anthracophyllum archerii*, Species 164 (LBM "olive gills"), *Marasmius crinisequi*, *Marasmius elegans*, *Mycena* aff. *rorida*, Peziza (aff. *Nothojafnea*) sp. (Species 189) and *Plectania* sp. (Species 190). The most common species recorded on both site types were *Inocybe australiensis*, *Marasmius alveolaris*, *Mycena alcalina*, the small stalked Discomycete (Species 51) and *Xylaria hypoxylon*.

The results from the third year of monitoring are presented in this report.

METHODS

Site selection, and plot establishment are detailed in Robinson (1999, 2000). Ten sites were chosen in burnt and unburnt stands of 20-25-year-old karri regrowth. At eight of the sites (4 burnt, 4 unburnt) 4 plots, 5m x 5m, were installed. At two sites, one burnt one unburnt, only 2 plots were installed. This made a total of 36 plots (Table 1). Plots were monitored on a monthly basis until the fruiting season commenced (mid-May) at which time they were visited every 2 weeks until the end of the fruiting season (late-October, early-November). Monthly visits were then resumed. On each date, the number of species and total number of fruitbodies were recorded in each plot. Voucher specimens were photographed *in situ* and collected. At the lab the vouchers were given numbers and species descriptions were prepared. All vouchers are housed in the Tony Annels Herbarium at Manjimup.

In November 2000, the amount of the litter, trash and coarse woody debris on all the sites was measured. Because monitoring of the plots is to continue, the assessment was done on the general site surrounding the plots rather than in the plots. At each site, the layer of leaf litter and twigs (<10mm diam.) above the mineral soil was collected from five 0.05 m^2 quadrats. The depth of the litter in each quadrat was measured prior to collecting. Trash, comprising dead woody material to a diameter of 25 mm, and suspended bark, twigs and leaves was collected from five 1.0 m^2 quadrats. Trash depth was calculated by averaging the depth from 3 random points within the quadrat (Plate 1a). Litter and trash samples were oven dried for 24 hours at 105° C and then weighed to determine loadings in tonnes ha^{-1} (McCaw *et al.* 2001). Litter and trash measurements from each site were averaged to provide representative values for each site. Coarse woody debris was measured using the line intersect method of Van Wagner (1968). A 50 m transect was laid across each site and the diameter of each piece of wood greater than 25 mm which was crossed by the transect was measured. Volume was calculated using the formula:

$$V = \frac{\pi^2 \Sigma d^2}{8L}$$

where V = volume, d = diameter of each piece of wood crossed by the transect and L = transect length. Two wood volumes were calculated for each site; for the burnt sites, one which included large logs which were left following the 1997 fire and one which did not, and for the unburnt sites, one which included logs left following harvest and the regeneration burn and one which did not. Volumes were determined in m^3 ha^{-1}.

Table 1. Characteristics of sites chosen for fungal survey.

Site Number	Site Locations	Year of Regeneration	Plot Numbers	Community Type[1]
	Burnt			
1	Gobblecannup	1979	9-12	Stewart
2	Flybrook 1	1972	13-16	Beggs
3	Flybrook 2	1972	17-18	Beggs
4	June Rd 1	1978	19-22	Stewart
5	Landing Rd	1977	23-26	McNamara
	Unburnt			
6	Cripple Rd 2	1980	5-8	Shea/Stoate/ White
7	June Rd 2	1978	9-12	Beggs/White
8	Wallace Rd	1981	13, 16	Beggs
9	Lockyer Rd	1980	17-20	Beggs/Annels
10	Flybrook 3	1978	21-24	Shea

[1] Community type is based on the floristic attributes of Inions *et al*. (1990). NB. Stewart, Beggs and McNamara community types belong to Community-Group 3, which occurs on drier sites with low summer rainfall, high radiation all year and soils with low P levels.

RESULTS AND DISCUSSION

The number of species recorded

In 2000, the third year following the fire, 193 species of fungi were recorded. Of these 113 species fruited in plots on the burnt sites (producing 3775 fruitbodies) and 136 species (producing 7737 fruitbodies) in plots on the unburnt sites, including 55 species which were recorded on both site types (Table 2).

In each year there were large changes in the composition of the species recorded on the burnt sites. In 1999 the change in species composition was 71% from that in 1998. In 2000 the species recorded were 48% and 81% different from those recorded in 1999 and 1998 respectively. These changes result largely from the process of species succession which occurred as the burnt sites recovered from the fire. However, a part of the change may be due to natural variation.

Table 2. The number of species and fruitbodies recorded in plots on burnt and unburnt karri regrowth sites in the period 1998-2000.

	1998	**1999**	**2000**
Total number of species recorded on burnt sites	68	96	113
Species fruiting in successive years		28	59
Total number of fruitbodies recorded on burnt sites	9279	3329	3775
Species occurring on burnt sites only	55	58	58
Total number of species recorded on unburnt sites	112	119	135
Species fruiting in successive years		75	94
Total number of fruitbodies recorded on unburnt sites	4245	6193	7737
Species occurring on unburnt sites only	99	81	80
Species recorded on both Burnt and Unburnt sites	13	38	55
Species fruiting on both sites in successive years		10	25
Total number of species (**261**)	**167**	**177**	**193**
Total number of fruitbodies (**34,558**)	**13,524**	**9,522**	**11,512**

On the unburnt sites changes in species composition due to natural variation were observed. In 1999 the change was 37% from that present in 1998, and in 2000 it was 30% and 42% from that recorded in 1999 and 1998 rerspectively. Such changes illustrate the variable nature of fungal fruiting patterns and demonstrate the need to monitor fungal flora over a long time period in order to understand the composition of the flora present and the complexity of fruiting behaviour.

Over the three-year period a total of 304 species were recorded and 34,558 fruitbodies were counted in the plots (Table 2). In addition 7 species of Myxomycetes were recorded (Appendix 1). Only 8 species exclusive to the burnt sites fruited in all three years.

All the species recorded from January 1998 to December 2000 are shown in Appendix 1. It must be reiterated that many of these species are as yet unidentified and possibly undescribed, and as taxonomic studies continue the number of species will change. This has proved to be the case for the previous two years. Continuing taxonomic examination of the collections from 1998 and 1999 has noticeably reduced the number of species initially reported (Robinson 1999, 2000) and has resulted in correcting the names on a number of species. The revised figures are detailed in Table 2, alongside figures for 2000, and it is likely that these figures will change again following further taxonomic examination.

Litter, trash and woody debris assessment

On the burnt sites, scorched leaves were shed from the canopy during the first 4 weeks (Plate 1b). Next, small twigs and dead branches were gradually shed, and scorched bark was first observed peeling off the stems in December 1999 (Plate 1c). By the end of 2000 the burnt sites had a coverage of decomposing litter 10-14 mm thick and a developing trash layer 7-15 cm in height (Table 3). On the burnt sites, the

mean litter loads were approximately one-third and the trash loads about one-half that measured on the unburnt sites (Plate 1c-d). However, the Cripple Rd and Lockyer Rd sites carried only one-half the amount of litter and Cripple Rd only one-half the amount of trash compared to the other unburnt sites. The amount of coarse woody debris varied widely with a similar range of volumes on both site types. An exception was Gobblecannup, which carried a very low (12.8 m^3 ha^{-1}) volume (Table 3).

Table 3. The amount of litter, trash and woody debris at each site (mean ± s.e.)

Site Location	Litter		Trash		Woody Debris (m^3 ha^{-1})	
	Load (t ha^{-1})	Depth (mm)	Load (t ha^{-1})	Depth (cm)	+ Old Logs	- Old Logs
Burnt						
Gobblecannup	8.80 ± 1.28	10. ± 0.9	4.21 ± 0.79	8.1 ± 1.6	12.80	2.47
Flybrook 1	10.96 ± 1.05	11.4 ± 0.9	8.30 ± 0.68	15.4 ± 3.2	576.44	11.35
Flybrook 2	8.71 ± 1.01	11.8 ± 1.3	7.11 ± 0.27	14.6 ± 3.0	93.30	12.82
June Rd 1	9.38 ± 7.27	14.2 ± 1.3	7.71 ± 0.93	10.6 ± 0.7	137.85	7.40
Landing Rd	8.92 ± 1.37	10.6 ± 2.0	7.61 ± 1.61	6.8 ± 1.4	254.88	11.35
Unburnt						
Cripple Rd	13.32 ± 2.53	24.2 ± 3.2	7.85 ± 1.09	10.8 ± 1.5	27.77	5.72
June Rd 2	32.06 ± 16.26	57.6 ± 7.3	13.47 ± 2.90	28.0 ± 2.6	635.34	7.30
Wallace Rd	31.92 ± 8.50	47.8 ± 2.2	12.68 ± 1.18	24.2 ± 3.2	419.01	6.12
Lockyer Rd	18.32 ± 3.34	45.6 ± 6.6	13.63 ± 0.72	23.6 ± 2.3	217.53	12.14
Flybrook 3	28.60 ± 3.73	29.0 ± 1.9	14.68 ± 1.75	24.0 ± 3.1	77.58	77.58

Litter loads ranged from 9-11 t ha^{-1} on the burnt sites 3 years after the fire (Table 3) which agrees with other studies. In immature (Bradshaw and Rayner 1997) karri forest, O'Connell (1989) estimated the amount of litter accumulating over a 1, 2 and 3 year period following a fire at 7, 12 and 15 t ha^{-1}. Similarly, Peet (1971) estimated litter loads of 3-10, 4-13 and 6-15 t ha^{-1} (depending on the amount of canopy cover) 1, 2 and 3 years following prescribed burning in karri stands. McCaw *et al*. (1996) reported litter loads in three immature karri regrowth stands ranging from 11-15 t ha^{-1} when measured 3 years following prescribed burning. Combined litter and trash loads (dead fuel) were 18-19 t ha^{-1} after 3 years. It was also demonstrated that when full crown scorch occurred, litter levels were 7 t ha^{-1} after one year and little or no accumulation occurred for a further 3 years.

Litter loads on the unburnt sites ranged from 18-32 t ha^{-1} (Table 3). McCaw *et al*. (1996, 2001) estimated litter loads in juvenile regrowth stands to be 25-28 t ha^{-1} 10 years following prescribed burning, and to be 26-32 t ha^{-1} in unburnt stands of the same age. O'Connell (1989) suggested that litter loads in immature karri reach an equilibrium of 38-48 t ha^{-1} after about 20 years. However, it is likely that O'Connell's sites, which were located within a 10 km radius of Pemberton, were in higher quality stands than those in this study. Peet (1971) estimated litter loads after 10 years to be 17-31 t ha^{-1}, but did not note the age of the stands.

PLATE 1.

(a) Litter sampling on burnt site, (b-d) litter and trash build-up on unburnt sites from Jan. 1998 to Dec. 2000, (e) litter and trash on unburnt sites, (f) the recovery of burnt forest 3 years after the fire compared to (g) unburnt forest. Note the dead and coppiced crowns on the burnt site.

(a) Litter sampling at Gobblecannup in Nov. 2000

(b) Gobblecannup Plot 12 on 23 Jan. 1998

(c) General Site, Gobblecannup on 7 Dec. 1999

(d) Gobblecannup Plot 11 on 29 Dec. 2000

(e) Lockyer Rd Plot 17 on 29 Dec. 2000

(f) General site, Landing Rd on 29 Dec. 2000

(g) General site, Lockyer Rd on 29 Dec. 2000

Species diversity and fruitbody abundance

In 2000, species diversity on both site types had an initial peak in mid-May, fell and rose to a major peak in mid-June then gradually declined throughout the rest of the year (Fig. 1). The initial peak occurred 2 weeks following a wet period from April 26-30 during which 70 ml of rain was recorded. Fruitbody production on both sites peaked in mid-May then fell dramatically over the next two weeks (Fig. 2). The numbers reached a lower plateau through early-winter then gradually declined throughout the rest of the year. The unburnt sites had both higher species diversity and fruitbody production than burnt sites.

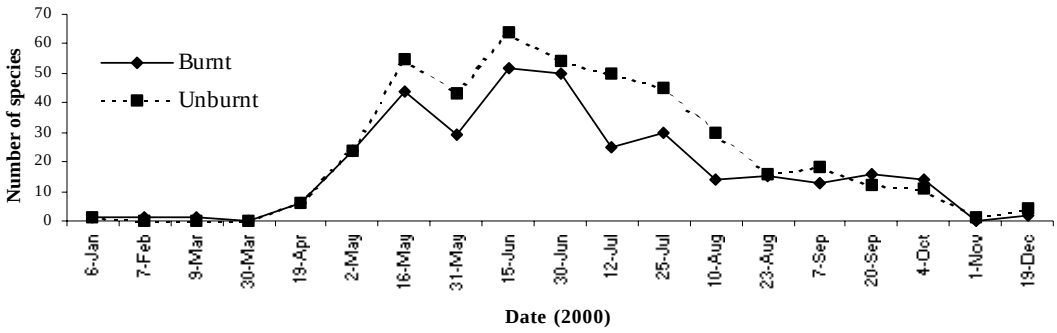

Figure 1. The number of fungal species recorded in burnt and unburnt karri regrowth plots in 2000.

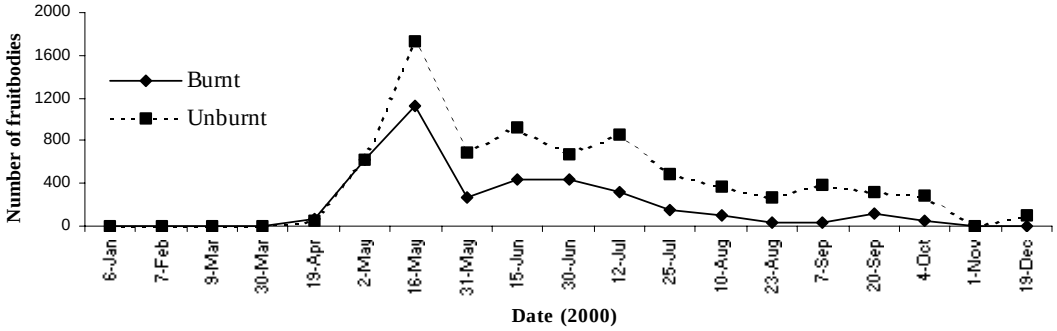

Figure 2. The number of fungal fruitbodies recorded in burnt and unburnt karri regrowth plots in 2000

In previous years, the maximum peak for fruitbody production on the burnt sites lagged behind that of the unburnt sites. In 1998 the lag was 4 weeks, and in 1999 it was 2 weeks. In 2000 the peak on burnt and unburnt sites occurred on the same date. This is likely attributed to the build up of litter and the addition of organic matter to the surface soil which allows for better moisture retention in the upper soil profile and litter on the burnt sites. On the burnt sites in 1998 and 1999, a significant flush of fruiting was observed in the spring. This did not occur in 2000. This may have been due to upper soil and litter being drier than usual. The highest monthly rainfall was recorded in July (Fig. 3). However, it then declined rapidly and the SDI began to rise sharply towards the end of September (Fig.3). This is approximately 4 weeks earlier than 1999 and 8 weeks earlier than 1998.

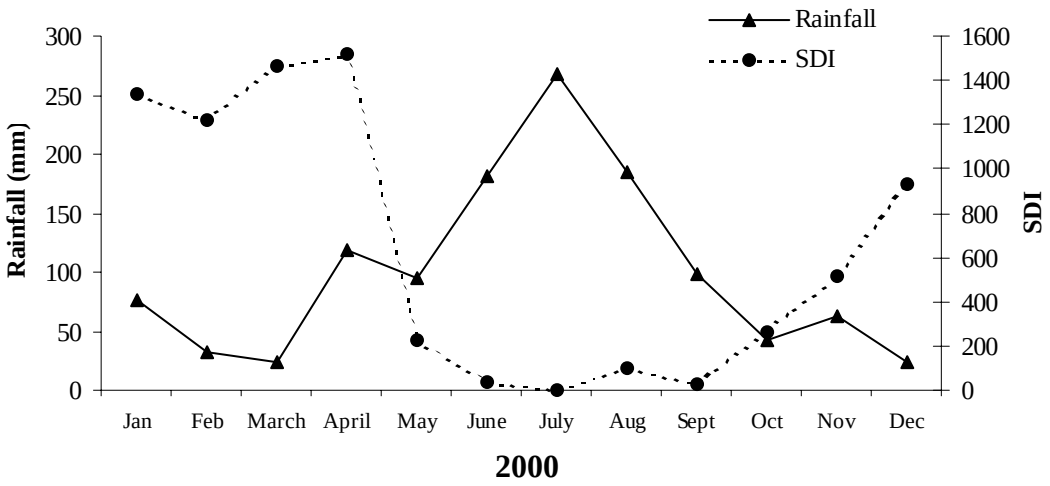

Figure 3. The total monthly rainfall measured at Pemberton in 2000 and the Soil Dryness Index (SDI) calculated at Pemberton on the 15th day of each month in 2000.

Fruiting patterns and species associated with burnt sites

In 2000, 113 species of fungi fruited on the burnt plots. Fifty-five of these species were also recorded on unburnt plots (Table 2). Of the 58 species exclusive to the burnt sites, 28 were recorded for the first time in 2000, 19 fruited in 1999, 3 fruited in 1998 and 8 fruited in all three years (Table 4).

Table 4. The number of species of fungi recorded in each year and successive (or alternate) years on burnt and unburnt karri regrowth plots.

Year (s) which species were recorded	The number of species recorded on :		
	Burnt sites only	Unburnt sites only	Both site types
1998 only	37	42	2
1999 only	24	25	12
2000 only	28	35	29
1998 + 1999	7	22	1
1999 + 2000	19	10	16
1998 + 1999 + 2000	8	24	9
1998 + 2000	3	11	1

BASIDIOMYCETES

Forty-one species of basidiomycetes fruited on the unburnt plots in 2000. Fifteen were recorded for the first time. These included an unknown Agaric (Species 346), an unknown Polypore (Species 376) an unknown Hypogean (Species 359), single species of *Clitocybe* (Species 339), *Concomyces* (Species 323), *Cortinarius* (Species 340), *Mycena* (Species 331) and *Clavaria* (Species 349), *Melanophyllum echinatum*, 4 Thelephores (Species 373, 360, 356 and 332) and 2 species of *Marasmius* (Species 326 and 341).

Six species of Basidiomycetes fruited exclusively on the burnt sites in all three years. They were *Coprinus* sp. (Species 73), *Inocybe* sp. (Species 128), *Marasmius* sp. (Species 243), *Psilocybe coprophila, Ramaria ocracheosalmonicolor* and *Ramaria* sp. (Species 43). All fruit on the soil surface except *P. coprophila* which fruits on kangaroo scats.

The species with the largest number of fruitbodies were *Concomyces* sp. (Species 323) fruiting on burnt marri bark, *Concomyces* sp. (Species 104) on karri bark, *Marasmius* sp. (Species 243) on the soil amongst leaf litter, *Mycena* aff. *subcapillaris* on rotting leaves, *R. ochraceosalmonicolor* and a small Clavaria (Species 349) fruiting on the soil.

ASCOMYCETES

Fifteen species of Ascomycetes were recorded on the burnt plots in 2000. Six of these species were also recorded on unburnt plots. Of the 11 species exclusive to the burnt plots, 5 fruited for the first time and Species 370 ("pale orange" cup fungus) was the only one to produce a reasonable number of fruitbodies. Both the number of species and the fruitbodies produced by Ascomycetes on the burnt plots has reduced each year following the fire. Only *Pulvinula archerii* and *Daldinia eschscholzii* (*D. concentrica*) had fruited exclusively on the burnt sites for all three years. The number of *P. archerii* fruitbodies decreased from 2245 in 1998 to 686 in 1999 and finally to 69 in 2000. One small cup fungus (Species 304 "khaki-olive") increased in numbers from 11 in 1999 to 60 in 2000.

Fruiting patterns and species associated with unburnt sites

One hundred and thirty five species of fungi fruited on the unburnt plots in 2000. Fifty five of these species were also recorded on burnt plots (Table 2). Of the 80 species exclusive to the unburnt sites, 35 were recorded for the first time in 2000, 10 fruited in 1999, 11 fruited in 1998 and 24 fruited in all three years (Table 4). This illustrates the year-to-year variability of fungal fruiting behaviour.

BASIDIOMYCETES

One hundred and seventeen species of Basidiomycetes were recorded on the unburnt sites in 2000. Fifty four of these species were found only on unburnt plots and 19 fruited in all three years (Table 5) and are likely typical of regenerated karri stands 20-25 years old. Species such as *Anthracophyllum archerii*, *Mycena* sp. (Species 153, "buff umbrella"), *Pluteus lutescens* (Plate 2a) and *Clavicorona piperata* (Plate 2d) fruit only on well-rotted twigs and small branches. Species 128 (LBM "olive gills"), *Marasmius crinisequi*, *M. elegans*, *Mycena* aff. *rorida*, *M. pura* (Plate 3b), *Mycena* sp. (Species 24, "tiny white cap/yellow stem", Plate 2c), *Clavulina* sp. (Species 95, "pink-buff"), *Macrotyphula junceus* and *Cantharellus cibarius* var. *australiensis* (Plate 3g) fruit only on or amongst well-rotted leaf litter. All these species appear to require the moist habitat provided by a deep litter and trash layer and a closed canopy.

ASCOMYCETES

Sixteen species of Ascomycetes fruited on the unburnt plots in 2000. Eleven of these species were found exclusively on the unburnt sites. Only one species, *Peziza* sp. (aff. *Nothojafnea*), fruited in all three years (Table 5). Five Xylariaceous species, *Hypoxylon* spp. (Species 316, 317 and 363), *H.* aff. *subrutilum* and *H.* aff.

diatrypeoides, were restricted to the unburnt sites. These species are weak semi-parasites and fruit on the wood of understorey species, such as *Trymalium floribundum, Bossiae laidlawiana* and *B. linophyla*, after the plants die. A hot fire will destroy both the host and the fungus.

Therfore it would be expected that these fungal species are fire sensitive and will reappear on the burnt sites when the host species recolonise or regenerate and the cycle of dying and regeneration in the understorey begins once again.

Table 5. Species of fungi fruiting exclusively on unburnt sites and fruiting in three consecutive years from 1998-2000.

Species No.	Species[1]	Number of Fruitbodies		
		1998	**1999**	**2000**
	BASIDIOMYCETES			
296	*Anthracophyllum archerii* **	79	766	828
202	*Cortinarius* sp. 9 (Plate 3a)	2	3	2
164	LBM "olove gills" **	241	217	51
27	*Marasmius crinisequi* *	603	243	227
28	*Marasmius elegans* *	215	147	366
118	*Mycena* aff. *rorida* *	85	112	243
119	*Mycena pura* (Plate 3b)	7	12	18
153	*Mycena* sp. "buff umbrella" *	94	43	149
123	*Mycena* sp. "golden-orange" (Plate 3c)	22	32	3
24	*Mycena* sp. "tiny white cap/ yellow stem" (Plate 2c)	85	48	86
75	*Russula* aff. *adusta* (Plate 3d)	2	1	10
137	*Tricholoma* sp. "salmon buff cap/scaly stem" (Plate 3e)	6	2	22
194	*Pluteus lutescens* (Plate 2a)	1	15	5
15	Polypore "creamy-yellow, soft" (Plate 2b)	82	62	51
78	*Clavicorona piperata* (Plate 2d)	2	33	9
95	*Clavulina* sp. "pink-buff" *	181	125	87
176	*Clavulina* sp. "slender grey-brown" (Plate 3f)	40	10	35
145	*Macrotyphula junceus* *	2	45	9
268	*Cantharellus cibarius* var. *australiensis* (Plate 3g)	73	4	23
	ASCOMYCETES			
189	*Peziza* sp. (aff. *Nothojafnea*) *	146	246	624

[1] Plate numbers indicate illustrations in this report, * illustrated in Robinson (1999), ** illustrated in Robinson (2000)

Fruiting patterns and species associated with both burnt unburnt sites

During the three year period, a total of 69 separate species fruited on both burnt and unburnt plots (Table 6). In each successive year as more litter and trash built up on the burnt sites an increasing number of fungi which typically colonised unburnt sites was observed fruiting on burnt sites. In 1998, 13 species fruited on both burnt and unburnt sites. In 1999, this increased to 38 and in 2000 it was 55. The majority of these species (78%) were saprophytic fruiting on leaf litter and small twigs.

PLATE 2

FIRE SENSITIVE SPECIES

Species of fungi that fruited exclusively on the unburnt sites for three consecutive years. These species appear to fruit only on well-rotted twigs, small branches and wood. Mycena sp. (Species 24) also fruited on leaves.

(a) *Pluteus lutescens* x 1.25

(b) Polypore (Species 15) x 0.75

(c) *Mycensa* sp. (Species 24) x 1.5

(d) *Clavicorona piperata* x 0.9

PLATE 3

FIRE SENSITIVE SPECIES…..cont.

Species of fungi that fruited exclusively on the unburnt sites for three consecutive years. These species appear to only fruit on or under well-rotted leaf litter, or are mycorrhizal.

(a) *Cortinarius* sp. 9 (Species 202) x 0.9

(b) *Mycena pura* x 0.75

(c) *Mycena* sp. (Species 123) x 1.5

(d) *Russula* aff. *adusta* x 0.6

(e) *Tricholoma* sp. (Species 137) x 0.6

(f) *Clavilina* sp. (Species 176) x 1.25

(g) *Cantharellus cibarius* var. *australiensis* x 1

Table 6. The species of fungi recorded on both burnt and unburnt plots in 1998, 1999 and 2000.

Species N$^{o.}$	Species	1998		1999		2000	
		Burnt	Unburnt	Burnt	Unburnt	Burnt	Unburnt
	BASIDIOMYCETES						
	AGARICS						
171/52	*Amanita* sp. "brown-grey/creamy white/creamy white"		4	2	10	1	5
279	*Amanita xanthocephala*	10	2	47	3	35	3
216	*Collybia* aff. *butracea*				40	13	15
216B	*Collybia* sp.				3	5	3
175	*Cortinarius* sp. 6 "orange-brown viscid cap/white dry stem"		2	1	1		10
122	*Crepidotus* sp. "buff caps on karri bark"		43	78	91	507	394
49/81	*Crepidotus* sp. "light yellow, tomentose"		29		2	19	7
184	*Crepidotus* sp. "white"		16		55	40	62
308	*Entoloma* sp. "blue-black, white with blue tinge/black"				1	2	1
200	*Entoloma* sp. "blue-black/white with blue tinge/blue-black"		1		1	1	1
167	*Entoloma* sp. "dark brown-black/pink-buff /olive-grey, shiny"	1	2				
107/132/125	*Galerina* sp. (*G. unicolor*?)		11		36	4	42
351	*Hygrocybe conica*		2			7	7
299	*Hypholoma australe*	8	33	6	9	79	6
177	*Inocybe australiensis* "brown wooly cap/flesh coloured stem"	1	35	18	106	26	66
165	*Inocybe* sp. "white wooly cap/flesh coloured stem"		8		11	1	8
120/58/172	*Inocybe* sp. "broad umbonate (fibrillose)"	10	1	5		32	
159	*Inocybe* sp. "grey-br with white fibrils"		2	3	3	5	
133/154/77	*Inocybe* sp. "peaked tomentose cap"		37	3	30	14	53
277	*Inocybe* sp. "scaly cap/flesh stem - Gobblecannup"			23		10	1
155	*Laccaria* sp. (*L. laccata*?)		8	6	26	3	3
25	*Lepiota cristata*		12		5	2	27
329	*Lepiota* sp. "brick red"					1	4
297	*Macrolepiota konradii*	1	2	1	7	11	20
212/80/207	*Marasmius alveolaris* "white-tan wheels"		470	29	1113	332	889
28	*Marasmius elegans*		215	1	147		366
92/16/85/47	*Marasmius* sp. LBM "karri bark 4, free rim"	3	224	7	404	21	295
210	*Marasmius* sp. "2-4mm, white"				10	6	11
328	*Marasmius* sp. "decurrent gills on leaf litter"					10	11
18/242a	*Marasmius* sp. "orange-red"		37	1	29		

Table 6. ……Continued

Species N$^{o.}$	Species	1998		1999		2000	
		Burnt	Unburnt	Burnt	Unburnt	Burnt	Unburnt
223/134/19	*Marasmius* sp.		6	54	40	533	160
121/50/198/105	*Mycena* aff. *alcalina*		124	3	195	4	241
147/76/345	*Mycena* aff. *subgallericulata*?		20	7	21	1	19
229/91	*Mycena sanguinolenta*	1	1	39		24	12
331	*Mycena* sp. "grey-brown, small, weak bleach"					2	2
219	*Mycena* sp. "14-30mm, gr br/smokey,/white-grey-brown."			8	1		
195	*Mycena* sp. "1mm, tiny, (mealy)white/white /white"		3			4	1
209/205/211/214/186/97/98	*Mycena* sp. "2.5-5mm small buff"		4	33	50	149	23
232	*Mycena* sp. "2mm white/white (dec)/white, on soil"			45	1	71	2
227	*Mycena* sp. "6-10mm, dk br, weak bleach/ creamy white/grey brown"			3	3	7	1
226	*Mycena* sp. "9-17mm, gr-br/light gr/gr-br, bleach"			46	12		19
146	*Mycena* sp. "tiny white scaly cap (1-2mm)"		23	34	90	176	63
156	*Panellus ligulatus* "gilled, orange soft bracket"		14		65	6	74
168	*Pholiota* sp. "red-brown scales on cap and stem"		8		10	3	13
204	*Pluteus* sp. (Goblecannup, plot 11, 12/5/99)			29		5	4
82	*Russula clelandii* "burgandy/white/pinkish"		4		7	1	6
83	*Russula* sp "creamy white/creamy white/creamy white"		15		2	1	2
131/101	*Tricholoma eucalipticum*	20	30	44	29	42	67
289	*Tubaria rufofulva*	3	18	2	36	14	34
258	*Xerula australis*				1	2	2
	BOLETES						
10	*Paxillus* sp. "yellow, brown scales"		7	51		65	2
	POLYPORES and THELEPHORES						
314/142	*Coltricia oblectans* "dark brown pores"		9	3	27	8	9
222	Thelephore "Hydnoid" (*Trichopatum* sp.?)			1	9		4
	CORAL FUNGI						
96	*Clavulina amethystina* "mauve"		37		8	9	12
369	*Clavulina* sp. "yellow orange"					1	8
114/144	*Clavulinopsis* sp. (*C. amoena/aurantia*)		72	1	21	11	266
141	*Clavulinopsis* sp. "grey-white"		2	3	1		
113a/113b	*Clavulinopsis* sp. "white clubs"		148		6	2	191

Table 6. …….Contunued

Species N$^{o.}$	Species	1998		1999		2000	
		Burnt	Unburnt	Burnt	Unburnt	Burnt	Unburnt
169	*Ramaria* sp. "bright yellow"	1	4	1	3		3
	JELLY FUNGI						
273	*Heterotexus peziziformis*		8	2	26	10	37
	GASTEROMYCETES						
129	*Mesophellia* sp.	29		5	3	2	
	ASCOMYCETES						
	CUP and DISC FUNGI						
51	Discomycete "black, stalked"	15	105	57	167	29	183
240	Discomycete "tiny yellow, stalked"			11	30		
280/264	Peziza (aff. *Discina* sp.) "brown wrinkled"			2	6		
190	*Plectania* sp.		362		653	9	813
	EARTH TONGUES						
166	*Geoglossum* sp.		21		2	2	30
	PYRENOMYCETES						
192	*Biscogniauxia plana*		12		9	2	1
253	*Hypoxylon* cf. *subcorticeum* "flat purple"			1	2	1	
294	*Xylaria hypoxylon*		1	22	234	86	233

BASIDIOMYCETES

The saprophytic Basidiomycetes included 11 species of *Mycena* and 7 species of *Marasmius*. Species such as *Mycena alcalina* and *Mycena* sp. (Species 232) were more usual on the burnt sites and only fruited in low numbers on the burnt sites. Others such as *Marasmius alveolaris* and *Clavulinopsis* sp. (Species 114) were more prolific on the unburnt sites and were not found on the burnt sites in the first year.

Amanita xanthocephala and *Tricholoma eucalypticum* were the only mycorrhizal species to fruit consistantly in all three years. A high number of *Mesophellia* sp. (Species 129) fruitbodies were found on the burnt sites in 1998 but only in low numbers the following two years. It was found on unburnt sites only in 1999. This species is well known as a food source for small mammals, both in Western and Eastern Australia (Christensen 1980, Claridge *et al.* 1996) and was thought to be stimulated to fruit by fire (Cleland 1934, Christensen 1980, Taylor 1991, 1992). It has since been shown that *Mesophellia* spp. fruit in large numbers in the absence of fire (Claridge *et al.* 1993, Johnson 1994) and it is more likely that the fruitbodies survive the fire aided by a hard soil encrusted outer layer and the fact that they fruit underground. They are more easily located and excavated by animals immediately after a fire.

ASCOMYCETES

Ascomycetes were the dominant fungal flora on the burnt sites in the first year following the fire. However, over the three year period only 8 species of Ascomycetes were found fruiting on both site types and only one species, Species 51 ("black stalked" Discomycete), fruited on both in all three years. *Plectania* sp. (Species 190) was predominantly a species typical of the unburnt sites, fruiting on well-rotted twigs buried in a well composted leaf litter. In 2000, however, this species was found fruiting amongst moss and leaf litter in the burnt plots at Gobblecannup. *Xylaria hypoxylon* is a wood decay fungus. Generally it fruits on well-rotted wood and small stumps. Although it was not recorded in burnt plots in 1998 (NB. Only one specimen was recorded on the unburnt plots in 1998), it was found fruiting on dead understory stumps in the burnt plots in 1999 and 2000. It fruited in low numbers compared to the unburnt sites, which reflects the low availability of suitable substrates on recently burnt sites.

CONCLUSIONS

A distinct and recognizable mycoflora fruits on recently burnt sites in karri regrowth forests. In each year the number of species on the burnt sites was less than that on the unburnt. In 1998, more than twice the number of fruitbodies were recorded in the burnt plots than the unburnt plots (Table 1). In 1999 and 2000, however, this was reversed with the burnt sites having only one-half the number of fruitbodies as the unburnt sites. On the burnt plots, there were distinct and significant changes in the species recorded each year. In 1999 and 2000 there was a 71% and 48% change respectively in the species composition from the previous year. In 2000 the change was 81% from that in 1998. In 1999 the changes were attributed to (i) the absence of sclerotial basidiomycetes which appear to be directly stimulated by the fire to fruit, (ii) the absence of several pyrophilous Ascomycetes which apear to favour the temporarily high alkaline conditions produced by the ash-bed affect and (iii) the presence of saprophytic fungi colonising the increasing litter and trash layer. In 2000 the change can be attributed to the added diversity of the saprophytic fungi associated with well-rotted litter and an increase in the number of mycorrhizal fungi. Some of the change may also be attributed to seasonal variation in fungal fruiting patterns.

On the unburnt plots the change in species composition was 37% and 30% respectively for 1999 and 2000, and 42% for 2000 compared to 1998. Non-fruiting does not indicate the absence of a species, as any number of species may be present in the form of mycelium in soil, litter or wood, but they do not fruit. Fugal species fruit in a range of soil temperatures and moistures (Bougher *et al*. 1999) and changes of 30% in species composition from year to year may be nornal.

The number of species recorded on both sites increased dramatically each year. In 1998, 8% of the species reported fruited on both sites. In 1999 and 2000, this increased to 22% and 29% respectively. This is mainly attributed to the specialised flora colonising recently burnt sites and the gradual build up of litter following the fire. The rapid decline in soil pH during the first year following a fire (Hatch 1960) creats conditions unsuitable for the alkaline-loving pyrophilous species and the addition of litter favours colonisation by species of saprophytic fungi more common on unburnt sites.

The pyrophilous fungi appear to fall into four broad groups. The first group consisting of those fungi which fruited from subterranean sclerotia following the fire. This group includes the sclerotial agaric *Neolentinus dactyloides* and the sclerotial polypores, *Polyporus mylittae* and *P. tumulosa* which fruit within days of the fire. *Polyporus sclerotinus* which fruited in the autumn and *Morchella elata* which fruited *en masse* in the spring following the fire are also included in this group. All five species were recorded only in the first year.

The second group is made up of species such as *Peziza tenacella*, *Geopyxis* aff. *carbonaria*, *Peziza* aff. *praetervisa*, *Peziza* spp. (Species 196 and 41), Species 64 (Agaric), *Coprinus* sp. (Species 73), Species 30 (LBM) and Species 60 ("lemon-yellow" Discomycete). All fruited exclusively on burnt soil in the first autumn following the fire and were not recorded in the second year.

The third group contains species such as *Anthrocobia muelleri*, *Coprinus* aff. *domesticus*, *Coprinus* spp. (Species 182 and 74) and *Peziza* sp. (Species 40) which fruited on the burnt soils in the first season following the fire and continued through the second year in smaller numbers. There were other species which could be included in the second and third categories, but they were only recorded in very low numbers.

A fourth group included *Pulvinula archerii*, *Coprinus* sp. (Species 73), *Inocybe* sp. (Species 128), *Marasmius* sp. (Species 243), *Ramaria ochraceosalmonicolor*, *Ramaria* sp. (Species 43) and *Daldinia eschscholzii*. All fruited on the burnt sites for three consecutive years. Generally they were recorded in large numbers in the first year then in low numbers in the following two years. Exceptions were *R. ochraceo-salmonicolor* and *D. eschscholzii* which fruited in low numbers in the first year and in high numbers in the second and third years. *Psilocybe coprophila* could also be included in this group as it fruited exclusively on burnt sites for three years. However, it is more likely found on burnt sites as a consequence of it colonising kangaroo droppings. Kangaroos are common on the burnt sites, feeding on the new shoots of resprouting and regenerating flora.

There were a number of species which fruited only on the burnt sites in 2000. Included were *Marasmius* sp. (Species 326, illustrated on cover) which fruited on the burnt stumps of *Podocarpus drouynianus*, *Mycena* sp. (Species 334), Species 373 (Thelephore) which fruited on newly fallen marri twigs, Species 332 (Thelephore, illustrated on cover) which fruited amongst moss, Species 346 ("grey *Inocybe*-like agaric") and Species 349 ("small lemon club", illustrated on cover) which fruited on bare soil and Species 370 ("pale orange cup fungus", illustrated on cover) which fruited on the soil amongst well-rotted leaf litter. These species may belong to a fifth group but further monitoring is necessary in order to ascertain whether their presence is reliant on fire.

The outcome for managers of both regrowth and natural eucalypt forests is to aim for a mosaic of stands of different times since burning in order to maximise fungal biodiversity.

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APPENDIX 1. The species of fungi and the number of fruitbodies recorded in karri regrowth forest on burnt and unburnt plots in 1998. 1999 and 2000.

Sp. No.	Species	Life Mode[1]	1998 Burnt	1998 Unburnt	1999 Burnt	1999 Unburnt	2000 Burnt	2000 Unburnt
	BASIDIOMYCETES							
	AGARICS (Gilled Mushrooms)							
139	Agaric "black, black scales"	S		1				
20	Agaric "brick red/yellow/brick red + scales"	S		1				
307	Agaric "bronze, brown gill edges"	S				1		
67	Agaric "brown, brown scales"	S	1					
29	Agaric "dark brown, inrolled margin"	S	13					
49	Agaric "cinnamon, gilled bracket"	S		4		2		
2/64	Agaric "creamy buff, viscid/white/pinkish buff"	S/M?	40					
130	Agaric "dark grey-brown (slimy)/white (waxy)/long buried stem"	S/M	1					
271	Agaric "olive-yellow"	S			1			
257	Agaric "orange-br, orange-br, yell-br"	S/M?				4		
372	Agaric "plum with yellow gills"	S						2
108/108B	Agaric "red gills"	S		3		6		12
244	Agaric "Wallace"	S				25		
246	Agaric aff. *Melanoleuca* sp.	S/M?			1			
352	Agaric Unknown "red, mycena-like"	S						1
346	Agaric Unkown "grey, Inocybe-like"	S					11	
322	*Agaricus* sp. "yellow stainer"	S						23
300	*Agaricus* sp."red-brown stain"	S				3		
235	*Amanita* sp. "13mm, white, deep rooting stem and volva"	M			2		7	
171/52	*Amanita* sp. "brown-grey/creamy white/creamy white"	M		4	2	10	1	5
279	*Amanita xanthocephala*	M	10	2	47	3	35	3
265	*Amanita xanthocephala* (forma *macalpiniana*?)	M				3		
296	*Anthracophyllum archerii*	S		79		766		828
302	*Armillaria luteobubalina* (Flybrook Con 21, 6/5/98)	P/S		2		1		
185	*Clitocybe* sp.	S		1				
185	*Clitocybe* sp.	S						1
275	*Clitocybe* sp. "small dk grey"	S				2		1
283	*Clitocybe* sp. "cream-buff"	S				3		
342	*Clitocybe* sp. "creamy grey"	S						19
344	*Clitocybe* sp. "large grey brown"	S						1
339	*Clitocybe* sp. ? "grey"	S					4	
216	*Collybia* aff. *butracea*	S				40	13	15
216B	*Collybia* sp.	S				3	5	3
305	*Collybia* sp. "hygrophanous"	S			1			
197	Collybia?	S		4				
323	*Concomyces* sp. "burnt Marri bark"	S					95	
104	*Concomyces* sp "grey gill edges"	S		10		25	102	
72	*Coprinus* aff. *domesticus*	S	668		181			
281	*Coprinus* sp. "grey scaly cap"	S			1			
311	*Coprinus* sp. "light brown"	S			3			
306	*Coprinus* sp. "tall, grey scaley cap"	S			9		1	
111	*Coprinus* sp. "brown mealy scales, short stem - Gobblecannup"	S	2		18			
158	*Coprinus* sp. "light brown, grooved"	S	3					

Appendix 1….cont

Sp. No.	Species	Life Mode[1]	1998 Burnt	1998 Unburnt	1999 Burnt	1999 Unburnt	2000 Burnt	2000 Unburnt
182	*Coprinus* sp. "mealy scales, long stem - Flybrook"	S	57		8			
74	*Coprinus* sp.2 "large"	S	24		2			
73	*Coprinus* sp.3 "medium"	S	121		1		6	
350	*Cortinarius* (*Dermocybe*) sp.16 "yellow gills and stem"	M						1
358	**Cortinarius basirubescens**	M						1
173	*Cortinarius rotundisporus*	M		1				6
138	*Cortinarius* sp. 1 "purple hued Dermocybe"	M		9				32
237	*Cortinarius* sp. 12 aff sinapicolor?	M			9			
249	*Cortinarius* sp. 13 "red brown with light orange brown margin"	M			1		3	
340	*Cortinarius* sp. 15 "small orange brown"	M					3	
353	*Cortinarius* sp. 17 "purple hue on margin"	M						14
140	*Cortinarius* sp. 2 "light brown, red-brown centre"	M		4				
143	*Cortinarius* sp. 4 (*C. vinaceolamellatus*?) "purple hues"	M		6		10		2
162	*Cortinarius* sp. 5	M		3				
175	*Cortinarius* sp. 6 "orange-brown viscid cap/white dry stem"	M		2	1	1		10
163	*Cortinarius* sp. 7	M		2				1
179	*Cortinarius* sp. 8 "covered with soil"	M	1					
202/284	*Cortinarius* sp. 9 "brown conic"	M		2		3		2
231/236 /325	*Cortinarius* sp. 10 "mauve-brown hygrophanous cap, purple-brown gills, "	M			14		24	
238	*Crepidotus* sp. "white, tomentose"	S				44		
122	*Crepidotus* sp. "buff caps on karri bark"	S		43	78	91	507	394
49/81	*Crepidotus* sp. "light yellow, tomentose"	S		29		2	19	7
184	*Crepidotus* sp. "white"	S		16		55	40	62
310	*Entoloma* sp. "blue-black, black gill edge"	S				2		5
308	*Entoloma* sp. "blue-black, white with blue tinge/black"	S				1	2	1
200	*Entoloma* sp. "blue-black/white with blue tinge/blue-black"	S		1		1	1	1
180	*Entoloma* sp. "brown/pinkish-buff/dark brown"	S	2					
167	*Entoloma* sp. "dark brown-black/pink-buff/olive-grey, shiny"	S	1	2				
136	*Entoloma* sp. "dark brown/pinkish-buff/light br"	S		7				1
335	*Entoloma* sp. "grey brown, silky"	S						1
183	*Entoloma* sp. "grey-brown/pinkish-brown/grey-brown"	S						
374	*Entoloma* sp. "silky grey-brown/blue-white/blue"	S						2
174	*Entoloma* sp. "silver-grey/creamy-pink/silver-grey"	S		2				
377	*Entoloma* sp. "silver-grey/tan/silver-light blue"	S						2
242(b)	*Galerina* sp. "no ring" Gobblecannup	S			4		2	
107/132 /125	*Galerina* sp. (*G. unicolor*?)	S		11		36	4	42
298	Gymnopilus Flybrook 17 8/6/99	S					33	
298	*Gymnopilus* sp. "Flybrook"	S			10			
248	*Gymnopilus* sp. (*G. austrosapineus*) "creamy yellow"	S			32		41	
368	*Hygrocybe* aff. *cantharellus*	S						2
351	*Hygrocybe conica*	S		2			7	7
299	*Hypholoma australe*	S	8	33	6	9	79	6
177	*Inocybe australiensis* "brown wooly cap/flesh coloured stem"	M	1	35	18	106	26	66
188	*Inocybe* sp.	M	4					

Appendix 1….cont

Sp. No.	Species	Life Mode[1]	1998 Burnt	1998 Unburnt	1999 Burnt	1999 Unburnt	2000 Burnt	2000 Unburnt
120/58/172	*Inocybe* sp. "broad umbonate (fibrillose)"	M	10	1	5		32	
165	*Inocybe* sp. "white wooly cap/flesh coloured stem"	M		8		11	1	8
159	*Inocybe* sp. "grey-brown with white fibrils"	M		2	3	3		
133/154/77	*Inocybe* sp. "peaked tomentose cap"	M		37	3	30	14	53
277	*Inocybe* sp. "scaly cap/flesh stem - Gobblecannup"	M			23		10	1
103	*Inocybe* sp. "umbonate scaly cap"	M		6		1		11
128/89	*Inocybe* sp. "water soaked gills"	M	796		370		30	
159	*Inocybe* sp? "grey-brown with white fibrils"	M					5	
354	*Laccaria* sp. "purple-brown"	M						4
155	*Laccaria* sp. (*L. laccata*?)	M		8	6	26	3	3
336	*Lactarius eucalypti*	M						2
164/79	LBM "olive gills"	S?		241		217		51
30/93/116	LBM "on soil, decurrent gills"	?	73					
25	*Lepiota cristata*	S		12		5	2	27
329	*Lepiota* sp. "brick red"	S					1	4
217	*Lepiota*sp. "creamy tan"	S				12		19
297	*Macrolepiota konradii*	S	1	2	1	7	11	20
212/80/207	*Marasmius alveolaris* "white-tan wheels"	S		470	29	1113	332	889
27	*Marasmius crinisequi*	S		603		243		227
28	*Marasmius elegans*	S		215	1	147		366
243/199	*Marasmius* sp. "tan"	S	10		60		95	
92/16/85/47	*Marasmius* sp. LBM "karri bark 4, free rim"	S	3	224	7	404	21	295
210	*Marasmius* sp. "2-4mm, white"	S				10	6	11
328	*Marasmius* sp. "decurrent gills on leaf litter"	S					10	11
326	*Marasmius* sp. "emu bush"	S					44	
18/242a	*Marasmius* sp. "orange-red"	S		37	1	29		
341	*Marasmius* sp. "red brown, on leaves"	S					14	
207	*Marasmius* sp. “2mm light brown-tan, ginger scales”	S					1	
223/134/19	*Marasmius* sp.	S		6	54	40	533	160
355	*Melanophyllum echinatum*	S					4	
234	*Mycena* aff *subcapillaris*? (on leaf litter)	S			39		73	
118/109	*Mycena* aff. *rorida*	S		85		112		243
147/76/345	*Mycena* aff. *subgallericulata*?	S		20	7	21	1	19
121/50/198/105	*Mycena* aff. *alcalina*	S		124	3	195	4	241
119/53	*Mycena pura*	S		7		12		18
229/91	*Mycena sanguinolenta*	S	1	1	39		24	12
195	*Mycena* sp. "1mm, tiny, (mealy)white/white/white"	S		3			4	1
334	*Mycena* sp. "1.5 mm, white/dec., white/white, on litter"	S					14	
331	*Mycena* sp. "grey-brown, small, weak bleach"	S					2	2
11	*Mycena* sp. "10mm, smokey grey-tan/tan-grey/dark brown"	S		12				
221	*Mycena* sp. "11-13mm, grey-brown/cream-grey/light brown-grey brown"	S			23			

Appendix 1….cont

Sp. No.	Species	Life Mode[1]	1998 Burnt	1998 Unburnt	1999 Burnt	1999 Unburnt	2000 Burnt	2000 Unburnt
151	*Mycena* sp. "12mm, dk br/smokey gr/gr br to dk br in lower portions"	S	2					
219	*Mycena* sp. "14-30mm, gr br/smokey,/white-gr br."	S			8	1		
14	*Mycena* sp. "14mm, dk br/creamy tan/dy br"	S		1				
209/205 /211/214 /186/97/98	*Mycena* sp. "2.5-5mm small buff"	S		4	33	50	149	23
170	*Mycena* sp. "21mm, br/pinkish light br/steely dk br"	S	1					
4	*Mycena* sp. "25-35mm, dk br/silver grey/silver br"	S	32					
232	*Mycena* sp. "2mm white/white (dec)/white, on soil"	S			45	1	71	2
365	*Mycena* sp. "2-3mm,small buff, on karri trunk"	S						9
213	*Mycena* sp. "3-4mm white/white/white"	S				1		
157	*Mycena* sp. "3-4mm, creamy gr/light creamy gr/br"	S	2					
115/87	*Mycena* sp. "3-5mm, light gr/creamy gr/white to br to dk br at base"	S		5				
124	*Mycena* sp. "4.5-7mm, light br/creamy white/buff"	S		3				
13	*Mycena* sp. "4-13mm, light br-gr/light br-tan/steely dk br"	S		10				
245	*Mycena* sp. "5-9mm, buff(tan)/white/red br. to dk br"	S			14			
227	*Mycena* sp. "6-10mm, dk br, weak bleach/cr.white/grey brown"	S			3	3	7	1
233	*Mycena* sp. "6-15mm, light gr br/dull white/white-brown grey, no odour"	S			25		2	
230	*Mycena* sp. "7-12mm, dk br/grey/smokey-light grey, no odour"	S			45		1	
135	*Mycena* sp. "7mm, dk br/creamy buff/dk br to light br at base"	S		1				
228	*Mycena* sp. "9-14mm, dk br/dull white/white-grey, no odour"	S				3		1
84	*Mycena* sp. "9-15mm, dk br/smokey/silver-white"	S		3				
226	*Mycena* sp. "9-17mm, gr-br/light gr/gr-br, bleach"	S			46	12		19
330	*Mycena* sp. "10-28mm,dark brown, large, caespitose"	S						15
219	*Mycena* sp. "14-30mm, gr.br/smokey,/white-gr.br."	S						3
153/102 /106/117	*Mycena* sp. "buff umbrella"	S		94		43		149
123/218 /287	*Mycena* sp. "golden-orange (4-10mm)"	S		22		32		3
146	*Mycena* sp. "tiny white scaly cap (1-2mm)"	S		23	34	90	176	63
24/9	*Mycena* sp. "tiny white/yellow stem (2-5mm)"	S		85		48		86
250	*Mycena* sp. "translucent white (3-5mm)"	S				25		23
7/68/5	*Neolentinus dactyloides*	S	642					
99/201	*Omphalina* sp. "orange, brown scales"	S		3		9		
100	*Omphalina* sp. "yellow-orange"	S		1				5
290	*Omphalina* sp. Flybrook Con 24. 24/8/99	S?				1		
156	*Panellus ligulatus* "gilled, orange soft bracket"	S		14		65	6	74
168	*Pholiota* sp. "red-brown scales on cap and stem"	S		8		10	3	13
1/55/70	*Pleurotus* sp.	S	7					
270	*Pluteus attromarginata*	S			1			5
194	*Pluteus lutescens* "phleboid, red-brown/yellow/yellow"	S		1		15		5
204	*Pluteus* sp. (Goblecannup, plot 11, 12/5/99)	S			29		5	4
94/65	*Psilocybe coprophila* "on 'roo dung"	C	26		51		37	

Appendix 1….cont

Sp. No.	Species	Life Mode[1]	1998 Burnt	1998 Unburnt	1999 Burnt	1999 Unburnt	2000 Burnt	2000 Unburnt
82	*Russula clelandii* "burgandy/white/pinkish"	M		4		7	1	6
83	*Russula* sp "creamy white/creamy white/creamy white"	M		15		2	1	2
75	*Russula* sp. *R.* aff. *adusta*?	M		2		1		10
86	*Russula* sp. "grey-brown/creamy white/grey-brown"	M		4				
86	*Russula* sp. "grey-brown/creamy white/grey-brown"	M						1
131/101	*Tricholoma eucalipticum*	M	20	30	44	29	42	67
267	*Tricholoma* sp. "grey-white"	M				1	4	
137/161	*Tricholoma* sp. "salmon-buff, scaly stem"	M		6		2		22
289	*Tubaria rufofulva*	S	3	18	2	36	14	34
258	*Xerula australis*	S				1	2	2
	Unidentifiable (Agarics)		26	27	15	12	20	33
	BOLETES (Pored Mushrooms)							
319	*Boletellua ananiceps* 'shaggy, blue staining bolete"	S?			1			
241	*Boletus* sp. "Creamy yellow red/yellow/yellow, flesh stains intense blue"	S/M?				4		
46	*Boletus* sp. "purple-black"	S/M?		6				
252	*Paxillus* sp. "common yellow"	M			16		2	
220	*Paxillus* sp. "dk brown"	M			4			
10	*Paxillus* sp. "yellow, brown scales"	M		7	51		65	2
	POLYPORES and THELEPHORES							
314/142	*Coltricia oblectans* "dark brown pores"	S		9	3	27	8	9
193	Coltricia sp. "miniature"	S	6					
285	*Hymenochaete* sp.	S			1		2	
291	*Piptoporus australiensis*	S		2		4		
269	*Podoserpula pusio*	S				1		6
292	Polypore "hydnoid, brown resupinate"	S			1			
293	Polypore "white resupinate"	S				2		
301	Polypore "beige, resupinate"	S		1		1		2
15	Polypore "creamy-yellow, soft"	S		82		62		51
272	Polypore "resupinate, hydnoid-ridged"	S				1		
274	Polypore "resupinate, irregular elongated pores"	S		1		1		
364	Polypore "small creamy, on marri stem"	S						12
206	Polypore "small velvet hoof"	S			30			
54	Polypore "toothed resupinate"	S	1					
376	Polypore "white resupinate"	S					1	
321	*Polyporus mylittae*	S	3					
23	*Polyporus sclerotinus*	S	71		2			
320	*Polyporus tumulosus*	S	25					
295	*Stereum hirsutum*	S		30		6		
247	Thelephore "black, mauve margin"	S			9			
373	Thelephore "brown - on marri twigs"	S					10	
360	Thelephore "chocolate brown"	S					3	
362	Thelephore "coltricia-like"	S						1
356	Thelephore "dark grey-brown, light grey margin"	S					1	
222	Thelephore "Hydnoid" (*Trichopatum* sp.?)	S			1	9		4
17	Thelephore aff. *Merulius* sp.	S		1				
278	Thelephore "shallow merulioid"	S			1		4	

Appendix 1….cont

Sp. No.	Species	Life Mode[1]	1998 Burnt	1998 Unburnt	1999 Burnt	1999 Unburnt	2000 Burnt	2000 Unburnt
332	Thelephore "translucent funnels"	S					22	
263	Thelephore "translucent salmon fan"	S				3		
361	Thelephore "yellow glue"	S						4
203	Trametes "brown zoned"	S		1				
	HYDNOID (Spined) FUNGI							
178	*Hydnum* aff. *repandum*	M		1				20
	CORAL FUNGI							
349	Clavaria "small lemon clubs"	S					112	
78	*Clavicorona piperata*	S		2		33		9
96	*Clavulina amethystina* "mauve"	S		37		8	9	12
26	*Clavulina* sp. "creamy tan"	S		1				
95	*Clavulina* sp. "pink-buff"	S		181		125		87
176	*Clavulina* sp. "slender grey-brown"	S		40		10		35
266	*Clavulina* sp. (aff. *coralloides*) "white"	S				2		
375	*Clavulina sp. "*white"	S						4
369	*Clavulina* sp. "yellow orange"	S					1	8
114/144	*Clavulinopsis* sp. (*C. amoena/aurantia*)	S		72	1	21	11	266
126	*Clavulinopsis* sp. "grey-buff, simple or branched club"	S		3				
141	*Clavulinopsis* sp. "grey-white"	S		2	3	1		
113a/113b	*Clavulinopsis* sp. "white clubs"	S		148		6	2	191
145	*Macrotyphula* sp? "cream-white candles"	S		2		45		9
225	*Ramaria ochraceosalmonicolor*	M	2		626		202	
169	*Ramaria* sp. "bright yellow"	M	1	4	1	3		3
282	*Ramaria* sp. "lemon-yellow"	M				1		
43/127	*Ramaria* sp. "light yellow-brown"	M	12		3		1	
	CHANTERELLES							
268	*Cantharellus cibarius* var. *australiensis*	S/M?		73		4		23
	JELLY FUNGI							
357	*Calocera* sp. "yellow"	S		1				1
273	*Heterotexus peziziformis*	S		8	2	26	10	37
286	Tremella "translucent white"	S			3		17	
3	*Tremella fuciformis* (Lockyer Con 17, 2/6/98)	S		5				1
8	*Tremella mesenterica*	S		5				
	GASTEROMYCETES							
378	*Gaestrum* sp.	S						1
359	Hypogean "light yellow brown, sac-like gleba"	M					2	
276	Hypogean "light yellow"	M			2		2	
262	Hypogean "olive-yellow, white gleba with irregular convoluted locules"	M			1			
61	Hypogean "orange-brown gelatinous core"	M	2					
254	Hypogean "white, olive gleba"	M			8		3	
129	*Mesophellia* sp.	M	29		5	3	2	
148	*Nidularales* sp. "bird nest fungi"	S	2					
224	*Scleroderma areolatum*	S			4		4	

Appendix 1….cont

Sp. No.	Species	Life Mode[1]	1998 Burnt	1998 Unburnt	1999 Burnt	1999 Unburnt	2000 Burnt	2000 Unburnt
	ASCOMYCETES							
	CUP and DISC FUNGI							
112	*Aleuria rhenana* "stalked orange cup fungus"	S	9				9	
66/35	*Anthrocobia muelleri*	S	209		25			
149/152	Cup Fungi (*Geopyxis carbonarius*?)"light orange"	S	355					6
304	Cup Fungus "khaki-olive"	S			11		60	
370	Cup Fungus ""pale orange"	S					40	
288	Cup Fungus "light orange"	S				2		
303	Discomycete "yellow, stalked, on Podocarpus fruits"	S			66			
51	Discomycete "black, stalked"	S	15	105	57	167	29	183
251	Discomycete "cream, 2-3mm"	S				17		26
337	Discomycete "cream/grey"	S						30
60	Discomycete "lemon-yellow on bare soil"	S	109					
48	Discomycete "lemon-yellow on 'roo dung"	C		25				
33	Discomycete "lemon-yellow, on emu dung"	C	100					
261	Discomycete "orange-yellow, 1-3mm"	S			71			
208	Discomycete "tiny orange"	S			6			
240	Discomycete "tiny yellow, stalked"	S			11	30		
366	Discomycete "yellow/white, stalked"	S					11	
280/264	Peziza (aff. *Discina* sp.) "brown wrinkled"	S			2	6		
38/63	Peziza (*P.* aff. *succosa*) "light brown/tan"	S	66					
196	Peziza "black/brown, tangled hairs"	S	815					
34	Peziza "brown/khaki"	S	4					
187	Peziza "creamy-white cup fungus"	S	2					
32	Peziza "dk brown/black"	S	10					
260	Peziza "dk brown/brown" (same as 41?)	S			10			
41	Peziza "dk brown/buff"	S	272					
160	Peziza "dk brown-black, on rotton wood"	S	65					
90	Peziza "dk maroon-br/br-khaki"	S	87					
189	Peziza (aff. *Nothojafnea* sp.) "brown hairy cup fungus"	S		146		246		624
40/36/37	Peziza (*P.* aff. *badia*) "br-black/br, pimples"	S	123		4			
31/39/69	Peziza "maroon/tan"	S	33					
191	Peziza (*P.* aff. *repanda*) "large brown cup on bark of karri"	S	3					
22/71	*Peziza* aff. *praetervisa*	S	923				2	
259	*Peziza* aff. *whitei*	M				1		
21	*Peziza tenacella*	S	803					
190	*Plectania* sp.	S		362		653	9	813
66B	*Pulvinula archerii*	S	2245		686		69	
309	*Scutellinia* aff. *margaritacea* (*S. scutellata*)	S				13		4
	MORELS							
181	*Morchella elata*	S/M	152					
	EARTH TONGUES							
166	*Geoglossum* sp.	S		21		2	2	30
	PYRENOMYCETES (Flask Fungi)							
315	*Hyphomyces crysospermum* "white/yellow, on Bolete"	P				1		

Appendix 1….cont

Sp. No.	Species	Life Mode[1]	1998 Burnt	1998 Unburnt	1999 Burnt	1999 Unburnt	2000 Burnt	2000 Unburnt
	(XYLARIACEOUS FUNGI)							
255	*Daldinia eschscholzii*	S	7		58		42	
313	*Hypoxylon* cf. *subrutilum*	S				2		3
253	*Hypoxylon* cf. *subcorticeum*	S			1	2	1	
316	*Hypoxylon* sp. "tiny, black erumpent mounds"	S						4
317	*Hypoxylon* sp. "brown grey with beige margin"	S						2
318	*Hypoxylon* cf. *diatrypeoides*	S				1		3
192	*Biscogniauxia plana*	S		12		9	2	1
312	*Biscogniauxia uniapiculata*	S		2				
363	*Hypoxylon* sp. "grey, on *Trymalium*"	S						1
371	*Xylaria* aff *polymorpha*	S					1	
294	*Xylaria hypoxylon*	S		1	22	234	86	233
56	Xylaria-like "small grey antlers"	S	106					
	(CORDYCEPS)							
239	Cordyceps (case moth cocoon)	P				2		
256	Cordyceps "coral-like"	P			1			
347	Cordyceps "large, brown irregular"	P					1	
333	Cordyceps "tall slender"	P					2	
338	Cordyceps "white clubs"	P						1
	Others							
324	Infected Insects	P					2	
367	Unknown "Ascomycete?, black and white, horn-like"	?						1
12	Unknown "White Spikes"	S		17		NC[2]		13
327	Unknown "wooly antlers"	S					7	
343	Unknown "*Xylaria*-like, on marri fruit"	S						1
348	Unknown Ascomycete?	?					1	
	Number of Species		68	112	96	119	113	135
	Number of Fruitbidies		9279	4245	3329	6193	3775	7737
				13524		9522		11512
	Total Number of Species Recorded = 261							
	Total Number of Fruitbodies Counted = 34558							
	MYXOMYCETES (slime moulds)							
ND 60	Myxomycete *Fuligo septica* (white/yellow)	B			4	1		
ND 51	Myxomycete *Lycogala epidendrum* (Flybrook Plot 16, 21/10/98)	B	1					
ND 71	Myxomycete "orange heads"	B					2	3
ND 72	Myxomycete "purple heads"	B						1
ND 68	Myxomycete "strawberry" Wallace Rd Con 14, 1/11/98	B				2		
ND 70	Myxomycete "white spines"	B					4	5
ND 69	Myxomycete "yellow heads" Wallace Rd Con 14, 3/5/99	B				90		28

[1] Life Mode: M = mycorrhizal, S = saprophytic, C = coprophilous, P = parasitic, B = bacteriaphore
[2] NC = present in moderate numbers, but not counted