Biological impacts of the 2005 wildfire on southern Eyre Peninsula:

monitoring post-fire recovery within three years using *Biological Survey of South Australia* sites.

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Cover photo:

Site KOP00201 in Wanilla Conservation Park, taken post-fire in September 2007.

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SUMMARY

This study presents the results of a biological survey undertaken in 2007 on southern Eyre Peninsula to investigate the impact of the January 2005 wild fire on plant and animal communities using standard Biological Survey quadrats. A secondary aim of the study was to trial the use of Biological Survey methods to monitor and assess major changes over time.

In 2004 a biological survey of both flora and fauna was conducted by the Department for Environment and Heritage across remnant native vegetation habitats in southern Eyre Peninsula. The survey used standard sampling techniques applied to 36 sites representing major native habitat types. All the sites had been accurately located and permanently marked to enable repeatable photographs and sampling. In January 2005 a wild fire burnt through nine of the sites that had been surveyed in the previous year.

In this study, the nine burnt sites were re-sampled in 2007, three growing seasons after the fire, to assess the recovery and loss of plant and animal species, and the appearance of previously unrecorded species. In addition five new burnt sites were sampled in 2007 to provide additional data on regeneration responses. Four survey sites with similar vegetation that were not burnt in the wildfire were also re-sampled as controls. These match the majority of burnt sites in being located in the main range system of the Koppio Hills and rainfall records indicate a similar pattern of a decrease in growing season rainfall from 2004 to 2007.

Fauna

The pre and post fire surveys sampled seven of the sites burnt in January 2005 and detected 213 records of 20 reptile species and 105 records of 9 mammal species. Overall there was a decline in both the number of individuals (36% reptile & 43% mammal) and the number of species detected (23% reptile & 33% mammal). This is in contrast to the vegetation where there was a general increase in species richness.

From the repeated fauna surveys, two native mammal species have disappeared from sites since the fire. That one of these, the Bush Rat (*Rattus fuscipes*), was previously the most abundant mammal and present at four sites, indicates that it may now be locally extinct in those habitat patches. The Western Pygmy-possum (*Cercartetus concinnus*) however was only present at one site in low levels prior to the survey, so the confidence that the post-fire null capture represents a real decline is much lower. Western Grey Kangaroos (*Macropus fuliginosus*) were still widespread throughout the burnt area and Common Brushtail Possums (*Trichosurus vulpecula*) had survived at two sites in Tucknott Conservation Reserve, although the possum's survival may have been assisted by the supplementary feeding done post-fire by local residents. Introduced species were present in similar levels after the fire as before it, except for rabbits which were recorded at all sites, indicating that they may have benefited from the fire.

Seven of the twenty species of reptiles recorded from both visits were present as a single record. No conclusions have been drawn as to the fate of these species because of the small amount of data. There were multiple records of 12 species in 2004 and 11 in 2007. Species that appear to have been severely disadvantaged from the fire were the Striped Wall Skink (*Cryptoblepharus pulcher*), Delicate Skink (*Lampropholis delicata*) and Spinifex Snake-lizard (*Delma butleri*). Sleepy Lizards (*Tiliqua rugosa*) and possibly Dwarf Skinks (*Menetia greyii*) also appear to have been disadvantaged post fire. All these species frequent microhabitats which make them vulnerable to intense understorey fires. A small skink, the Adelaide Snake-eye (*Morethia adelaidensis*), appears to have benefited with its appearance at two sites since the fire.

Murrunatta Conservation Park was found to support interesting outliers of three species during the 2004 survey. These were the Bight Coast Ctenotus (*Ctenotus euclae*), the Western Three-lined Skink (*Bassiana*

trilineata) (Rare: SA NPW Act) and the Bull Skink (*Egernia multiscutata*). The latter two skinks have a southern coastal distribution on Eyre Peninsula, Murrunatta being an inland outlier for both species. The white sands typical in Murrunatta are similar to those found along the coast but are now isolated from these areas through vegetation clearance. One of each species was recorded during the 2004 survey, however only the Bight Coast Ctenotus was evident during 2007. Murrunatta is the most southerly recorded locality for this species. Given that the Western Three-lined Skink has a Rare rating it would be worthwhile conducting more extensive surveys to determine its status in the Conservation Reserve.

Flora

A total of 320 vascular plant species were recorded from the survey area in 2007, comprising 272 (85%) native and 48 (15%) alien species. Sixteen of the plant species are listed on the schedules of the SA NPW Act as either Rare or Vulnerable, and two have national status under the EPBC Act as Vulnerable species.

One plant which appeared post-fire is a new species record for the Eyre Peninsula region: the small native, spore-producing Pigmy Clubmoss (*Phylloglossum drummondii*), discovered in Wanilla Conservation Park. A small clump of the rarely encountered Streaked Hop-bush (*Dodonaea tepperi*) found on the 2004 survey in a Heritage Agreement area in the Koppio Hills, was further documented by voucher collections. This occurrence of Streaked Hop-bush is significant because of its close association with both putative parents and provides useful evidence supporting the delisting of this plant as a nationally Endangered species due to its status as a non-proliferating hybrid.

The total vascular plant species richness across the nine burnt quadrats increased substantially post-fire, from 175 species (150 indigenous and 25 alien) in 2004, to 237 species (193 indigenous and 44 alien) in 2007. However, using an index based on cover scores, the disparity in responses of alien and indigenous species was much greater, with a post-fire increase of 136 % for alien species compared to 11 % for indigenous species. These results support the view that disturbance by fire promotes the introduction and increase of weed species in native habitats.

The pre-fire plant species richness per quadrat for the nine burnt sites ranged from 30 to 61, with a mean value of 45 species. Three years on, the species richness had increased substantially in nearly all sites, and the 2007 counts ranged from 51 to 92 with a mean value of 67 species per quadrat. Although species were lost from all these quadrats, in every case the gains outweighed losses, and on average 32 new species were gained compared to 10 that were lost from each quadrat. The four unburnt quadrats provide a reasonable control for rainfall influences operating from 2004 to 2007 and indicate the extent to which these changes can be attributed to the fire. Although all four of the northern unburnt sites had between 14 and 23 new species records, taking into account losses, their net change was small with a mean increase of only 2 species. Thus, treating the northern unburnt sites as a control, the average net gain of 22 plant species per site for the burnt quadrats in 2007 can be largely attributed to the effect of fire.

Most changes in species presence/absence involved plants with low cover/abundance scores that made a minor contribution to the total biomass of quadrats. The appearance and disappearance of small numbers of small-sized plants can be patchy across the landscape, but considered collectively the changes in counts of species overall showed a clear pattern of increasing diversity post-fire. Notable amongst the gained species with more substantial cover were Slender Cherry (*Exocarpos sparteus*), a small tree well-known as a fire successional species, and Cleland Beard-heath (*Leucopogon clelandii*), a small epacrid shrub rated as a rare species for the State. The loss of species with substantial cover was minimal and localised. Native Pine (*Callitris gracilis*) had only a minor occurrence in one quadrat, but from additional observations in the surrounding area it seemed that the fire has caused its local extinction from Wanilla Settlement Reserve and vicinity.

Analysis of species richness and cover measures for different life form classes showed a marked post-fire reduction in the contribution by trees, mallees and shrubs over 1.5m as expected, but below this height richness-cover scores had increased illustrating the general height range of 1.0-1.5 m attained by regenerating shrubs. Perennial forbs, perennial grasses and perennial sedges had only minor increases in species richness post-fire, compared to marked increases in annual forbs, annual grasses and annual sedges, and this pattern was maintained for all except perennial sedges using an index weighted for cover estimates.

The mode of regeneration (seedling or regrowth) was ascertained from field observations as far as possible for all species occurrences in the burnt quadrats. This data is tabulated in an appendix to the report and is supported by many examples which are documented by photographs of herbarium specimens or plants in situ. Both modes of regeneration were present for trees and mallees, and a significant number of shrub species occurrences. Regrowth alone was the major mode for shrubs and perennial sedges, but was relatively minor for perennial forbs, perennial grasses and vines. Obligate seedling regeneration, at least within the study context, is indicated for 28 shrub species that were found in post-fire quadrats only as seed-established plants. The majority of these (17 species) were legumes, comprising all five Bush-pea (*Pultenaea*) species and 10 of the 12 Acacia species recorded. Thorn Wattle (*Acacia continua*) and Spiny Wattle (*A. spinescens*) are the two exceptional Acacias that were observed re-sprouting as well as regenerating by seedlings. Other plants relying solely on seedling regeneration were the three recorded *Spyridium* species and the two Riceflower (*Pimelea*) species, Twiggy Daisy-bush (*Olearia ramulosa*), Ruddy Beard-heath (*Leucopogon rufus*) and the large shrub Totem-poles (*Melaleuca decussata*) which surprisingly showed no re-sprouting at any of its six post-fire sites. Twenty of the 28 'obligate seeder' species had already reached reproductive maturity within three years post-fire despite in most cases being under 1 m tall and well below their mature height.

A significant occurrence of Desert Banksia (*Banksia ornata*) in Murrunatta Conservation Park showed poor post-fire recruitment and warrants ongoing monitoring. Except for a single individual which had some small regrowth shoots, all mature plants observed had been killed by the fire and seedlings were uncommon. It is suggested that the poor seedling recruitment of this species may be the result of dryer than normal seasons post-fire. This illustrates the importance of allowing for seasonal variability in planning fire frequencies, as conditions may not always be favourable for predicted reproductive cycles. Recruitment failure can have serious consequences, especially where minimum cycles are implemented to maximise fuel reduction outcomes.

Fuel load assessment

A pre- and post-fire assessment of fuel loads was undertaken in the office with assessments made by referring to site photographs and relevant survey data, and using the criteria established by the'Overall Fuel Hazard Guide for South Australia ' (Department for Environment & Heritage, 2006). Sites showed considerable variation in overall hazard scores, both pre- and post-fire, reflecting the complexity and diverse nature of the vegetation communities sampled. The nine sites assessed pre-fire had fuel hazard levels ranging from 'Moderate' to 'Extreme'. Although the fire removed all readily flammable biomass (including the ground litter layer) from all the 2004 sites, three years on only five of these still had a lower overall fuel hazard level than they did pre-fire. It is a concern that only three years after the fire, five of the 14 burnt sites had reached a fuel level of 'Medium', and four had a 'Very High' *Overall Fuel Hazard*. The variability in the fuel hazard scores shows that an extreme fire still does not provide uniform or long term reduction of fuel hazard across the range of vegetation types sampled by this study.

The prolific post-fire regeneration of Rock Wattle, a resinous and flammable species, was observed in large areas of Wanilla Conservation Park and provides a dramatic example of how fire-induced regeneration can escalate fuel loads within three years.

Management burns to reduce fuel hazard may be an unwarranted and wasted effort in those vegetation communities where survey results indicate a rapid return to pre-fire levels. Increasing the frequency of burns would be difficult to achieve: firstly, because available resources are usually limited and secondly, because of the narrow and unpredictable window of opportunity provided by local weather conditions. Climate change may further reduce suitable opportunities. From a conservation perspective, increased fire frequency is likely to cause the local extinction of species not capable of reaching reproductive maturity within shorter time-spans, and lead to increasing opportunities for weed invasion and dominance of 'fire-increaser' species.

Biological Survey methodology

The Biological Survey (BS) methodology[1] was designed to provide a baseline inventory of vascular plant and vertebrate communities occurring in the major habitat types of a region, whereas most monitoring situations call for more detailed quantitative comparisons. Nevertheless in an area that has already been

[1] described by Heard and Channon (1997) for vegetation, and Owens (2000) for fauna

burnt, any pre-existing site survey data is inherently valuable. Consequently this study looked at a full range of standard Biological Survey data to investigate what information they could provide on changes to vegetation post-fire.

Biological Survey sites provide a representative and comprehensive State-wide array of standardised potential pre-fire data with defined photo points and a repeatable process for reassessing change. On Eyre Peninsula the BS sites proved to be readily and accurately relocatable, with steel droppers which marked the photo points surviving the fire. As the coverage of BS sites is very extensive there is a reasonable likelihood of having some pre-fire sites within a study area, depending on the size of the burn. However, the sampling intensity is relatively low and there is poor replication of particular communities within a district. BS data could be put to greater use if the density of quadrats was increased.

A major deficiency of Biological Survey sampling, the lack of replicates, can be circumvented to some degree by using summative measures such as species richness, by aggregating data into life form groups, and by combining data across all quadrats, when making comparisons. Species richness is an easily derived measure and the Biological Survey data is well suited for using this attribute to compare pre- and post-fire sites. Changes in the presence or absence of particular species are only likely to be significant if they are particularly abundant or the changes are replicated across a number of quadrats.

A serious impediment in using BS data for comparisons is that cover/abundance information is recorded in a way that is hard to separate from floristics, life form and structure. The broad cover classes used in Biological Survey quadrats enable broad qualitative comparisons but are not suited to detect subtle changes that may be of concern from a monitoring perspective. Useful data can certainly be extracted from Biological Survey sites for pre- and post-fire comparisons, but the BS sites are not a substitute for quantitative sampling methods that are tailored to answer specific questions.

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The results of this study raise concerns that highlight the needs for: further monitoring of biota recovering from the 2005 fire; and ongoing research to better understand how fragmented ecosystems are affected by fire and the optimum strategies for their management. Prescribed burning with the principal aim of fuel reduction, if carried out effectively, will necessarily have significant conservation impacts on species survival, and on ecosystem structure and function.

Figure 1: Survey sites sampled for the post-fire study.

INTRODUCTION

This study presents the results of a biological survey undertaken in 2007 on southern Eyre Peninsula to investigate the impact of the January 2005 wild fire on plant and animal communities using standard Biological Survey quadrats. A secondary aim of the study was to trial the use of Biological Survey methods to monitor and assess major changes over time.

During 2004, 36 sites on southern Eyre Peninsula were sampled as part of an ongoing biological survey of remnant habitats across the whole Eyre Peninsula (BS128) conducted by the Department for Environment and Heritage... The 36 sites had been chosen to represent the range of major native habitat types present in the area and were surveyed using standard Biological Survey methods. The vegetation survey component was conducted during September 2004, and selected quadrats were followed up with vertebrate surveys during December 2004. All sites had been permanently marked with star droppers as reference points for repeatable photographs and the location of a 30m x 30m vegetation quadrat.

In January 2005 a wild fire which started near Wangary south of the Marble Range swept across southern Eyre Peninsula and burnt through nine of the sites that had been surveyed during the previous year (Figure 1). Seven of the nine sites had been surveyed for fauna as well as vegetation.

The nine burnt sites were revisited during 2007, three growing seasons after the fire, and re-surveyed using the same biological survey methods to assess the recovery and loss of plant and animal species, and the appearance of previously unrecorded species. Three of the burnt sites were on the plains in between the Marble Range and Koppio Hills with the remaining six in the Koppio Hills. An additional five new burnt sites were also sampled in 2007 to provide extra data on regeneration responses.

Four unburnt original survey sites from the northern half of the Koppio Hills were also re-surveyed as controls. These match the majority of burnt sites in being located in the main range system of the Koppio Hills and district rainfall records indicate that they experienced a similar pattern of a decrease in growing season rainfall from 2004 to 2007.

All of the patches burnt were characterised by being relatively small and isolated from other similar sized areas of native vegetation. As well as being fragmented, all of the burnt patches supported vegetation communities that are restricted in range, are unique to the southern Eyre Peninsula, and have been greatly reduced to less than 10% of their former extent through native vegetation clearance. Vegetation communities sampled ranged from Melaleuca shrubland over Cutting-grass sedges, to Open mallee over sand heath, and to Woodlands dominated by Sugar Gum, Drooping Sheoak, Eyre Peninsula Blue Gum or Peppermint Box. Fortunately some unburnt examples of the dominant communities remain in adjacent areas.

This report compares findings from the 2004 survey with the follow up survey three seasons post fire comprising nine burnt sites, four unburnt comparison sites, and five new burnt sites sampled during 2007 (Table 1). The aim was firstly to document the impact of the fire on the flora and fauna of this highly fragmented suite of unique Eyre Peninsula habitats and secondly to investigate the value of revisiting standard biological survey quadrats to describe major changes over time. This report should be seen as the first stage of a longer study monitoring the ecological response of these habitats over time.

Table 1: Site locations and history.

SITEID	PATCHID	BURNT	FAUNA	FLORA 2004	FLORA 2007	MGA	EASTING	NORTHING
KOP00201	20188	Y	Y	Y	Y	53	565899	6176750
KOP00301	20189	Y	Y	Y	Y	53	565864	6177370
KOP00401	20190	Y	Y	Y	Y	53	572919	6180716
KOP00501	20191	Y	Y	Y	Y	53	573915	6182667
KOP00601	20192	Y	Y	Y	Y	53	574522	6183084
KOP00701	20193	Y		Y	Y	53	581138	6191064
KOP00801	20194			Y	Y	53	588607	6202068
KOP00901	20195			Y	Y	53	588771	6201891
KOP01001	20196			Y	Y	53	589670	6204128
KOP01101	20197			Y	Y	53	586370	6209490
MUR00101	36233	Y			Y	53	553067	6177694
MUR00201	36234	Y			Y	53	554991	6176828
MUR00301	36235	Y			Y	53	554958	6176401
ULE01001	20184	Y		Y	Y	53	555080	6175649
ULE01101	20185	Y	Y	Y	Y	53	554964	6177501
ULE01201	20186	Y	Y	Y	Y	53	562132	6178651
WAN00101	36236	Y			Y	53	565399	6176988
WAN00201	36237	Y			Y	53	564812	6176200

METHODS

The methods used in this study were consistent with those used for the Biological Survey of South Australia detailed by Heard and Shannon (1997) for vegetation, and Owens (2000) for fauna. Sites were originally selected to sample the range of landforms and vegetation types represented in the region and spread as far as practical to cover geographic variation. All nine burnt sites (ULE01001-ULE01201 and KOP00201-KOP00701), plus an additional four unburnt sites (KOP00801-KOP01101) were re-sampled for vegetation. Due to time and personnel constraints only seven burnt sites were sampled for vertebrates (ULE01101, ULE01201 and KOP00201-KOP00601). The location of sites and their history is summarised in Table 1.

For flora records, between-observer biases were eliminated by using the same two botanists for all quadrats, and seasonal differences were minimised (although not eliminated) by timing both surveys in September.

On the first visit in 2004 sites were marked with two galvanised star droppers spaced 10m apart to mark the centre of one edge of a 30m x 30m vegetation quadrat and provide a camera position and sighting post for the photograph. During September 2004 each plant species detected within the quadrat was recorded and assigned a cover abundance class. The dominant life form category, and one or more phenological 'life stages ' (flowering, fruiting etc) with significant representation were also recorded. For the post fire visit in September 2007, datasheets were produced for each quadrat with a pre-printed list of species found in 2004 sorted by cover/abundance scores. These species were checked and if still present their new cover/abundance, dominant life form and life stage information was recorded, while species not previously recorded at the quadrat were added to the bottom of the list. The datasheet also contained a column for regeneration comments. These comments included the type of regeneration that was observed, viz. basal, epicormic, or seedling). In addition to the sites surveyed, more extensive opportunistic searching for rare and previously unrecorded species was done in some of the conservation reserves once all sites had been surveyed.

The vertebrate fauna at each site was sampled in December 2004 using one 50 m line of six evenly spaced pit traps joined by 60m of aluminium flywire. Most pit traps were 150 mm diameter and 380 mm deep, except where exceptionally hard ground lead to shorter 190mm deep traps being employed. Pit lines effectively sample reptiles, most small ground dwelling mammals and frogs. A line of 15 Elliott type 2 aluminium box traps was set at 5-10m intervals in a random direction from the start of each pit line, to sample for small mammals such as rodents which can jump out of pit traps, some larger reptiles and snakes may occasionally be captured. Two larger wire cage traps were set in association with the Elliott line, one at each end, to capture larger possum-sized mammals. One hour was spent at each site searching for reptiles and mammals by two or more people. Bat call detection equipment (Anabat) was set for one night at each site to sample for bats. Harp traps were also used at sites ULE01201 for three nights to capture bats. The techniques used during December 2007 were identical except that no Harp traps were set, primarily because the situations where Harp traps are effective had been removed by the fire.

RESULTS & DISCUSSION

Site attributes and comparisons between sites

The biological survey sites had been selected to constitute a sample from the full range of major vegetation communities of the region but with only limited replication, as is usual for a basic inventory survey of the State-wide program. The passage of the fire burnt out three sites on the plains (coded as ULE) and the majority of sites on the main Koppio Hills range (coded as KOP), but it did leave several range sites unburnt to the north, providing a limited opportunity for comparison.

It is important to establish the extent to which the vegetation and environments of the unburnt sites replicate conditions in the burnt sites. Consideration of factors such as landform, soil, climate and common plant species are important in making these comparisons.

Physical and geographical characteristics

The four unburnt sites provide a limited control. Table 2 summarises physical and geographical characteristics recorded from all sites. Apart from the plains sites (ULE01001, ULE01101, ULE01201) which have unique landforms and lower altitudes, the burnt KOP sites are in hills and gullies and have an altitude range of 140 – 240 m. The four unburnt control sites match the latter in their hill landforms with altitudes spanning 158 – 245 m.

There is no clear differentiation between sites on field-recorded soil texture classes or strew cover. The two southern-most control sites fall within the area mapped by Crocker (1946) in the "podsols and residual podsols" class, the same broad soil unit that encompasses all the burnt sites. Their soil similarities are reflected in the vegetation communities as both the sites had Sugar Gum (*Eucalyptus cladocalyx*), in common with many of the burnt sites on the range.

Table 2: Site physical attributes.

SITEID	BURNT	ALT	LANDFORM	SOIL	STREW SIZE	STREW COVER
KOP00201	Y	230	hill crest	loamy sand	none apparent	nil
KOP00301	Y	220	hill slope	sandy clay loam	pebble (5-50 mm)	<10%
KOP00401	Y	177	gully	loam	none apparent	nil
KOP00501	Y	240	hill slope	clay loam sand	pebble (5-50 mm)	<10%
KOP00601	Y	225	hill slope	sandy clay loam	pebble (5-50 mm)	<10%
KOP00701	Y	140	gully	clay loam sand	none apparent	nil
KOP00801		235	hill slope	clay loam sand	cobble (51-250 mm)	<10%
KOP00901		245	hill crest	clay loam sand	pebble (5-50 mm)	10-30%
KOP01001		180	hill slope	clay loam	pebble (5-50 mm)	<10%
KOP01101		158	hill slope	sandy clay loam	cobble (51-250 mm)	<10%
MUR00101	Y	37	sandy plain	loamy sand	pebble (5-50 mm)	<10%
MUR00201	Y	42	sandy plain	loamy sand	none apparent	nil
MUR00301	Y	37	sandy plain	loamy sand	none apparent	nil
ULE01001	Y	29	swamp	sandy clay loam	none apparent	nil
ULE01101	Y	56	sandy plain	loamy sand	none apparent	nil
ULE01201	Y	81	plain	sandy clay loam	pebble (5-50 mm)	10-30%
WAN00101	Y	190	hill slope	sandy loam	pebble (5-50 mm)	<10%
WAN00201	Y	150	hill slope	sandy loam	pebble (5-50 mm)	<10%

Rainfall patterns

While the control sites match the majority of burnt sites in being located in the main range system of the Koppio Hills, they are located further north under a slightly lower rainfall regime. The station with the highest annual average rainfall is Koppio in the southern part of the ranges with 522 mm, and Wanilla on the western margin of the hills (and towards the western part of the study area) is at a similar level (Table 3). The annual average rainfall at Wanilla is probably under-represented in the data, being based on only five years of records which were mostly below average across the region, and this is supported by the close correspondence between Wanilla and Koppio in growing season rainfall The isohyet map in Smith (1963) shows a steady decline in rainfall progressing north-north-east along the main range before it decreases dramatically in the vicinity of the northernmost site. The outlying stations off the higher part of the range at Ungarra and Cummins have much lower mean annual rainfall (415 and 426 mm respectively) than is likely at the northern control sites. Of these, the three more southern sites are likely to approach 500 mm, although the northernmost control would be substantially lower.

The condition of the vegetation sampled across the quadrats gave the impression that 2007 had been a significantly drier year than 2004 and this is borne out by the rainfall records for nearby stations (Table 4). Rainfall during the 4 months preceding the survey (May through August) is likely to have the greatest impact on plant growth and the abundance and diversity of annual plants. The graph of this"growing season" rainfall (Figure 2) shows a broadly similar overall decline from 2003 to 2007 (but with 2006 the driest of these years at the two southern stations). Notably, the drop in rainfall comparing 2007 with 2004 is proportionate at all three stations (Table 4). This suggests that the unburnt northern quadrats would provide a reasonable control for rainfall influences.

Table 3: Mean annual rainfall records from near study area.

Station	Latitude	Longitude	Altitude m	# years data	mean annual rainfall mm
UNGARRA	34° 11'	136° 03'	98	83	415
CUMMINS	34° 16'	135° 44'	65	85	426
KOPPIO	34° 25'	135° 49'	173	115	522
WANILLA	34° 33'	135° 42'	80	5	506
WHITE FLAT	34° 30'	135° 52'	120	120	489

Table 4: Rainfall totals (Jan-Dec), and 'growing season' rainfall (May-Aug), for survey period years.

Station		2003	2004	2005	2006	2007	difference 2004 - 2007
UNGARRA	Jan-Dec	450	**323**	399	324.3	**361.8**	
"	May-Aug	259.2	**209**	188	154.9	**146.3**	**62.7**
KOPPIO	Jan-Dec	557.4	**480.8**	566.9	382.7	**501.6**	
"	May-Aug	334.8	**329.2**	293.4	158.3	**249.8**	**79.4**
WANILLA	Jan-Dec	561	**513.8**	516	410.6	**484.4**	
"	May-Aug	324.4	**335.6**	291.6	204.8	**251.8**	**83.8**

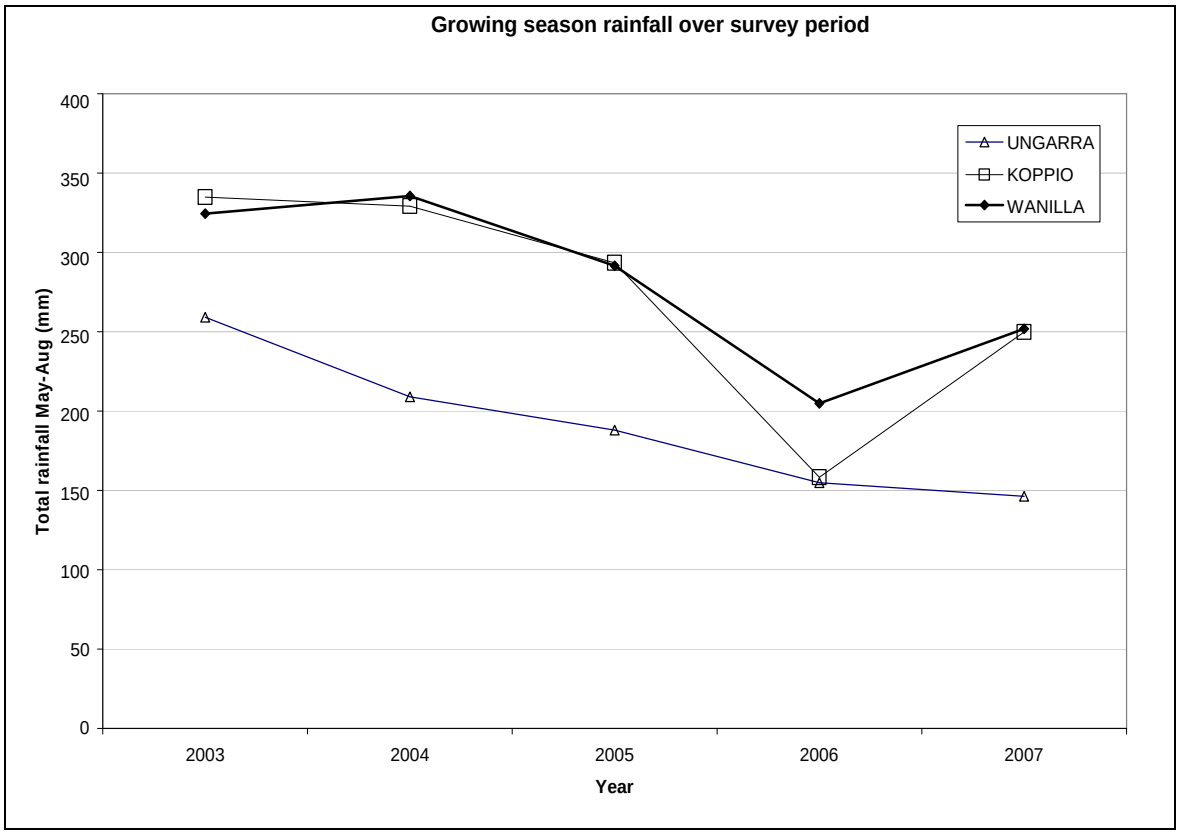


Figure 2: Growing season rainfall over survey period.

Context within broader Eyre Peninsula vegetation classifications

To compare the plant communities in the control sites and burnt sites pre-fire we used the broad classification of vegetation communities across Eyre Peninsula carried out by Brandle et al.(2009). Brandle included the 13 original vegetation sites from this fire study and re-ran the PATN analysis with post-fire repeat visits removed. A total of 36 major floristic clusters were recognised according to major groups in the dendrogram of site similarities defined by an arbitrary cut level. That analysis classified the 13 sites from this current study in only four of those clusters (Table 5). The overall proximity of the clusters suggests that in the context of Eyre Peninsula there is a broad floristic similarity between all the sites of this fire study. The unburnt control sites were classified into clusters 20 and 22 together with two burnt sites in each.

Unburnt sites KOP01001 and KOP01101 were grouped in cluster 20 along with burnt sites KOP00401 and KOP00701. This is a broad, poorly defined cluster with a wide range of sites that'chain' together. The two unburnt sites and KOP00701 however all have Peppermint Box (*Eucalyptus odorata*) and/or Eyre Peninsula Blue Gum (*Eucalyptus petiolaris*) in the overstorey and are in the same sub-group (floristic group 103).

The grouping of unburnt sites KOP00801, KOP00901 in cluster 22 along with burnt sites KOP00201, KOP00601 indicates the most valid control comparison. The two unburnt sites in this group are the southernmost of the control sites and share with the two burnt sites the highest altitudes (all over 200 m), high rainfall, leached soils (podsols) and vegetation dominated by Sugar Gum (*Eucalyptus cladocalyx*).

Table 5: Extract from classification of Eyre Peninsula vegetation communities (Brandle et al., 2009) showing the assignment of the 13 original fire study sites. (The unburnt sites are underlined.)

Cluster 17. Silver Broombush / Broombush Shrublands over Smooth Guinea-flower +/- mallee overstorey

Floristic Group 132. Silver Broombush *Babingtonia behrii* / Broombush *Melaleuca uncinata* / Yacca *Xanthorrhoea semiplana* Shrubland over Smooth Guinea-flower *Hibbertia* sp. Glabriuscula / Flame Heath *Astroloma conostephioides*

KOP00301, KOP00501, ULE01201

Floristic Group 167. Coastal White Mallee *Eucalyptus diversifolia* +/- Coast Ridge-fruited Mallee *Eucalyptus angulosa* Mallee over Yacca *Xanthorrhoea semiplana*, Myrtle Wattle *Acacia myrtifolia* and Smooth Guinea-flower *Hibbertia* sp. Glabriuscula

ULE01101

Cluster 19. Thatching Grass and Cutting Grass Sedgelands with or without an overstorey of Short-leaf Honey Myrtle or Swamp Paperbark.

Floristic Group 70. Short-leaf Honey-myrtle *Melaleuca brevifolia* Shrubland +/- Totem-poles *Melaleuca decussata* / Cutting Grass *Gahnia trifida* over Bare Twig-rush *Baumea juncea* / Tassel Rope-rush *Hypolaena fastigiata*

ULE01001

Cluster 20. A diverse collection of floristic groups that include as overstorey dominants: Peppermint Box, Peninsula Mallee, Coast Ridge-fruited Mallee, Darke Peak Mallee and River Red Gum.

Floristic Group 85. Drooping Sheoak *Allocasuarina verticillata* +/- Coastal White Mallee *Eucalyptus diversifolia* Woodland / Mallee over Yacca *Xanthorrhoea semiplana* +/- Port Lincoln Guinea-flower *Hibbertia cinerea* / Needle Bottlebrush *Callistemon rugulosus* / Broad-leaf Raspwort *Gonocarpus mezianus*

KOP00401

Floristic Group 103. Peppermint Box *Eucalyptus odorata* Mallee / Eyre Peninsula Blue Gum *E. petiolaris* Woodland over Broombush *Melaleuca uncinata* +/- Feathery Wattle *Acacia imbricata* / Sweet Bursaria *Bursaria spinosa* / Peach Heath *Lissanthe strigosa*

KOP00701, KOP01001, KOP01101

Cluster 22. Sugar Gum Woodlands of the Koppio Hills and Marble Range.

Floristic Group 145. Sugar Gum *Eucalyptus cladocalyx* Woodland over Rock Wattle *Acacia rupicola* / Yacca *Xanthorrhoea semiplana* / Peach Heath *Lissanthe strigosa* / Broad-leaf Raspwort *Gonocarpus mezianus* / Coarse Bottle-daisy *Lagenophora huegelii*

KOP00201, KOP00601, KOP00801, KOP00901

Vertebrate fauna responses

The pre and post fire sampled seven of the sites burnt in January 2005 and detected 213 records of 20 reptile species and 105 records of 9 mammal species. Overall there was a decline in both the number of individuals (36% reptile & 43% mammal) and the number of species detected (23% reptile & 33% mammal). This is in contrast to the vegetation where there was a general increase in species richness. The detailed results have been separated taxonomically into sections for each vertebrate Class.

Mammals

Three species of bat were also captured at one site during the 2004 visit, however no bat traps were set in 2007so comparable post-fire data is lacking. The number of sites at which a species was recorded is generally better for comparative purposes than actual capture numbers because capture numbers can be greatly influenced by variables operating at a site that do not reflect true abundance. However if animals were numerous at a site on one occasion, and absent on another, then the assumption that no captures means they were not at that site has reasonable confidence. If on the other hand only one individual was captured, then a null capture for the other visit has less confidence since the probability of being trapped may be very low. A detailed breakdown of species recorded at sites pre- and post-fire is presented in Appendix 3 (p.101).

From the summarised results below (Table 6) it can be seen that two native mammal species have disappeared from sites since the fire. That one of these, the Bush Rat (*Rattus fuscipes*), was previously the most abundant mammal and present at four sites, indicates that it may now be locally extinct in those habitat patches. The Western Pygmy-possum (*Cercartetus concinnus*) however was only present at one site in low levels prior to the survey, so the confidence that the post-fire null capture represents a real decline or loss is much lower.

Western Grey Kangaroos (*Macropus fuliginosus*) were still widespread throughout the burnt area and Common Brushtail Possums (*Trichosurus vulpecula*) had survived at two sites in Tucknott Conservation Reserve, although the possum's survival may have been assisted by the supplementary feeding done post-fire by local residents. Introduced species were present in similar levels after the fire as before it, except for rabbits which were recorded at all sites, indicating that they may have benefited from the fire.

Table 6: Mammal species recorded at sites in 2004 and 2007, showing number of individuals and the number of sites at which they were recorded.

(SUB)FAMILY NAME	SPECIES	COMMON NAME	INDIGENOUS?	2004 # obs	2004 # sites	2007 # obs	2007 # sites
BOVIDAE	*Ovis aries*	Sheep	N	1	1	0	0
BURRAMYIDAE	*Cercartetus concinnus*	Western Pygmy-possum	Y	2	1	0	0
CANIDAE	*Vulpes vulpes*	Fox	N	3	3	4	3
LEPORIDAE	*Oryctolagus cuniculus*	Rabbit	N	3	1	7	3
MACROPODIDAE	*Macropus fuliginosus*	Western Grey Kangaroo	Y	11	5	9	5
MURIDAE Murinae	*Mus musculus*	House Mouse	N	10	4	12	5
"	*Rattus fuscipes*	Bush Rat	Y	33	4	0	0
"	*Rattus rattus*	Black Rat	N	3	1	2	1
PHALANGERIDAE	*Trichosurus vulpecula*	Common Brushtail Possum	Y	1	1	4	2
			TOTAL INDIVIDUALS	**67**		**38**	
			SPECIES	**9**		**6**	
			(NATIVE)	**4**		**2**	
			(INTRODUCED)	**5**		**4**	

Reptiles

Seven of the twenty species recorded from both visits were present as a single record. No conclusions have been drawn as to the fate of these species because of the small amount of data. There were multiple records of 12 species in 2004 and 11 in 2007 (Table 7). Species that appear to have been severely disadvantaged from the fire were the Striped Wall Skink (*Cryptoblepharus pulcher*), Delicate Skink (*Lampropholis delicata*) and Barred Snake-lizard (*Delma butleri*). Sleepy Lizards (*Tiliqua rugosa*) and possibly Dwarf Skinks (*Menetia greyii*) also appear to have been disadvantaged post-fire. Only one site appeared to still support Sleepy Lizards. The decline in this species throughout the burnt area was supported by the lack of observations and road kills along tracks in the burnt areas (only one was observed in over five days of driving between sites). These species all utilize habitat in a way that make them vulnerable to intense fire events. These include hiding under bark and in hollows near the bases of trees (Striped Wall Skink), frequenting moister leaf litter and decaying timber (Delicate Skink), and sheltering under dense flammable ground vegetation such as Spinifex (Barred Snake-lizard). Sleepy Lizards also spend most of their time near the surface and are likely to have survived the fire only where they were able to use larger mammal or reptile burrows such as those made by rabbits. Dwarf Skinks also spend most time on the ground surface, often under vegetation or amongst leaf litter and would be vulnerable where cracking soils or boulders were absent.

Two other species that had very low capture probabilities during 2004 were not recaptured in 2007 (single captures at one site in Murrunatta Conservation Park). Murrunatta Conservation Park was found to support interesting outliers of three species during the 2004 survey. These were the Bight Coast Ctenotus (*Ctenotus euclae*), the Western Three-lined Skink (*Bassiana trilineata*) (Rare: SA NPW Act) and the Bull Skink (*Egernia multiscutata*). The latter two skinks have a southern coastal distribution on Eyre Peninsula, Murrunatta being an inland outlier for both species. The white sands typical in Murrunatta are similar to those found along the coast but are now isolated from these areas through vegetation clearance. One of each species was recorded during the 2004, however only the Bight Coast Ctenotus was evident during 2007. Murrunatta is the most southerly recorded locality for this species. Given that the Western Three-lined Skink has a Rare rating, and the Bight Coast Skink a very limited distribution in SA, it would be worthwhile conducting more extensive surveys to conclusively determine their status in the Conservation Reserve.

One reptile, a small skink known as Adelaide Snake-eye (*Morethia adelaidensis*), appears to have benefited from the fire with its appearance at two sites in 2007. This possibly reflects the species preference for areas with dense understorey and open overstorey, as they are commonly associated with sedge-lands and grasslands on Eyre Peninsula.

A detailed breakdown of species recorded at sites pre- and post-fire is presented in Appendix 4 (pp.101-2).

Table 7: Reptile species recorded at sites in 2004 and 2007. Shows the number of individuals (#ind.) and number of sites at which they were recorded.

SUBFAMILY NAME	SPECIES	COMMON NAME	2004 # ind.	2004 # sites	2007 # ind.	2007 # sites
AGAMIDAE	*Pogona barbata*	Eastern Bearded Dragon	1	1	0	0
ELAPIDAE	*Pseudonaja inframacula*	Peninsula Brown Snake	2	1	2	2
GEKKONIDAE Diplodactylinae	*Diplodactylus granariensis*	Western Stone Gecko	0	0	1	1
GEKKONIDAE Gekkoninae	*Christinus marmoratus*	Marbled Gecko	8	5	10	4
GEKKONIDAE Pygopodinae	*Aprasia striolata*	Lined Worm-lizard	0	0	1	1
"	*Delma australis*	Barred Snake-lizard	3	3	4	2
"	*Delma butleri*	Spinifex Snake-lizard	2	1	0	0
SCINCIDAE	*Bassiana trilineata*	Western Three-lined Skink	1	1	0	0
"	*Cryptoblepharus pulcher*	Striped Wall Skink	9	2	0	0
"	*Ctenotus euclae*	Bight Coast Ctenotus	1	1	2	1
"	*Ctenotus orientalis*	Eastern Spotted Ctenotus	6	3	4	3
"	*Egernia multiscutata*	Bull Skink	1	1	0	0
"	*Hemiergis peronii*	Four-toed Earless Skink	25	5	21	5
"	*Lampropholis delicata*	Delicate Skink	8	5	0	0
"	*Lerista bougainvillii*	Bougainville's Skink	5	3	5	3
"	*Menetia greyii*	Dwarf Skink	17	4	8	3
"	*Morethia adelaidensis*	Adelaide Snake-eye	0	0	5	2
"	*Morethia obscura*	Mallee Snake-eye	24	5	17	5
"	*Tiliqua occipitalis*	Western Bluetongue	1	1	0	0
"	*Tiliqua rugosa*	Sleepy Lizard	16	4	3	1
		NO. SPECIES	**17**		**13**	
		TOTAL NO. INDIVIDUALS	**130**		**83**	

Vascular plant floristics

A complete list of the vascular plant species recorded during the Sep 2007 survey is provided in Appendix 1 (p.70). A total of 320 unique[2] vascular plant taxa were recorded from the survey area in 2007, comprising 272 (85%) native and 48 (15%) alien species. The total number increases to 347 taxa when records from 2004 visits are included. A total of 262 voucher specimens were collected in 2007 and lodged at the State Herbarium of South Australia (AD). Voucher numbers are cited against the species listings in Appendix 1 to facilitate future updates as taxonomic and nomenclatural revisions are applied to State Herbarium specimens in the future. Where voucher specimens exist from the 2004 visit for species that were not vouchered in 2007 these have also been cited.

Rare and threatened plants

Although the quadrats were only intended to provide a limited representative sample (30 x 30 m) of typical examples of the major vegetation communities, they intercepted a surprising number of rare and threatened taxa and thus provide some useful incidental information. Sixteen of the plant species sampled in 2007 are listed on the schedules of the SA NPW Act as either Rare or Vulnerable, and two have national status under the EPBC Act as Vulnerable (Table 8).

Table 8: Rare and threatened plants recorded in 2007 survey.

Conservation status: **AU** (Australian EPBC Act): **VU** = Vulnerable; **SA** (South Australian NPW Act): **R** = Rare; **V** = Vulnerable

SPECIES	COMMON NAME	FAMILY	Cons status		# quadrats	
			AU	SA	2004	2007
Acacia imbricata	Feathery Wattle	LEGUMINOSAE	**VU**	R	6	6
Caladenia pusilla	Pigmy Caladenia	ORCHIDACEAE		R		1
Daviesia pectinata	Zig-zag Bitter-pea	LEGUMINOSAE		R	1	1
Drosera sp. Rigid (R.J.Bates 2268)	Erect Sundew	DROSERACEAE		V	1	2
Grevillea halmaturina ssp. *laevis*	Prickly Grevillea	PROTEACEAE		R	1	3
Haeckeria cassiniiformis	Dogwood Haeckeria	COMPOSITAE		R		*
Leucopogon clelandii	Cleland's Beard-heath	EPACRIDACEAE		R		1
Levenhookia stipitata	Common Stylewort	STYLIDIACEAE		R		2
Philotheca angustifolia ssp. *angustifolia*	Narrow-leaf Wax-flower	RUTACEAE		R	1	1
Phylloglossum drummondii	Pigmy Clubmoss	LYCOPODIACEAE		R		1
Prasophyllum fecundum	Self-pollinating Leek-orchid	ORCHIDACEAE		R	2	1
Ptilotus beckerianus	Ironstone Mulla Mulla	AMARANTHACEAE	**VU**	V	2	2
Schoenus sculptus	Gimlet Bog-rush	CYPERACEAE		R		2
Sphaerolobium minus	Leafless Globe-pea	LEGUMINOSAE		R		1
Thelymitra flexuosa	Twisted Sun-orchid	ORCHIDACEAE		R	2	2
Triglochin minutissimum	Tiny Arrowgrass	JUNCAGINACEAE		R		1
Wurmbea decumbens	Trailing Nancy	LILIACEAE		R		2

* at 2 opportunistic sites

Further details for these species, including Site ID codes, cover/abundance scores and regeneration notes may be obtained from Appendices 4 and 5, but the following species deserve special mention.

[2] excludes incompletely identified taxa if potentially redundant (ie when potentially overlapping with, or equivalent to, other taxa)

Feathery Wattle (*Acacia imbricata*)

This medium-sized shrub is widespread and often common in a range of habitats on southern Eyre Peninsula. Its overall abundance and good representation in Heritage Agreement areas means that it probably does not warrant its national Vulnerable status, but it is still of significance as a species that is endemic to the region. It was present in six quadrats, of which two were burnt. The species appears to be recruiting well and seedlings were recorded in all cases. The heights of seedlings ranged between 1.2 and 1.5 m in the two burnt quadrats but were only 5 to 50 cm in the four unburnt quadrats, showing the greater growth rates that can be achieved with the release of additional nutrients after fire.

Dogwood Haeckeria (*Haeckeria cassiniiformis*)

This Cassinia-like shrub is virtually endemic to Eyre Peninsula (apart from a single isolated collection in the northern Mt Lofty Ranges). It is widely distributed throughout Eyre Peninsula and its apparent rarity is due to it being a post-disturbance coloniser that establishes rapidly, produces abundant seed and then disappears after a few years. Although not found in any quadrats, it was encountered and collected opportunistically on two occasions while en route to quadrat sites. In Wanilla Conservation Park (CP) it was found as a localised patch of c. 10 plants from 75 cm to 1.2 m tall and just coming into bud. A larger population was found in Tucknott Scrub CP and adjoining roadside where hundreds of plants occurred as a locally dominant species in the regenerating understorey (Figure 3). Flowering here was further advanced and the plants were spindly shrubs c. 1.6 m tall. Both were post-fire occurrences and represent a new species record for each reserve.

Figure 3: Roadside view of the Tucknott Scrub population of Dogwood Haeckeria (*Haeckeria cassiniiformis*). The seedlings with broad foliage are Golden Wattle (*Acacia pycnantha*).

Cleland's Beard-heath (*Leucopogon clelandii*)

This small tiny-leaved epacrid shrub is nowhere common, but in SA is known principally from the South-eastern region where it is widely scattered. Elsewhere it is seldom encountered, and it is rated as Rare for the

State. It was first discovered on Eyre Peninsula in 1982 in Wanilla CP with a second collection being made in 1985 from 20 km SE of Pt Lincoln. These two isolated records at the species' western limit were the basis for a regional rating as Vulnerable on Eyre Peninsula, now in need of amendment as a result of further records. Five more recent collections (four from Biological Surveys) have revealed another area of occurrence on Eyre Peninsula comprising Hincks CP and two of the Hundreds adjoining its southern side.

The record made on this survey from quadrat KOP00201 in Wanilla CP is only the third collection from southern Eyre Peninsula. Of interest is the obvious response to fire: Cleland's Beard-heath was absent in 2004 but was common post-fire in 2007 (assigned a cover score of 1 for "plentiful", although less than 5% cover). This suggests that it is a fire-adapted species that establishes from seed. With its depauperate habit and small foliage, it is anticipated that the population will decline dramatically as other larger and denser shrubs outgrow it.

Figure 4: Herbarium voucher (BS128-4626) of Cleland's Beard Heath (*Leucopogon clelandii*) from site KOP00201 in Wanilla CP, showing seedlings with fine tap roots and immature fruits developing on central stem.

Pigmy Clubmoss (*Phylloglossum drummondii*)

This diminutive annual, tuberous, spore-producing plant is a new discovery for Eyre Peninsula. The collection in 2007 from site KOP00901 in Wanilla CP is a new regional record and represents a major extension of range, adding a fourth area to the existing three disjunct South Australian areas of occurrence in the South-east, Mt Lofty Ranges and on Kangaroo Island.

Ironstone Mulla Mulla (*Ptilotus beckerianus*)

Pre-fire in 2004 this nationally Vulnerable species was recorded in two sites (KOP00501, ULE01201), but only as very small localised rosettes of dwarfed leaves emergent from the subterranean rhizomes. Davies (1995) indicated that this species was stimulated by disturbance and likely to respond to fire. Prolific flowering of this species in December 2005 following the bushfires was reported by Ecological Associates (2006) and K. Pobke (2007, pers. comm.). When the two sites were resurveyed in 2007 the flowering phase had subsided and most plants seemed to have returned to a dormant state. The population sampled by site ULE1201 in the Wanilla Settlement CR was found to be extensive with small patches of rosettes scattered

throughout the reserve. Although small, they were much easier to detect after the fire-induced reduction in ground layer vegetation.

Evidence supporting the hybrid origin of Streaked Hop-bush *(Dodonaea tepperi)*

A side-benefit from the survey are some herbarium collections that provide evidence supporting the hybrid status of Streaked Hop-bush (*Dodonaea tepperi*) (Figure 5). In the past this plant has been assessed as a nationally Endangered species and was listed under the Endangered Species Protection Act 1992. However, its conservation status was removed from national and state listings on the basis of anecdotal evidence of hybrid origin, although its hybrid origin has never been conclusively demonstrated. Streaked Hop-bush has been recorded at a small number of widely scattered locations throughout the semi-arid and mallee districts of South Australia, usually as single individuals and often with only one of the presumed parents recorded as being present. Field observations support the view that Streaked Hop-bush represents the progeny produced from the occasional cross-fertilization of Horned Hop-bush (*Dodonaea hexandra*) and Crinkled Hop-bush (*Dodonaea baueri*) and that the hybrid offspring are unable to form viable populations.

The unburnt quadrat KOP00901 is valuable in providing a well-documented and re-locatable site where several hybrid plants and both putative parents occur in close proximity. Voucher specimens were taken for both parents and the hybrid plants were sampled as separate collections (three individuals in 2004 and two in 2007) as cited in Appendix 1.

Figure 5: Streaked Hop-bush *(Dodonaea tepperi)* from site KOP00901 showing detail of fruit.

Effect of fire on plant community structure

Changes in dominant species and structural formations

A broad overview of the changes to the vegetation structure and floristics may be gained by comparing the descriptions of the plant community that are generated for the quadrat (and its immediate vicinity) as part of the standard biological survey process. The vegetation is assigned a structural formation based on the foliage cover of the uppermost stratum and described floristically in terms of its dominant plant species by listing up to 3 overstorey species, up to 3 prevalent emergent species that protrude above the overstorey stratum, and up to 5 understorey dominants in lower strata. The subjectivity in selecting dominant species to represent the vegetation was minimised in this project because the same two observers were used for all the quadrats sampled in 2004 and 2007. In all cases species ranked as dominant had a cover score of 2 (5-25% cover) or, less often, 3 (25-50%), and were deemed to be well distributed across the quadrat and surrounding area rather than in a localised patch.

From this crude analysis a number of basic observations can be made (Table 9). The *Melaleuca* Shrubland with Cutting Grass (*Gahnia trifida*) is now, three years post-fire, a *Gahnia* Sedgeland with the two dominant *Melaleuca* species regenerating as low understorey shrubs, well below the height of the Cutting Grass tussocks (see site photos for ULE01001in Appendix 5). Sugar Gum Woodlands (ULE01201, KOP00201, KOP00601) have retained their essential character as Sugar Gum Woodlands, although there have been substantial changes in their understorey composition, for example the post-fire appearance of three dominant *Acacia* species in KOP00201). Two sites associated with drainage lines (KOP00401 and KOP00701) have undergone major changes in structure and composition with the addition South African Daisy (*Senecio pterophorus*) and other alien weedy species as dominants.

In the unburnt site comparisons (Table 10) the structural formation is unaltered, as expected, and there are only minor differences in species recorded as dominants, namely the loss of *Lagenophora huegelii* from KOP00801, *Helichrysum leucopsideum* from KOP01101 and *Acacia imbricata* from KOP0901. The first two, at least, are almost certainly as a result of a dryer season in 2007 compared to 2004.

For the five additional burnt sites sampled in 2007 only (Table 11), a partial description of the pre-existing plant community has been inferred from burnt limbs and dead vegetation remains observed in the quadrats. The major change evident here is the loss of Sheoak (*Allocasuarina verticillata*) as a dominant species (quadrats MUR00301 and WAN00201).

Table 9: Burnt sites: Major changes to plant communities reflected in vegetation descriptions.

SITEID	Year	Survey	STRUCTURAL FORMATION	VEGETATION DESCRIPTION (based on dominant species)
ULE01001	2004	Flora & fauna	Shrubland	*Melaleuca decussata – M. brevifolia – Gahnia trifida* Shrubland over *Hypolaena fastigiata*
"	**2007**	**Flora**	**Sedgeland**	***Gahnia trifida*** **Sedgeland over** ***Melaleuca decussata, M. brevifolia, Hypolaena fastigiata***
ULE01101	2004	Flora & fauna	Open Mallee	*Eucalyptus angulosa – Eucalyptus diversifolia* Open Mallee over *Melaleuca uncinata, Leptospermum coriaceum, Hibbertia* sp. Glabriuscula (D.J.Whibley 9012), *Hypolaena fastigiata, Triodia irritans*
"	**2007**	**Flora & fauna**	**Open Low Mallee**	***Eucalyptus angulosa – Eucalyptus diversifolia*** **Open Low Mallee over** ***Acacia myrtifolia, Hibbertia* sp. Glabriuscula (D.J.Whibley 9012), *Hypolaena fastigiata***
ULE01201	2004	Flora & fauna	Woodland	*Eucalyptus cladocalyx* Woodland over *Babingtonia behrii, Xanthorrhoea semiplana, Hibbertia* sp. Glabriuscula (D.J.Whibley 9012), *Opercularia scabrida, Neurachne alopecuroidea*
"	**2007**	**Flora & fauna**	**Woodland**	***Eucalyptus cladocalyx*** **Woodland over** ***Babingtonia behrii, Astroloma conostephioides, Hibbertia* sp. Glabriuscula (D.J.Whibley 9012), *Opercularia scabrida***
KOP00201	2004	Flora & fauna	Woodland	*Eucalyptus cladocalyx* Woodland over *Xanthorrhoea semiplana, Gonocarpus mezianus, Chamaescilla corymbosa, Pyrorchis nigricans*
"	**2007**	**Flora & fauna**	**Woodland**	***Eucalyptus cladocalyx*** **Woodland over** ***Acacia rupicola, A. myrtifolia, A. gillii, Gonocarpus mezianus, Opercularia scabrida***
KOP00301	2004	Flora & fauna	Shrubland	*Melaleuca uncinata* Shrubland, with emergent *Eucalyptus cladocalyx,* over *Babingtonia behrii, Hibbertia* sp. Glabriuscula (D.J.Whibley 9012), *Homoranthus homoranthoides, Opercularia scabrida*
"	**2007**	**Flora & fauna**	**Low Shrubland**	***Melaleuca uncinata – Babingtonia behrii*** **Low Shrubland, with emergent** ***Eucalyptus cladocalyx,* over *Hibbertia* sp. Glabriuscula (D.J.Whibley 9012), *Opercularia scabrida, Neurachne alopecuroidea***
KOP00401	2004	Flora & fauna	Closed Shrubland	*Melaleuca decussata – Callistemon rugulosus – Xanthorrhoea semiplana* Closed Shrubland, with emergent *Acacia pycnantha, Allocasuarina verticillata,* over *Lissanthe strigosa, Chorizandra enodis*
"	**2007**	**Flora & fauna**	**Low Shrubland**	***Acacia pycnantha – *Senecio pterophorus*** **Low Shrubland over** ***Melaleuca decussata, Chorizandra enodis, *Lotus subbiflorus, *Vulpia* sp.**
KOP00501	2004	Flora & fauna	Very Low Woodland	*Acacia pycnantha* Very Low Woodland, with emergent *Eucalyptus cladocalyx,* over *Allocasuarina muelleriana, Melaleuca uncinata, Babingtonia behrii, Xanthorrhoea semiplana, Homoranthus homoranthoides*
"	**2007**	**Flora & fauna**	**Open Shrubland**	***Eucalyptus cladocalyx – Acacia pycnantha – Xanthorrhoea semiplana*** **Open Shrubland over** ***Babingtonia behrii, Stenanthemum leucophractum, Opercularia scabrida***
KOP00601	2004	Flora & fauna	Woodland	*Eucalyptus cladocalyx – Acacia pycnantha* Woodland over *Xanthorrhoea semiplana, Opercularia scabrida*
"	**2007**	**Flora & fauna**	**Open Woodland**	***Eucalyptus cladocalyx*** **Open Woodland over** ***Acacia pycnantha, Xanthorrhoea semiplana, Opercularia scabrida***
KOP00701	2004	Flora & fauna	Woodland	*Eucalyptus petiolaris* Woodland over *Acacia pycnantha, A. imbricata, Lissanthe strigosa, *Oxalis pes-caprae*
"	**2007**	**Flora**	**Tall Very Open Shrubland**	***Eucalyptus petiolaris*** **Tall Very Open Shrubland over** ***Acacia pycnantha, A. imbricata,*Senecio pterophorus, Austrodanthonia setacea,*Vulpia myuros***

Table 10: Unburnt sites: Vegetation descriptions for pre-fire and post-fire survey years.

SITEID	Year	Survey	STRUCTURAL FORMATION	VEGETATION DESCRIPTION (based on dominant species)
KOP00801	2004	Flora & fauna	Woodland	*Eucalyptus cladocalyx – Eucalyptus odorata* Woodland over *Lissanthe strigosa, Eremophila behriana, Pultenaea pedunculata, Lagenophora huegelii*
"	**2007**	**Flora**	**Woodland**	***Eucalyptus cladocalyx – Eucalyptus odorata*** **Woodland over** ***Lissanthe strigosa, Eremophila behriana, Pultenaea pedunculata***
KOP00901	2004	Flora & fauna	Low Woodland	*Eucalyptus cladocalyx – Eucalyptus odorata* Low Woodland over *Melaleuca uncinata, Lissanthe strigosa, Acacia imbricata, Pultenaea pedunculata*
"	**2007**	**Flora**	**Low Woodland**	***Eucalyptus cladocalyx – Eucalyptus odorata*** **Low Woodland over** ***Melaleuca uncinata, Lissanthe strigosa, Pultenaea pedunculata***
KOP01001	2004	Flora & fauna	Woodland	*Eucalyptus odorata – Eucalyptus petiolaris* Woodland over *Acacia imbricata, Bursaria spinosa Acacia paradoxa, Lissanthe strigosa*
"	**2007**	**Flora**	**Woodland**	***Eucalyptus odorata – Eucalyptus petiolaris*** **Woodland over** ***Acacia imbricata, Bursaria spinosa Acacia paradoxa, Lissanthe strigosa***
KOP01101	2004	Flora & fauna	Woodland	*Eucalyptus odorata* Woodland over *Bursaria spinosa, Melaleuca uncinata, Acacia imbricata, Grevillea ilicifolia* complex, *Helichrysum leucopsideum*
"	**2007**	**Flora**	**Woodland**	***Eucalyptus odorata*** **Woodland over** ***Bursaria spinosa, Melaleuca uncinata, Acacia imbricata, Grevillea ilicifolia*** **complex**

Table 11: Additional burnt sites: Vegetation descriptions for pre-fire and post-fire survey years (2004 pre-fire vegetation interpreted from dead limbs present in 2007).

SITEID	Year	Survey	STRUCTURAL FORMATION	VEGETATION DESCRIPTION (based on dominant species)
MUR00101	2004	none	(+/- Open) Mallee	*Eucalyptus angulosa* (+/- Open) Mallee . . .
"	**2007 only**	**Flora**	**Low Mallee**	***Eucalyptus angulosa* Low Mallee over *Xanthorrhoea semiplana, Melaleuca uncinata, Hibbertia riparia, Lepidosperma carphoides, L. concavum***
MUR00201	2004	none	(+/- Open) Mallee	*Eucalyptus diversifolia* (+/- Open) Mallee **. . .**
"	**2007 only**	**Flora**	**Low Open Mallee**	***Eucalyptus diversifolia* Low Open Mallee over *Acacia myrtifolia, Xanthorrhoea semiplana, Leptospermum coriaceum, Hypolaena fastigiata***
MUR00301	2004	none	Low Woodland	*Allocasuarina verticillata – Eucalyptus angulosa* Low Woodland **. . .**
"	**2007 only**	**Flora**	**Low Open Mallee**	***Eucalyptus angulosa – Allocasuarina verticillata* Low Mallee over *Acacia euthycarpa, Olearia ramulosa, Babingtonia behrii, Melaleuca uncinata, Hibbertia* sp. Glabriuscula (D.J.Whibley 9012*)***
WAN00101	2004	none	Shrubland	*Melaleuca uncinata – Babingtonia behrii – Xanthorrhoea semiplana* Shrubland **. . .**
"	**2007 only**	**Flora**	**Low Shrubland**	***Xanthorrhoea semiplana – Melaleuca uncinata – Babingtonia behrii* Low Shrubland over *Hibbertia* sp. Glabriuscula (D.J.Whibley 9012*), Prostanthera spinosa, Opercularia scabrida***
WAN00201	2004	none	Low Woodland	*Allocasuarina verticillata* Low Woodland **. . .**
"	**2007 only**	**Flora**	**Low Shrubland**	***Acacia rupicola – Callistemon rugulosus – Babingtonia behrii* Shrubland with emergent (mostly dead) *Allocasuarina verticillata***

Changes in life form /structural layers of the vegetation assemblage

The primary cover/abundance data collected on standard biological surveys are cover class values scored against each individual species. As the relative cover of each species is not estimated, and the cover classes are broad, the scores cannot be combined additively to give an across species measure of cover or biomass. The information on cover is effectively compounded by variation in species richness. However, two other sets of estimates from the standard biological survey process address this shortcoming. Firstly, the structural assemblage data summarizes vegetation structure regardless of species composition by giving an overall estimate of foliage cover for habitat layers and components based on modified Muir life form codes (Muir, 1977; Forward & Robinson, 1996). This is gained by viewing the vegetation horizontally through 360 degrees from the centre of the quadrat and estimating the foliage cover class for each category. Although this provides a summation across species within a layer, it should be noted that the life-form layers in most cases do not constitute mutually exclusive height classes, and are not additive vertically or across life forms.

Table 12 displays the averaged percentage change for cover classes across vegetation assemblage structure categories (after Muir 1977) between the 2004 and 2007 samples. The four cover classes were converted to mid values (1-10% = 5%, 10-30% = 20%, 30-70% = 50%, >70% = 85%) and the difference from 2004 to 2007 was averaged for all sites within burnt areas and then unburnt areas. Increase in average cover is positive whilst loss in cover is negative. The difference in change between the burnt and unburnt sites was tested for significance using t-test with two tails and unequal sample sizes. The most obvious change caused by fire was a decrease in tree cover, taller shrubs and vines, and an increase in shrubs less than 1 m high.

Table 12: Mean changes in cover classes of vegetation structural layers/components.

Muir Description & (Code)	BURNT		UNBURNT		t-test *p*	Significance
	% change	# sites	% change	# sites		*P*<0.05
trees 15-30 m (M)	-	0	0.0	1		
trees 5-15 m (LA)	-8.6	7	0.0	4	0.030	*
trees < 5 m (LB)	-8.8	8	0.0	4	0.020	*
mallee > 3 m (KT)	-20.0	1	0.0	1		
low mallee < 3 m (KS)	0.0	1	0.0	2		
shrubs > 2 m (S)	-3.8	8	0.0	4	0.303	ns
shrubs 1.5-2.0 m (SA)	-10.0	9	0.0	4	0.017	*
shrubs 1.0-1.5 m (SB)	-11.1	9	-5.0	3	0.524	ns
shrubs 0.5-1.0 m (SC)	21.7	9	0.0	4	0.008	**
shrubs 0.0-0.5 m (SD)	13.3	9	0.0	4	0.212	ns
hummock grass (H)	0.0	1	-	0		
sedges > 0.5 m (VT)	-2.5	2	-	0		
sedges < 0.5 m (VL)	-2.9	7	0.0	3	0.596	ns
grass > 0.5 m (GT)	5.0	4	0.0	3	0.225	ns
grass < 0.5 m (GL)	11.4	7	0.0	4	0.1519	ns
herbaceous spp. (J)	16.1	9	-7.5	4	0.062	ns
mat plants (P)	-16.3	4	-	0		
vines (V)	-7.0	5	1.7	3	0.016	*
mistletoes (MI)	-	0	-5.0	1		
mosses, liverworts (MO)	2.5	8	0.0	4	0.227	ns
lichens (LI)	-2.0	5	-13.3	3	0.550	ns
Total		**9**		**4**		

Changes in overstorey crown cover

The second set of non-species linked cover data collected in standard biological survey quadrats comprises a set of 10 measurements of overstorey plant height, canopy diameter, canopy depth and canopy gaps. This data is recorded when trees, mallees or shrubs are dominant in the uppermost stratum and is used for determining Crown Separation Ratios (CSR) and projected foliage cover. The results are presented in Table 13.

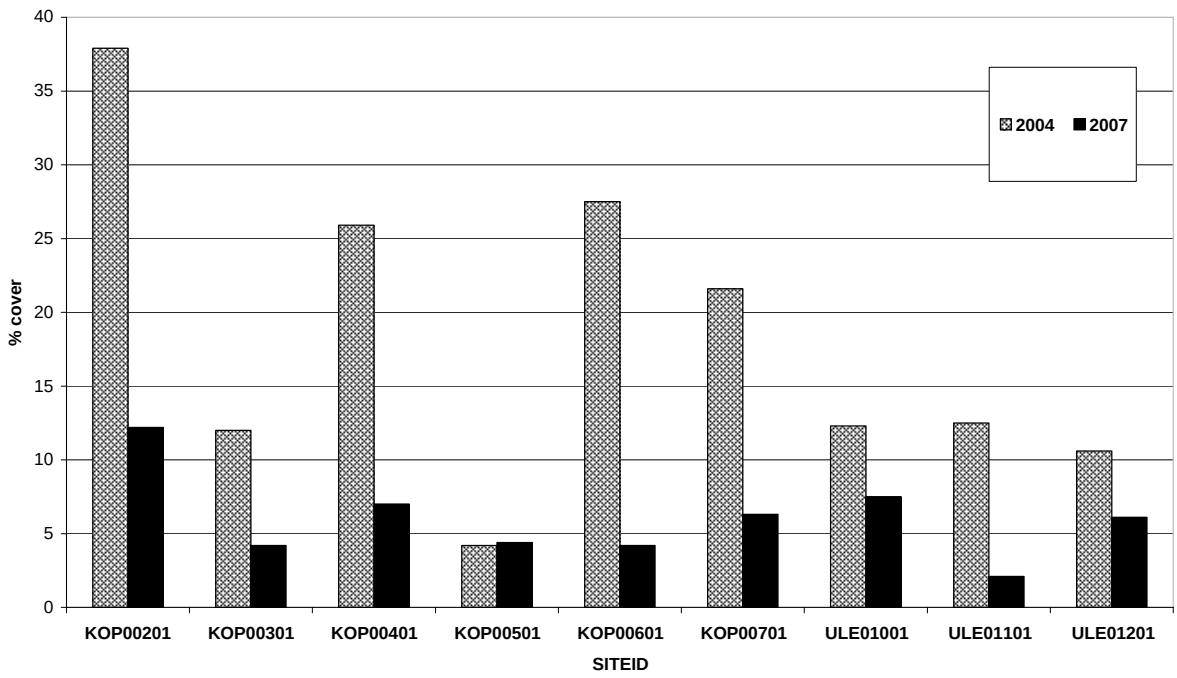
Three years post-fire all sites but one (KOP00501) still showed a much reduced projected overstorey foliage cover, having on average about one third of their original cover (Figure 6). Pre-fire cover values ranged from 4.2 to 37.9 % with a mean of 18.3%; three years post-fire they ranged from 2.1 to 12.2 % with a mean cover of 6%. Sites with the densest tree cover showed the greatest decline, with the Sugar Gum Woodland sites in Wanilla CP (KOP00201) and Tucknott CP (KOP00601) still having their canopy cover lower than their previous levels by 25.7 % and 23.3% respectively.

The exceptional site was KOP00501 (also in Tucknott Scrub CP) where there was no substantial change in overstorey cover. At this site changes in the diameter, depth and gaps of the canopy were minor although the average height of overstorey had reduced from 4 m to 0.9 m. The pre-existing low overstorey cover is the main reason for this anomaly: the site is located in an open area amongst Sugar Gum woodland where most of the original overstorey was composed of Golden Wattle (*Acacia pycnantha*) with Sugar Gum treated as an occasional emergent. The rapid recruitment of Golden Wattle and retention of larger Yaccas (*Xanthorrhoea semiplana*) was able to maintain the existing relatively low overstorey cover level (minimum of all sites surveyed).

Table 13: Overstorey data for burnt sites pre- and post-fire (sample size of 10 measurements)**.**

SITEID	PROJECTED FOLIAGE COVER %		CROWN SEPARATION RATIO		Mean overstorey height		Mean canopy diameter		Mean canopy gap		Mean crown depth		Canopy type (foliage density adjustment %)	
	2004	2007	2004	2007	2004	2007	2007	2007	2004	2007	2004	2007	2004	2007
KOP00201	37.9	12.2	0.02	1.12	9.1	4.9	3.9	3.2	0.1	3.6	2.9	4.6	50	70
KOP00301	12.0	4.2	0.62	1.89	1.9	0.5	0.7	0.5	0.4	1.0	0.7	0.5	40	45
KOP00401	25.9	7.0	0.40	1.48	1.6	1.1	1.2	0.7	0.5	1.1	0.8	0.9	65	55
KOP00501	4.2	4.4	2.06	2.28	4.0	0.9	1.2	0.9	2.4	2.0	0.8	0.9	50	60
KOP00601	27.5	4.2	0.13	2.61	6.5	6.6	3.0	4.9	0.4	12.8	1.7	6.6	45	70
KOP00701	21.6	6.3	0.35	1.85	7.6	3.1	6.9	3.0	2.4	5.6	4.2	3.1	50	65
ULE01001	12.3	7.5	0.79	1.29	1.5	0.5	1.6	0.3	1.3	0.4	0.8	0.4	50	50
ULE01101	12.5	2.1	0.68	3.96	6.2	2.3	5.8	2.3	4.0	8.9	3.5	2.3	45	65
ULE01201	10.6	6.1	0.72	1.89	9.7	6.2	7.6	5.3	5.5	10.0	4.4	6.2	40	65
mean	18.3	6.0	0.6	2.0	5.3	2.9	3.5	2.3	1.9	5.0	2.2	2.8	48.3	60.6

Figure 6: Projected foliage cover of overstorey pre-fire and post-fire.



Effect of fire on plant species composition

A basic question to consider is what the biological survey quadrats show in relation to the appearance or disappearance of plant species following the January 2005 fire, and to what extent these changes may be attributed to the fire.

Changes in total native and alien species richness

Using only the nine quadrats that were subsequently burnt, the total species richness[3] increased from 175 species in 2004 to 237 species in 2007. Proportionately there was a greater increase in richness for alien species (76%) compared to indigenous species (29%), although the alien species remained a minor component of the flora (Table 14).

To investigate the scale of the contribution by these alien species to the vegetation community, species counts were replaced with a sum of cover/abundance scores (obtained by assigning each cover class a numerical value [4]). This effectively produces an index that weights species richness by cover/abundance. The disparity between alien and indigenous scores was much greater using this measure, with a post-fire increase of 136 % for alien species compared to 11 % for indigenous species (Table 14).

Table 14: Alien vs indigenous species representation pre- and post- fire.

species richness	2004	2007	increase
alien	25	44	76.0%
indigenous	150	193	28.7%
total	175	237	
richness - cover index	**2004**	**2007**	**increase**
alien	22.8	53.8	136.3%
indigenous	283.5	313.8	10. 7%

These results support the view that disturbance by fire has implications for weed invasion by promoting the introduction and overall cover of alien species. Furthermore, the creation of a more open structure by fire at some sites (for example KOP00301) is likely to encourage access and browsing of regenerating vegetation by kangaroos. In two quadrats new weed species were noted germinating from kangaroo dung.

Changes in site species richness, gains and losses

Data on species presence and absence for each site are summarized in Table 15 (burnt sites) and Table 16 (unburnt sites). Within quadrats, species richness for the nine burnt sites sampled shortly before the fire in September 2004 ranged from 30 to 61, with a mean value of 45 species per quadrat. Three years on, there was a substantial increase in species richness for nearly all quadrats (the exception being ULE01101 which only increased by two species), with the 2007 counts ranging from 51 to 92 and an average of ca. 67 species per quadrat (Table 15). Although species were lost from all quadrats, in every case gains outweighed losses, and on average ca. 32 new species were gained compared to ca. 10 lost from each quadrat.

The four unburnt quadrats give some indication of the extent to which these changes may be attributed to the fire (Table 16). As previously noted, the unburnt northern quadrats provide a reasonable control for rainfall influences operating from 2004 to 2007. Although all four of the northern unburnt sites had between 14 and 23 new species records, taking into account losses, their net change was small overall with a mean increase of only 2 species.

[3] unique vascular plant taxa

[4] Weights were assigned as follows: “N” = 0.25, “T” = 0.5, “1 (<5%)” =1, “2 (5-25%) = 2, “3 (25-50%) = 3. This is essentially a logarithmic scale with the highest category under-weighted as the cover values fall within the lower part of the class range.

Thus, treating the northern unburnt sites as a control, the average net gain of 22 species per site for the burnt quadrats in 2007 can be largely attributed to the effect of fire.

The overall slight increase in species richness in the unburnt sites is intriguing given the decline in rainfall between 2004 and 2007. Factors that might explain this are unclear but may include: more thorough sampling in 2007 (in both burnt and unburnt sites) as a result of using a checklist of previously recorded species; and the dryer conditions enhancing light and moisture availability in the more diverse understorey layers by reducing tree and shrub canopy densities.

Table 15: Burnt sites: plant species richness, gains and losses.

SITEID	2004	2007	NET	LOST	RETAINED	GAINED	Lost species with cover-abundance score ≥ 1 [5]	Gained species with cover-abundance score ≥ 1 *
ULE01001	42	68	**26**	**9**	33	**35**		Gained annuals *Angianthus preissianus, Cotula coronopifolia* and annual sedge colonisers *Centrolepis polygyna* and *Triglochin mucronatum.*
ULE01101	49	51	**2**	**12**	37	**14**		Gained small tree *Exocarpos sparteus*.
ULE01201	62	80	**18**	**12**	49	**30**	Lost shrub *Astroloma humifusum*.	Gained perennial grasses *Austrostipa acrociliata* and *A. mundula*.
KOP00201	61	92	**31**	**13**	48	**44**		Gained shrub *Leucopogon clelandii,* perennial grass *Austrostipa mollis* and annual sedge colonisers *Centrolepis strigosa* & *Isolepis marginata*.
KOP00301	30	57	**27**	**4**	26	**31**		
KOP00401	23	59	**36**	**4**	19	**40**	Lost sedge *Carex breviculmis* and vine *Clematis microphylla*.	Gained weed *Lotus subbiflorus* (2) [†], and annual sedge colonisers *Isolepis marginata* and *Schoenus apogon*.
KOP00501	48	71	**23**	**10**	38	**33**		Gained creeper *Kennedia prostrata* and annual sedge coloniser *Schoenus nanus*.
KOP00601	50	75	**25**	**15**	35	**40**	Lost shrubs *Hibbertia* sp. Glabriuscula (D.J.Whibley 9012) and *Homoranthus homoranthoides,* and perennial sedge *Schoenus breviculmis*.	Gained creeper *Kennedia prostrata* and annual sedge coloniser *Isolepis marginata.*
KOP00701	44	53	**9**	**14**	30	**23**	Lost herbs *Oxalis perennans* and *Daucus glochidiatus.*	Gained annual weed grass *Vulpia myuros* (2).
mean	**45.4**	**67.3**	**21.9**	**10.3**	**35.0**	**32.2**		

Table 16: Unburnt sites: plant species richness, gains and losses.

SITEID	2004	2007	NET	LOST	RETAINED	GAINED	Lost species with cover-abundance score ≥ 1	Gained species with cover-abundance score ≥ 1
KOP00801	41	48	**7**	8	33	15		
KOP00901	71	79	**8**	15	56	23	Lost geophyte *Chamaescilla corymbosa* and annual herb *Crassula colligata*.	Gained geophyte *Wurmbea decumbens.*
KOP01001	65	60	**-5**	19	46	14	Lost perennial grass *Austrodanthonia* sp. and herb *Opercularia scabrida*.	
KOP01101	82	81	**-1**	16	66	15	Lost geophyte *Hypoxis glabella,* and the annual herbs *Crassula decumbens* and *Siloxerus multiflorus*.	
mean	**64.8**	**67.0**	**2.2**	**14.5**	**50.3**	**16.8**		

Most changes in species presence/absence involved plants with low cover/abundance scores (ie from the lowest two classes, N (not many, less than 10 small plants) and T (trace, sparsely present)) that made a minor contribution to the total biomass of the quadrats. The appearance and disappearance of small numbers of small-sized plants can be patchy across the landscape but considered collectively the changes in counts of species overall do show a clear pattern of increasing diversity post-fire. Species with more significant gains

[5] Species listed are of cover/abundance score of 1 (plentiful, but of less than 5% cover) except where flagged as being of class 2 (5-25 % cover).

or losses (ie more common species with cover/abundance scores of one or more) are individually noted in Table 15.

Notable amongst the gains in species of more substantial cover were the small tree Slender Cherry (*Exocarpos sparteus*), a well-known fire succession species, and the small epacrid shrub Cleland Beard-heath (*Leucopogon clelandii*), a State rare species discussed previously (pp. 21-22). Significant in the ground layer was the acquisition of the creeper Running Postman (*Kennedia prostrata*) in two quadrats (KOP00501, KOP00601), and various species of annual sedges (Cyperaceae) and plants of similar habit (*Centrolepis* spp. and *Triglochin mucronatum*) in five quadrats (ULE01001, KOP00201, KOP00401, KOP00501 and KOP00601).

A total of eight species with a cover/abundance score of '1' or more were lost from the burnt quadrats (Table 15). The significance of these losses is difficult to gauge. For example, the loss of the annual Native Carrot (*Daucus glochidiatus*), and possibly some of the other species, may be the result of seasonal variation such as lack of rain at a critical time. For the perennial species Cranberry Heath (*Astroloma humifusum*) and Port Lincoln Ground-myrtle (*Homoranthus homoranthoides*) which appear sometimes to be largely dependant on regeneration by seed, the loss may result from germination failure or lack of a suitable seed reserve. Smooth Guinea-flower (*Hibbertia* sp. Glabriuscula (D.J.Whibley 9012)) was recorded as regenerating by both regrowth and seedlings at a number of sites. The loss of this, and other species at one particular site, may be explained by variation on fire intensity across the landscape. The small quadrat size and limited replication makes it the significance of the loss unclear for the plant community occurrence beyond the quadrat area.

Native Pine (*Callitris gracilis*) had only a minor occurrence in quadrat ULE01201, and thus was excluded from (Table 15). However, based on additional observations it seems that the fire has caused the local extinction of this tree species from Wanilla Settlement Reserve (p. 47).

The matching of two control sites with two burnt sites in the Sugar Gum cluster enables examination of vegetation changes within a specific vegetation community using a subset of the data presented above. These data show less variation in species richness values with roughly proportionate gains and losses within each pair of sites. The mean initial species richness was very close between the burnt and unburnt sites (55.5 and 56 respectively). The net increase in mean species richness was 28 for burnt sites compared with 7.5 for the unburnt pair, implying a gain of about 20 species attributable to the effects of fire. This is very similar in magnitude to the change (ca. 22 species) obtained for the comparison using the full set of more diverse burnt and unburnt sites (where the control sites were less closely aligned) and adds support to that outcome.

Table 17: Cluster 17 Sugar Gum sites: plant species richness, gains and losses

SITEID	Burnt	2004	2007	NET	LOST	RETAINED	GAINED
KOP00201	Y	61	92	31	13	48	44
KOP00601	Y	50	75	25	15	35	40
mean		**55.5**	**83.5**	**28**	**14**	**41.5**	**42**
KOP00801	N	41	48	7	8	33	15
KOP00901	N	71	79	8	15	56	23
mean		**56**	**63.5**	**7.5**	**11.5**	**44.5**	**19**

Changes in life form representation

To investigate the fire response more closely in terms of differential changes in life form types, species were assigned to life form classes that were modified from the adapted Muir-based classes used by the standard biological survey process (Muir, 1977; Forward & Robinson, 1996). The new classes were designed to represent more ecologically based categories. Their definitions and relationships with Muir codes are set out in Table 18. The recorded life form class is listed against each species occurrence in Appendix 2.

Table 18: Life form categories applied in this study and their relationship to standard Biological Survey (BS) Life form classes.

LIFEFORM	Description	Standard BS class	Comments
LA	trees 5 – 15m	LA	
LB	trees < 5 m	LB	
KS	mallee > 3 m	KS	
S	shrubs > 2 m	S	
SA	shrubs 1.5 – 2 m	SA	
SB	shrubs 1 – 1.5 m	SB	
SC	shrubs 0.5 – 1 m	SC	
SD	shrubs < 0.5 m	SD	
FP	perennial forbs	J partly	Herbaceous plants that are non-woody above the ground, persist for more than two years (by means of perennial underground rhizomes, taproots or rootstocks) but excluding grasses and cyperoids (GP, CP) and bulbous or tuberous species (TB). Grades into shrubs.
V	vines	V + (P partly)	Incorporates non-woody mat plants.
CP	perennial cyperoids	(VL + VT) partly	Split from low and tall sedges combined
H	hummock grasses	H	
GP	perennial grasses	(GL + GT) partly	Split from low and tall grasses combined
TB	tuberous / bulbous geophytes	J partly	Bulbous or tuberous herbaceous geophytes (all SA Orchidaceae, many Liliaceae, Iridaceae, and Droseraceae with bulbs) which behave as renascent perennials. However *Asparagus asparagoides* included as Vine because of greater above-ground biomass.
GA	annual grasses	(GL + GT) partly	Split from low and tall grasses combined
FA	annual forbs	J partly	Annual or biennial herbaceous plants that are non-woody above the ground, but excluding grasses and graminoids (GA, CA) and bulbous or tuberous species (TB).
CA	annual cyperoids	(J + VL) partly	Strictly herbaceous and annual Cyperaceae and plants of similar habit from other monocot families (excluding Grasses)
X	ferns	X	

Analyses were done for each life form class in two ways: firstly by counting the species in quadrat occurrences; and secondly by replacing the species counts with the sum of cover/abundance scores (obtained by assigning each cover class a numerical value[6]). The second method effectively produces an index that weights species richness by cover/abundance. Both methods give similar results (Figure 7 & Figure 8), but in the second analysis the contribution of larger upper layer species is expanded and the changes in shrub species (as opposed to forbs and annual plants) are more pronounced, making the post-fire changes in these groups easier to discern.

As expected for the burnt quadrats, the graph (Figure 8) displays a marked reduction in contribution by trees (LA and LB) and the replacement of mallee (KT) with regenerating low mallee (KS). There is also a reduction in the upper two shrub classes (S and SA) but below this level (1.5 m) there is an increase in the richness-cover scores illustrating the height range that has been attained by regenerating shrubs. The control sites for all these classes show little change between their 2004 and 2007 values.

Perennial forbs, perennial grasses and perennial sedges (FP, GP, CP) all showed small increases in species richness post-fire (Figure 7), although there was a decrease in perennial sedges when weighted for cover. By comparison, the annual forbs, annual grasses and annual sedges (FA, GA and CP) showed a marked increase in species richness post fire and this was maintained when weighted for cover (Figure 7, Figure 8).

[6] Weights were assigned as follows: "N" = 0.25, "T" = 0.5, "1 (<5%)" =1, "2 (5-25%) = 2, "3 (25-50%) = 3. This is essentially a logarithmic scale with the highest category under-weighted as the cover values fall within the lower part of the class range.

Figure 7: Species richness by life form class.

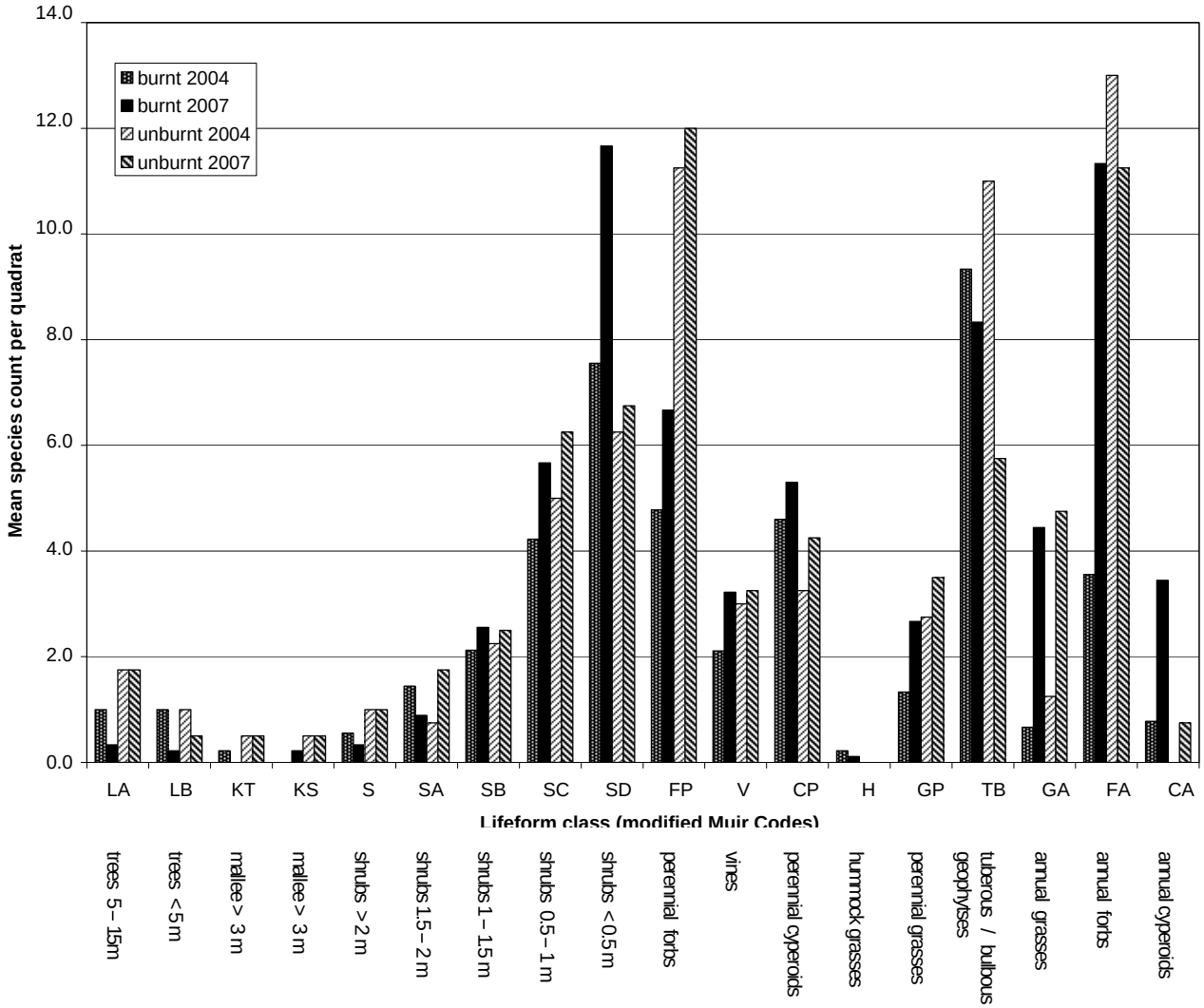
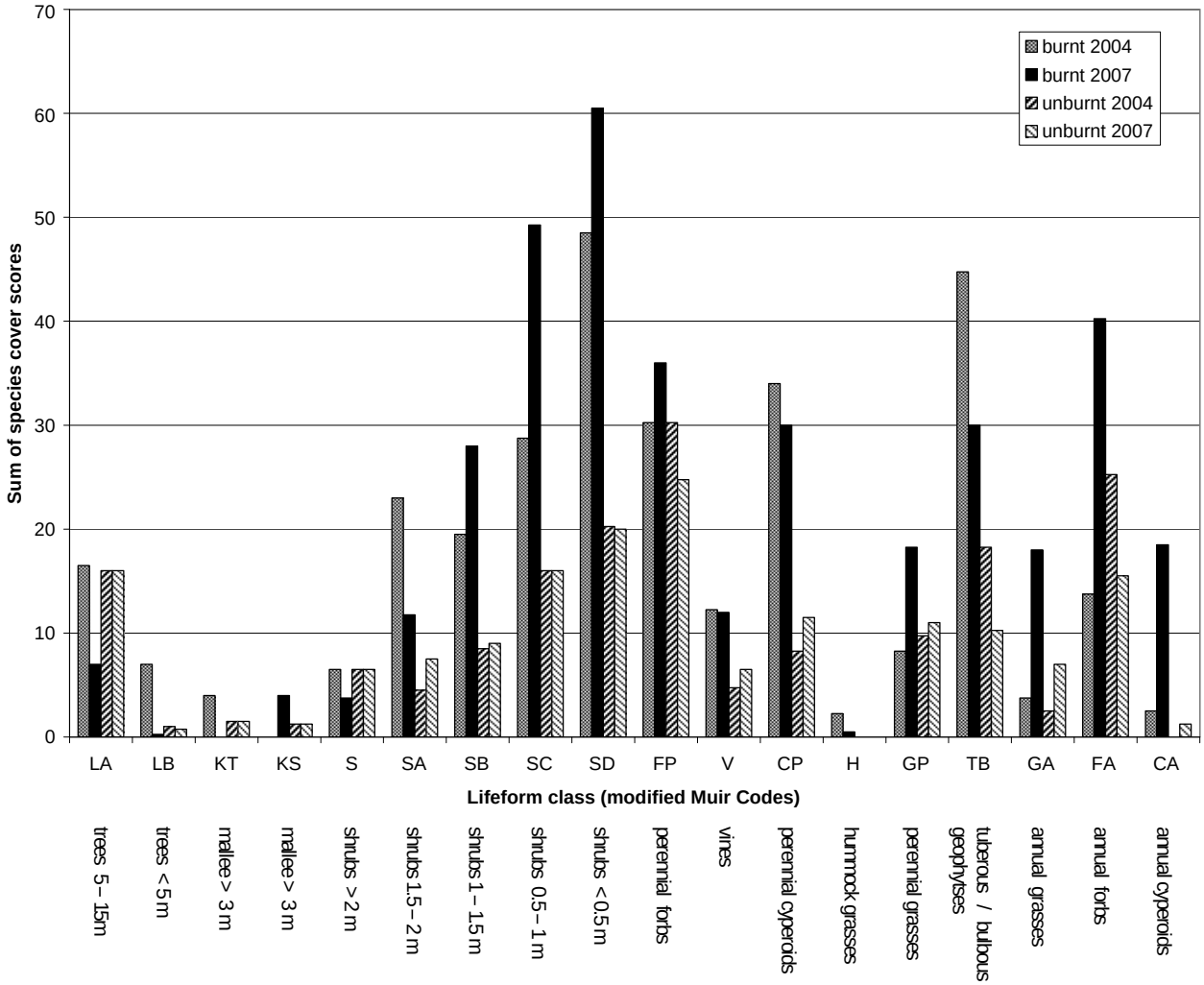


Figure 8: Species richness - cover index by life form class.



Plant species responses

Determination of plant regeneration modes

Observations on plant regeneration noted during the survey are compiled in Appendix 2. All plant species occurrences in quadrats burnt by the 2005 fire were assessed to determine their mode of regeneration. The following five categories were used:

- R = by regrowth;
- S = from seed;
- U = undetermined;
- R?= probably by regrowth;
- S? = probably by seed.

In a number of cases a species exhibited both seedling and regrowth regeneration modes and this was recorded. Additional regeneration comments were often noted against each species occurrence: these have been entered in the Survey database and are also incorporated in Appendix 2.

Non-basal regrowth (ie re-sprouting from stems well above ground level) was only recorded for Eucalypts (Sugar Gum, *Eucalyptus cladocalyx* and Eyre Peninsula Blue Gum, *E. petiolaris*) regrowing from epicormic shoots and for Yacca (*Xanthorrhoea semiplana*), re-shooting from the tops of burnt trunks.

Basal regrowth was readily deduced for shrubs with blackened dead woody stems emergent from the base of their new foliage (Figure 9, Figure 11), but smaller plants often had to be dug up to look for evidence of fire-scarring on their basal parts (Figures 37 to 40, pp. 57 to 59). In many cases smaller perennial species growing from underground rhizomes were assigned to the 'undetermined' category, as it was it was impossible to rule out the possibility that at least some of these had re-established from seed even though it seemed likely that they could have survived the fire from organs below the soil surface.

Seedling status was readily determined in a few instances where cotyledons persisted at the base of stems, or where plants had germinated from persistent woody fruit (Figure 11), but for most perennials it was based on the presence of a 'determinate' root system, typically with a long tap root or a central major root with diminishing lateral branching (Figure 25, p. 49). All annual plants were presumed to have regenerated by seed, but for renascent tuberous geophytes (such as orchids and many lilies) the regeneration mode was generally scored as undetermined.

Figure 9: Smooth Guinea-flower (*Hibbertia* sp. Glabriuscula (D.J.Whibley 9012) from site KOP00501 in Tucknott Scrub CP, showing remains of an original charred stems surrounded by new growth.

Figure 10: Small shrub of Smooth Guinea-flower (*Hibbertia* sp. Glabriuscula (D.J.Whibley 9012) that has regrown from the base post-fire. This is the same plant as in the previous figure, showing overall habit.

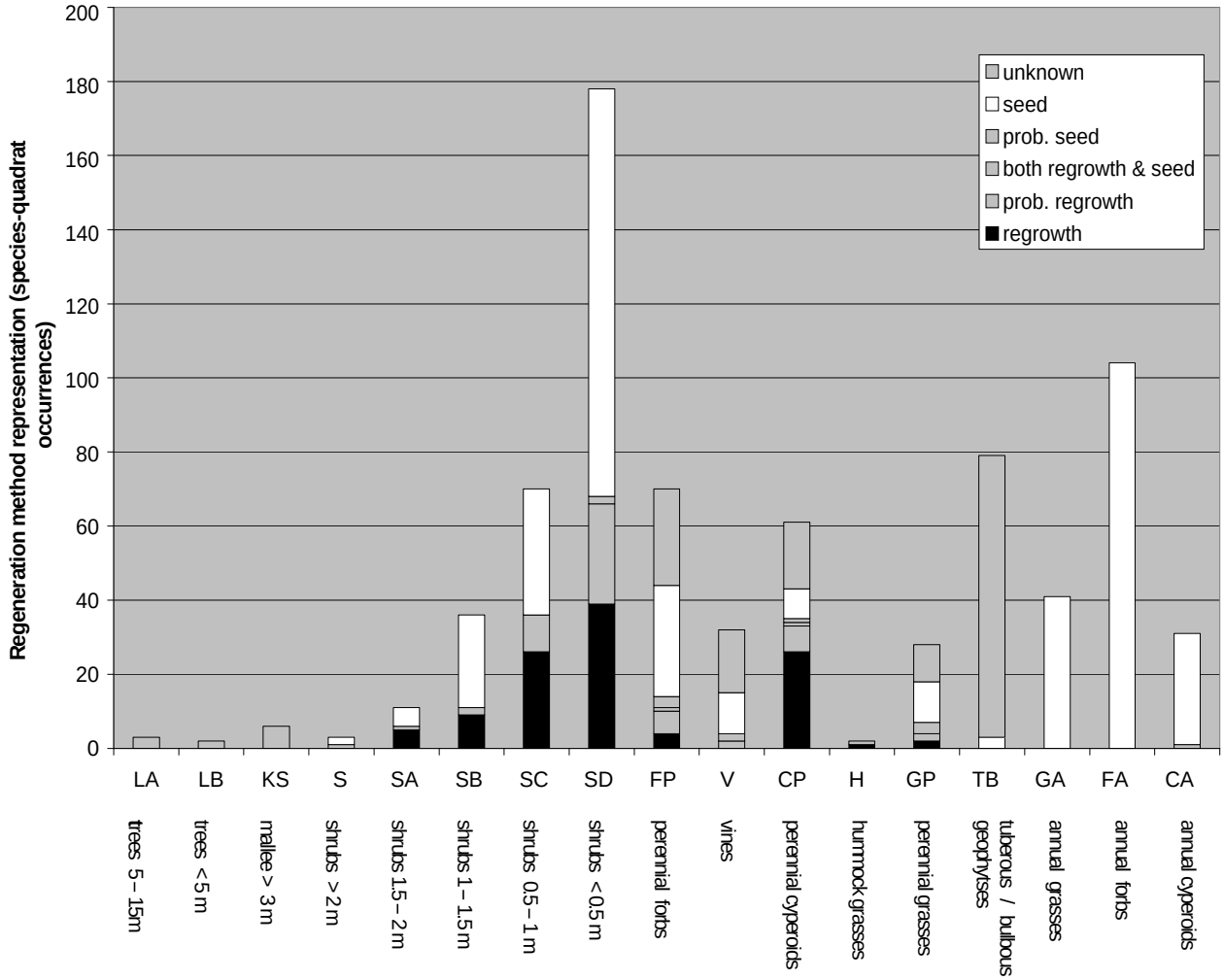
Figure 11: Seedlings of Port Lincoln Ground-myrtle (*Homoranthus homoranthoides*) BS128-4707 from site KOP00501 in Tucknott Scrub CP, showing taproots emerging from remains of fruit.

Incidence of regeneration modes

The incidence of regeneration modes is shown for all the various life form classes in Figure 12. Nearly all species occurrences in the tree and mallee classes, plus a significant proportion of those in the shrub classes, had both seedling and regrowth modes of regeneration represented. The category for'regrowth alone' was a major one for shrub and perennial sedge classes and relatively minor for perennial forbs, perennial grasses and vines. The category of 'seedling alone' naturally covered all the annual grasses, annual forbs and annual sedges, but was well represented in the shrub, perennial grass and forb classes.

This data is generalised across life form classes but it is of interest to look in more detail at the shrubs and identify those species which were only recorded in the 'seedling alone' class. These can be regarded as 'obligate seeders', although only in the context of the observations made in this survey. It is possible that under different conditions and in different habitats, some species may respond differently.

Figure 12: Species regeneration method by life form.



There were 28 'obligate seeder' native shrub species that were found in post-fire quadrats only as seed-established plants and these are listed in Table 19. The Legumes with 17 species are the best represented family in this list: all five Bush-pea (*Pultenaea*) species and 10 of the 12 Acacia species were recorded as regenerating solely by seed. The two exceptional Acacias that were also observed re-sprouting as well as regenerating by seedlings were Thorn Wattle (*Acacia continua*) and Spiny Wattle (*A. spinescens*). In addition the table includes all three *Spyridium* species and both Riceflower (*Pimelea*) species recorded in the survey quadrats, as well as , Twiggy Daisy-bush (Olearia ramulosa), Ruddy Beard-heath (*Leucopogon rufus*) and Totem-poles (*Melaleuca decussata.* It is also notable that Totem-poles, a moderately large shrub, showed no re-sprouting at any of its six post-fire sites.

For species that depend on seedling recruitment, the time taken for replenishment of the seed bank is important in relation to the timing of the next fire or other disturbance event that may impact seedling survival. The majority of these species (20 of the 28) had already achieved reproductive maturity within three years post-fire (life stage columns B, F and I) despite, in most cases, being below their mature height. Table 19 shows that most were under 1 m in height (Life form classes SD and SC), and a few (predominantly Acacia species) had exceeded 1.0 or 1.5 m (Life form classes SB and SA).

Eight shrub species recorded as regenerating solely by seed were only scored as having life stages "V" (sterile/vegetative phase established plants) and/or "S" (small seedlings). These species are marked with an asterisk in Table 19. Whilst evidence of earlier reproductive phases may be easily lost for annual species, this is unlikely to happen for these perennial shrubs. It is reasonable to conclude that the absence of any reproductive life stages recorded in September 2007 (including no remains of fruit shed in the last year or very young flowering buds) indicates that regrowth of these species had not yet reached reproductive maturity.

Two of the non-reproductive species, Twiggy Daisy-bush (*Olearia ramulosa*) and Ruddy Beard-heath (*Leucopogon rufus*), flower in autumn and summer respectively, and may have been close to initiating their first flower buds when the survey was conducted in September. The other six species are legumes of which four are Acacias, and as these are spring flowering, they would require at least another year of growth to reach reproductive maturity. This gives a minimum period of four years for the six legume species to achieve their first seed set.

Two species, Cranberry Heath (*Astroloma humifusum*) and Slender Cherry (*Exocarpos sparteus*), were excluded from the table because they were recorded as regenerating from basal regrowth, although for each this was a rare occurrence at a single site. However both also occurred in another five sites where only seedling regrowth was recorded, and therefore appear to be largely dependent on this regeneration mode. It was significant that both of these species had not yet reached reproductive maturity. Also notable was the disappearance of Cranberry Heath from site ULE01201 where it had previously been recorded with a cover/abundance score of '1' (plentiful but small cover – less than 5%) (Table 15).

Table 19: Native shrub species with post-fire regeneration in quadrats solely by seed. Gives number of quadrats for each life stage recorded (one or more life stages recorded per species per site).

KEY: **Life form:** **SD** = shrub < 0.5 m; **SC** = shrub 0.5– 1.0 m; **SB** = shrub 1.0-1.5 m, **SA** = shrub 1.5-2.0 m

Life stages: **S** = seedling < 25 cm, **V** = vegetative (non-reproductive & not **'S'**), **B** = budding; **F** = flowering; **I** = in immature fruit

***** 1 only recorded as having non-reproductive life stages for all sites

SPECIES	FAMILY	Common name	Quads	Life form				Life stages				
				SD	SC	SB	SA	S	V	B	F	I
*Olearia ramulosa**	COMPOSITAE	Twiggy Daisy-bush	5	1	3	1			5			
Leucopogon rufus	EPACRIDACEAE	Ruddy Beard-heath	2	2				2	1			
Acacia euthycarpa	LEGUMINOSAE	Wallowa	1			1				1	1	
*A. farinosa**	"	Mealy Wattle	1	1					1			
A. gillii	"	Gill's Wattle	6		2	2	2	2	1	5	1	1
A. imbricata	"	Feathery Wattle	2			2				1	1	2
*A. mearnsii**	"	Black Wattle	2		1	1		1	2			
A. myrtifolia	"	Narrow-leaf Myrtle Wattle	3		1	2		1	1	1	2	1
A. paradoxa	"	Kangaroo Thorn	1		1						1	
*A. pycnantha**	"	Golden Wattle	6	2	1	2	1	4	4			
A. rupicola	"	Rock Wattle	6		6			2	4	5	2	
*A. sclerophylla**	"	Hard-leaf Wattle	1	1					1			
*Gompholobium ecostatum**	"	Dwarf Wedge-pea	2	2				1	1			
Pultenaea acerosa	"	Bristly Bush-pea	2	2				1			1	
P. pedunculata	"	Matted Bush-pea	1	1							1	
P. tenuifolia	"	Narrow-leaf Bush-pea	4	3	1			2	2		2	1
P. teretifolia var. *teretifolia**	"	Terete-leaf Bush-pea	1	1				1	1			
P. trinervis	"	Three-nerve Bush-pea	4	4				1	2	1	1	
Sphaerolobium minus	"	Leafless Globe-pea	1	1						1		
Melaleuca decussata	MYRTACAEAE	Totem-poles	6	4	2			4	6	1	1	
Conospermum patens	PROTEACEAE	Slender Smoke-bush	1	1				1			1	
Grevillea halmaturina ssp. *laevis*	"	Prickly Grevillea	3	3				2	2			2
Spyridium nitidum	RHAMNACEAE	Shining Spyridium	2	1	1			1		2	1	
S. phylicoides	"	Narrow-leaf Spyridium	1	1				1			1	
S. vexilliferum	"	Winged Spyridium	2	1				1		1		
Stenanthemum leucophractum	"	White Cryptandra	7	7				3		4	5	
Pimelea flava ssp. *dichotoma*	THYMELAEACEAE	Diosma Riceflower	9	6	3			2		4	8	
P. octophylla	"	Woolly Riceflower	3	1	2			1	2	2		

Observations on regeneration of major tree and shrub species

Observations regarding post-fire responses have already been noted for rare or threatened species recorded during the survey (pp. 20-23). Populations of Dogwood Haeckeria (*Haeckeria cassiniiformis*), Cleland's Beard-heath *(Leucopogon clelandii),* and Ironstone Mulla Mulla (*Ptilotus beckerianus)* appear to have benefited from the fire in terms of their recruitment and growth.

This section provides further observations on impacts and responses for ecologically important plants and other species of interest.

Sugar Gum (*Eucalyptus cladocalyx*)

Sugar Gum is an important tree species for three reasons: it is a taxonomically distinctive eucalypt species without close relatives; it is endemic to South Australia; and it has a disjunct and restricted distribution, being confined to three isolated areas, namely southern Flinders Ranges, Kangaroo Island and southern Eyre Peninsula. The Eyre Peninsula trees have a more stunted habit than in the other regions and the species is confined to the higher rainfall zone on lateritic soils. Sugar Gum forms a unique community both structurally and floristically that is of high conservation importance. It is valuable as plant and animal habitat, due in part to its structural characteristics in readily producing hollows, abundant fallen timber and, beneath its umbrella-like canopies, much open space which provides for a variety of diverse understorey types.

Depending on the severity and frequency, fire can have deleterious impacts by consuming a substantial amount of fallen timber and destroying hollows. In addition, where major seedling recruitment of Sugar Gum occurs, the structure of the resulting community will be changed substantially due to crowding and consequent overshadowing and nutrient/water competition. This effect has been observed for Sugar Gum regeneration in the Flinders Ranges over a 20 year period of following a severe wildfire in Mount Remarkable National Park. This fire led to the development of many dense stands of thin-stemmed trees, understorey suppression and a much reduced capacity for hollow formation. In both the Tucknott Scrub sites (KOP00501 and KOP00601), there was a dense and extensive establishment of seedlings from 10 cm to 2 m tall (Figure 13). Without intervention, it is expected that over the ensuing decades these will produce a similar crowded overstorey structure as observed at Mt Remarkable; indeed it is highly unlikely that natural thinning could produce a typical Sugar Gum community structure with well-spaced large trees in the lifetime of these stands. Failure to restore this structure will affect recovery of dependent wildlife species.

Figure 13: Prolific seedling regeneration of Sugar Gum (*Eucalyptus cladocalyx*) (orange-brownish foliage arrowed), and Golden Wattle (*Acacia pycnantha*) (foreground) in Tucknott Scrub CP at site KOP00601.

Within and between sites Sugar Gums showed much variation in the impact of the fire and in their regeneration response. In the densest areas a few trees were killed and were usually burnt to below ground level with trunks and branches collapsed. Other trees were killed in most of the above ground parts with epicormic regrowth confined to the base of the trunk. Most often, trees were scorched of their canopies but were able to respond with epicormic growth along their major branches. Where Sugar Gums were more widely spaced, some original canopies were able to survive the fire despite complete burning of the understorey.

Figure 14: Examples of regeneration of Sugar Gum (*Eucalyptus cladocalyx*). Site KOP00201 (left) shows relatively dense woodland and the impact of a hotter fire. Note collapsed limbs and lower trunk and some basal epicormic growth (on the left). Site ULE01201 (right) shows patch of relatively open woodland with some original canopies intact.

Coastal White Mallee (*Eucalyptus diversifolia* ssp. *diversifolia*)

Coastal White Mallee was sampled in Murrunatta Conservation Park at sites MUR00201 and ULE01101 where it was dominant in the overstorey. Mallees readily regenerate from basal lignotubers and substantial seedling regeneration is not often observed. It is of interest to note that at both sites, seedlings were common and had attained heights of 20-40 cm. Regrowth from lignotubers was noted up to 2 m tall.

Coast Ridge-fruited Mallee (*Eucalyptus angulosa*)

As with Coastal White Mallee, Coast Ridge-fruited Mallee was observed to regenerate by both basal lignotubers and seedlings (Figure 15), and had reached heights similar to the preceding species.

Figure 15: Seedling of Coast Ridge-fruited Mallee (*Eucalyptus angulosa*) in Murrunatta Conservation Park at site MUR00301.

Sheoak (*Allocasuarina verticillata*)

Regeneration of Sheoak (*Allocasuarina verticillata*) in roadside vegetation throughout the burnt area was observed to be generally very successful, with high densities of well advanced, healthy seedlings in many stands, along with occasional re-sprouting of old trees. The Sheoaks in these areas had presumably benefited by water run-off from the road surface and verges.

Elsewhere seedling regeneration of Sheoak was poor, probably being hampered by the series of preceding dryer than average seasons (**Error! Reference source not found.** and Figure 2). In the two burnt quadrats where Sheoak had been present as a dominant overstorey species, its regeneration was relatively poor. Site MUR00301 sampled a small patch of Sheoak Woodland grading into Coast Ridge-fruited Mallee (*Eucalyptus angulosa*) dominated Mallee on the loamy sand flat in the southwest corner of Murrunatta Conservation Park. Here Sheoak seedlings (ca 1.2 m tall) were rare and most pre-existing Sheoaks had been completely killed, although a substantial number were regenerating with multiple stems regrowing from the base. Site WAN00201 sampled a fairly uniform area of (former) Sheoak Low Woodland (trees ca 5 m tall) on a south-facing hill slope on the western side of Wanilla Conservation Park (Figure 16). Regeneration of Sheoak here was extremely limited: no seedlings were present, and very few of the charred pre-existing trees had basal regrowth (only seven individuals with regrowth were counted within the quadrat). Unless there is secondary recruitment, Sheoak Woodland will have been lost as a community from this area. The failure of regeneration here may result from the steeper terrain and shallower soil less able to hold water, and/or a more intense fire (due to the slope and aspect) causing greater death of seeds and subcortical tissue.

Figure 16: Sheoak (*Allocasuarina verticillata*) Low Woodland effectively destroyed by fire at site WAN00201 on the western boundary of Wanilla CP. No Sheoak seedlings were present, and very few of the charred pre-existing trees had basal regrowth. Regenerating profusely are the dark green Rock Wattle (*Acacia rupicola*) and paler Silver Broombush (*Babingtonia behrii*).

Silver Banksia (*Banksia marginata*)

Silver Banksia is an uncommon species on Eyre Peninsula where it reaches it western limit and was only recorded on this survey in the additional post-fire site (MUR00101**)** in Murrunatta Conservation Park (CP).

Based on Herbarium and Biological Survey records for this region, Silver Banksia is confined to scattered locations with higher rainfall and more acid soils in the southern part of the peninsula and avoids calcareous soils such as those prevalent in Lincoln National Park. There are no herbarium collections of the species at the State Herbarium of SA (AD) that can be definitely ascribed to a National Parks and Wildlife (NPW) Reserve, although there are non-vouchered Biological Survey records for two NPW reserves, Murrunatta CP and Wanilla CP as well as a number of Heritage Agreement areas.

A large part of Silver Banksia's Eyre Peninsula range was impacted by the 2005 bushfire. Although probably limited in extent, the population in Murrunatta CP has high conservation importance, and its recovery through to reproductive maturity warrants monitoring. Charred cones indicate a previous high level of fruit set (Figure 19), yet no seedlings were observed and all regeneration was by re-sprouting and root suckers (Figure 17). Young plants that superficially looked like seedlings were found to be suckers when excavated (Figure 18).

Figure 17: Silver Banksia at site MUR00101 in Murrunatta Conservation Park. Regenerating bushes with burnt stems (middle right) and a young suckered plant produced from root (excavated at lower left). Suckers were 30-60 cm high.

Figure 18: Detail of excavated root sucker of Silver Banksia at site MUR00101 in Murrunatta Conservation

Figure 19: Charred remains of regenerating Silver Banksia showing fruit set (at same location as above).

Desert Banksia (*Banksia ornata*)

Desert Banksia has a broadly similar distribution and abundance to Silver Banksia on Eyre Peninsula, again being confined to the southern part of the peninsula where the species reaches its western limit and where it was similarly impacted by the 2005 fire. It was only recorded on this survey in the additional post-fire site (MUR00201**)** in Murrunatta Conservation Park. Based on Herbarium and Biological Survey records, the only other NPW reserves that it is known from are Wanilla CP and Kathai CP, but it is also found in a number of Heritage Agreement areas. As with Silver Banksia, its occurrence in Murrunatta CP, although small, is a significant one for the conservation of the species and its recovery here and elsewhere warrants further monitoring.

The charred remains of several original shrubs were found in the quadrat and its vicinity, including the adjoining roadside vegetation (Figure 20). Apart from one individual with poorly developed basal suckers, all had had been completely killed. There was evidence of moderate fruit set on cones (Figure 22) but seedling recruitment appeared to be very sparse and patchy and seedlings were around 20 cm tall (Figure 21). This species is well known for its adaptation to fire by regenerating from seed.

The poor recruitment observed here may be due the dryer than normal conditions post-fire. This has implications for planning fire frequencies. Unpredictable variation in seasonal patterns immediately following burning may not always be favourable for reproductive cycles and this could be critical, especially where minimum cycles are implemented to maximise fuel reduction outcomes.

Figure 20: Sand-Heath Banksia at site MUR00201 in Murrunatta Conservation Park with a single seedling marked by an arrow. The two dominant regenerating species are Tassel Rope-rush (*Hyoplaena fastigiata*) and Myrtle Wattle (*Acacia myrtifolia*).

Figure 21: Two seedlings of Desert Banksia, with cone and branch of the dead plant in background, and a Ruddy Beard-heath (*Leucopogon rufus*) seeding (lower centre).

Figure 22: Charred cones of Desert Banksia showing fruit set.

Native Pine (*Callitris gracilis*)

A scattering of Native Pine was recorded for quadrat ULE01201 in the Wanilla Land Settlement Conservation Reserve in 2004. These few individuals represented several cohorts from seedlings to mature plants. In 2007, none of the Native Pines had survived the fire and there was no evidence of seedling regeneration even though charred cones were present on mature trees. During an extensive reconnaissance of the reserve to survey regenerating (*Ptilotus beckerianus*) we discovered a single discrete small stand of 20-30 mature Native Pines from which the individuals in the quadrat appeared to have been derived. The trees were still standing but all had been killed completely by the fire and no seedlings were present. Subsequent recruitment of seedlings from a soil seed bank is unlikely because Native Pine generally relies on its canopy seed bank, with the seed in old woody cones being released in response to fire.

Based on State Herbarium and Biological Survey records the species is not known elsewhere in the Wanilla district and this occurrence is near the species southern limit on Eyre Peninsula. Unless some viable seed has survived, it appears that the wildfire has caused the extinction of Native Pine in the reserve and the Wanilla district.

Golden Wattle (*Acacia pycnantha*)

Prolific seedling regeneration of Golden Wattle occurred at two sites (KOP00601 in Tucknott Scrub CP (Figure 13), and KOP00701) where the species was assigned cover classes of 25-50% and 50-75% respectively. This is likely to have a similar effect on plant community structure as the dense Sugar Gum seedling recruitment described above although the impact is likely to be much more short-lived. At the pre-fire visit in 2004 the Tucknott CP site KOP00601 had a prominent sub-storey of senescing Golden Wattle, suggesting previous disturbance and/or fire history, although no fire scars were evident at this time. There would have been a well-stocked seed bank of Golden Wattle prior to the fire.

Seedling growth was not only prolific but rapid with seedling heights recorded from 5 cm to 1.75 m. The wide range probably results from staggered germination events.

Figure 23: Pre-fire sub-storey of senescing Golden Wattle (*Acacia pycnantha*) in Tucknott Scrub CP at site KOP00601 in September 2004. Compare with Figure 13 which shows dense seedling recruitment of Golden Wattle in the foreground.

Broombush (*Melaleuca uncinata*)

Broombush is a species well-known for its ability to re-sprout following fire or harvesting. It was of interest to also observe regeneration by seedlings at both burnt sites where Broombush was an overstorey dominant (KOP00301 and WAN00201). This may be related to dense Broombush suppressing other understorey species in the unburnt community and the volumes of seed produced.

Figure 24: Broombush (*Melaleuca uncinata)* Shrubland at site KOP00301, before and after fire, where there was substantial regeneration of Broombush by both re-sprouting and seedlings.

Figure 25: Herbarium specimens of Broombush (*Melaleuca uncinata)* seedlings (BS128-4779) collected at site KOP00301. Note lignotuberous swellings developing just below ground level.

Rock Wattle (*Acacia rupicola*)

Prolific post-fire regeneration of Rock Wattle was observed in large areas of Wanilla CP (Figure 45, p. 65) and this was sampled by quadrats KOP00201 and WAN00201. Given the resinous and highly flammable nature of Rock Wattle this has implications for the timing and effectiveness of fuel reduction burning (see section on 'Management implications of fire responses', p. 65).

The species was present in the seven original quadrats both before and after the fire and was recorded as regenerating by seedlings alone in them all. It was also present in two of the additional post-fire sites. The pre-fire cover in all sites was less than 5% and post-fire this only increased substantially in the two Wanilla CP quadrats where it was assigned the cover class of 50-75%. In two and a half years the regenerating seedlings had regained their former height class (0.5-1.0 m) and many had reached reproductive maturity.

Gill's Wattle (*Acacia gillii*)

This endemic Eyre Peninsula species was recorded in five original quadrats and two additional post-fire quadrats. It showed a marked post-fire increase at one quadrat, in Wanilla CP, KOP00201, where it went from a cover class of 'Trace' (sparsely present with a cover of less than 5%) to a cover class of 5-25%. Here it occurred in dense patches of saplings recruited from seed which had reached a height of 1.0-2.0 m and had attained reproductive maturity.

Yacca (*Xanthorrhoea semiplana*)

Yacca is a common and widespread species on southern Eyre Peninsula and was present at seven original pre-fire sites and four additional post-fire sites. It is a long-lived plant that is well adapted to fire, responding with rapid production of flowering spikes and new growth at the top of the stem. It is notable that death of mature plants was observed at several sites (some at KOP00301, most at KOP00401, a few at KOP00501, and some at ULE01201). Some Yaccas appeared to have been killed outright by the fire (Figure 26); in other cases it seemed the plants had flowered post-fire and subsequently died. This may be related simply to fire intensity, or it may be a consequence of the species rapid response under drought conditions. Only limited seedling recruitment was observed at two sites (KOP00201, KOP00401).

Figure 26: Understorey at site KOP00401, pre-fire (upper) and post-fire (lower). Most Yaccas at this site were killed by the fire including the two individuals visible in the in the right-hand foreground of the upper image. South African Daisy is evident in the upper photo with yellow flowers (taken in December 2004 during the fauna survey trip), and mature and senescing bushes of this species dominate the view in the lower image (taken in September 2007).

Regeneration observations for some other woody shrubs

Figure 27: Vigorous basal regeneration of Elm-seed Hakea (*Hakea cycloptera*) in Murrunatta Conservation Park. Emergent charred stems with open woody capsules remain from pre-fire growth.

Figure 28: Seedling of Elm-seed Hakea (*Hakea cycloptera*) in Murrunatta Conservation Park.

Figure 29: Basal regeneration of Yellow Gland-flower (*Adenanthos terminalis*) in Murrunatta Conservation Park. Dead stems of pre-fire growth marked by arrows.

Figure 30: Seedling of Yellow Gland-flower (*Adenanthos terminalis*) in Murrunatta Conservation Park. A second seedling of this species is visible in the background right, and the smaller scattered seedlings are Smooth Guinea-flower, *Hibbertia* sp. Glabriuscula (D.J.Whibley 9012).

Figure 31: Basal regeneration of Holly-leaf Grevillea (*Grevillea ilicifolia*) in Murrunatta Conservation Park. Note the two prominent charred woody stems in the upper part of the photo and a third in the immediate foreground, which are the dead remains of this individual's pre-fire growth.

Figure 32: Seedling of Holly-leaf Grevillea (*Grevillea ilicifolia*) in Murrunatta Conservation Park.

Figure 33: Basal regeneration of Common Oak-bush (*Allocasuarina muelleriana*) in Murrunatta Conservation Park. The emergent seedling is Shining Spyridium (*Spyridium nitidum*).

Figure 34: More advanced basal regeneration of Common Oak-bush (*Allocasuarina muelleriana*) in Murrunatta Conservation Park.

Figure 35: Re-sprouting Spiny Wattle (*Acacia spinescens*) bearing almost mature seed pods, Murrunatta Conservation Park

Figure 36: Detail of same shrub as above showing charred remains of original stems.

Resilience to fire of some small perennial species

In determining the mode of regeneration for each species encountered there were some surprising finds for a number of small perennial plants that perhaps would not be expected to survive a summer wildfire. On close examination they were found to have some charred remains of original growth at their base demonstrating that they were not post-fire seedlings but had survived the fire.

Figure 37: Herbarium voucher (BS128-4876) of Hand-flower (*Cheiranthera alternifolia*) from site WAN00101 in Wanilla CP, showing original burnt-off stem protruding from base on left side and the erect live stems that have regrown post-fire.

Figure 38: Herbarium voucher (BS128-4879) of Shrub Violet (*Hybanthus floribundus*) from site ULE01101 in Murrunatta CP, showing remains of an original charred stem (arrowed) surrounded by new growth.

Figure 39: Herbarium voucher (BS128-4665) of Rough Fanflower (*Scaevola linearis*) from site ULE01201 in Murrunatta CP, showing remains of an original charred stems surrounded by new growth.

Figure 40: Herbarium voucher (BS128-4672) of Golden Pennants (*Glischrocaryon behrii*) from site ULE01201 in Murrunatta CP, showing remains of an original charred stems over-topped by new growth.

Regeneration response of sedges

Perennial sedges usually have well-developed rhizomes and are ideally suited to survive burning and regenerate vegetatively. When rhizomes occur at sufficient depth below the ground it can be impossible to distinguish regrowth from cohorts regenerated by seed. In a number of cases however charred remains of the original growth persisted and clearly demonstrated the resilience of these plants to burning (Figure 41, Figure 42, Figure 43, Figure 44).

Figure 41: Herbarium voucher (BS128-4690) of Black Bristle-rush (*Chorizandra enodis*) from site KOP00601 in Tucknott Scrub CP, showing burnt-off remains of fibrous bases and dead stem (right). Note also the severe browse line on the earlier post-fire stem growth.

Figure 42: Herbarium voucher (BS128-4866) of Matted Bog-rush (*Schoenus breviculmis*) from site MUR0201 in Murrunatta CP, showing truncated and charred bases and subsidiary new growth.

Figure 43: Herbarium voucher (BS128-4760) of Spreading Sword-sedge (*Lepidosperma concavum*) from site ULE01101 in Murrunatta CP, showing burnt-off bases on either side of new growth.

Figure 44: Herbarium voucher (BS128-4716) of Black Rapier-sedge (*Lepidosperma carphoides*) from site KOP00501 in Tucknott CP, showing charred bases surrounding new growth.

Weed responses

South African Daisy (*Senecio pterophorus*)

South African Daisy was recorded in five quadrats pre-fire and in eight of the nine original quadrats post-fire. Apart from its first appearance at three sites, the survey technique was too coarse to pick up significant differences in abundance. This outcome is interesting because this species normally responds to fire with a large increase in abundance and cover. Once again, drought factors may have influenced the response. At site KOP00401 it was recorded in the 5-25% cover class both pre- and post-fire, and only two and a half years after the fire, many of the shrubs were already senescing (Figure 26).

Bridal Creeper (*Asparagus asparagoides*)

Bridal Creeper was present pre-fire in four sites. Apart from two sites which only had small traces, it was plentiful but less than 5% cover in one, and had between 5 and 25% cover in the other. After the fire the two most abundant sites showed a decrease to the next lowest cover class.

Cape Weed (*Arctotheca calendula*)

Cape Weed was only noted at two sites pre-fire with very small cover. After the fire it was recorded at eight sites but still with small cover. It was interesting to note its post-fire occurrence at one site in Wanilla Conservation Park as germinating seeds in kangaroo dung. The reserve is adjacent to open pasture where kangaroos feed.

Strawberry Clover (*Trifolium fragiferum*)

As with Cape Weed, Strawberry Clover is likely to have spread from adjacent farmland. It was noted in the park for the first time post-fire, and was also germinating from kangaroo dung.

Fuel hazard assessment

The wildfire has provided an opportunity to gauge the impact of fire on natural vegetation communities from management and conservation perspectives. The severity of the fire meant that fuel loads were reduced to minimal levels across most of the affected area and this has provided a baseline from which to assess re-establishment of fuel loads.

The assessment of fuel loads discussed below was undertaken post survey as a'desk-top' exercise when it became apparent that survey observations provided an opportunity to do this. Assessments were made following the criteria established by the 'Overall Fuel Hazard Guide for South Australia' (Department for Environment & Heritage, 2006). The established methodology for hazard assessments is largely a subjective and qualitative process. Whilst the standard biological survey methods used are not designed to measure fuel loads, their assessments of cover for various structural categories are well suited for assessing components of fuel hazard and add a level of rigour to the fuel load assessment process. However a disadvantage is that the contribution of dead plant material to the flammability and biomass of different layers could only be broadly inferred from the site photos as this was not included in the survey data.

For each site, pre- and post-fire assessments were made with reference to the site photographs and relevant survey data. The process entailed evaluating four components of fuel load which interact in defined ways to give an overall assessment of fuel hazard. Interactions were determined using conversion tables provided in the Fuel Hazard Guide and the results are summarised in Table 20.

Surface Fine Fuel was not recorded directly by measurements of litter depth but was extrapolated from the litter cover estimate for the quadrats used in conjunction with the site photos. The abbreviations L1 and L2 were used to denote litter depths of < 8 mm and 8 - <15 mm and M1 to denote the lower 'moderate' class litter with a depth of 15 - <20 mm. Litter depth was generally assigned low classes and represent conservative values that may underestimate the hazard contributed by this component.

The *Near-Surface Fuel* layer comprises grasses, sedges/rushes and low shrubs to 0.6 m tall. To assess this, species records with a cover score of 1 [7] or greater were extracted and filtered for Muir-based (Forward & Robinson, 1996) life-form classes GL, GT, VL, VT, SD, J and P [8]. The lower cover class limits for each of these major species were summed to give an overall minimum value (eg four species with cover in the class 2 (5-25%) would have a minimum aggregate cover of 20%). Data was also extracted for relevant structural layers from another standard Biological Survey attribute: the broad cover classes (of Specht, 1972) assigned in the Vegetation Assemblage Structural Summary to Muir-based structural layers. Minimum aggregate species cover scores were assessed in conjunction with these values and with the site photographs to assign the near-surface fuel layer an estimated cover, which was then compared with the cover range provided for each hazard class.

The effects of fuel layers on fire behaviour and intensity are complex. The *Near-Surface Fuel* layer interacts with the S*urface Fine Fuel* to increase the hazard in a non-linear fashion, with the greatest effect at the higher near-surface fuel levels. The *Adjusted Surface Fuel* hazard was derived from the combination of *Surface Fine Fuel* and *Near-Surface Fuel* classes using the conversion table provided in the Overall Fuel Hazard Guide on page 9.

The *Elevated Fuel Layer* comprises shrubs and juvenile understorey plants up to 2-3 m height and it was evaluated in a similar fashion to the near-surface layer but with species cover data filtered for Muir-based life-form classes SC, SB, SA, S, KL and LB [8]. The Overall Fuel Hazard Guide's initial criterion for *Elevated Fuel Hazard* is a generalised description of how easy it is to walk through this vegetation layer. This was largely determined from site photos and combined with the estimated fuel layer cover derive the hazard class.

[7] = included cover scores: 1 = plentiful, but of less than 5% cover, 2 = 5-25% cover, 3 = 25-50% cover, 4 = 50-75% cover.
[8] for definition of codes, see Table 12, p. 27 and Table 18, p. 32.

The *Bark Fuel Hazard* is influenced by the amount of loose or fibrous bark that is available to act as a link between ground and canopy fuels and to contribute to spotting beyond the fire front. Most of the tree species sampled were smooth-barked Eucalypts with a low bark hazard rating. The exceptions were site KOP00601 which, pre-fire, had numerous senescing Golden Wattles (*Acacia pycnantha*) with semi-detached rough bark (see site photo, Appendix 5, p. 111); KOP00701 which, pre-fire, had mature Eyre Peninsula Blue Gums (*Eucalyptus petiolaris*) with a stocking of rough bark; and WAN00201 which had, post-fire, dead Sheoaks (*Allocasuarina verticillata*) with semi-detached rough bark.

The *Overall Fuel Hazard* was determined by the interaction between the three components, *Bark Hazard*, *Surface Fuel Hazard* and *Elevated Fuel Hazard* using the tables on page 28 in the Overall Fuel Hazard Guide.

Table 20: Fuel hazard assessment matrix for nine burnt sites pre- and post-fire, and five additional post-fire sites.

Key: L = low, M = moderate, H = high, VH = very high, E = extreme
(as defined in 'Overall Fuel Hazard Guide for South Australia' (Department for Environment & Heritage, 2006).

SITE ID	fire	surface	near-surface	adjusted surface	elevated	bark	overall hazard	equivalent average fuel load (t/ha)	overall hazard change	fuel load change (t/ha)[9]
KOP00201	unburnt	M1	H	H	H	L	**H**	12	-2	-8
	burnt	L1	M	L	H	L	**L**	4		
KOP00301	unburnt	L1	VH	M	VH	L	**VH**	11	-3	-9
	burnt	L1	M	L	M	L	**L**	2		
KOP00401	unburnt	L1	VH	M	VH	L	**VH**	11	0	0
	burnt	L1	VH	M	VH	L	**VH**	11		
KOP00501	unburnt	L1	H	M	H	L	**M**	7	-1	-5
	burnt	L1	M	L	M	L	**L**	2		
KOP00601	unburnt	L2	M	M	H	M	**M**	7	+2	+4
	burnt	L1	H	M	VH	L	**VH**	11		
KOP00701	unburnt	L2	H	M	M	H	**M**	7	+2	+4
	burnt	L1	VH	M	VH	L	**VH**	11		
ULE01001	unburnt	L1	H	M	E	L	**E**	15	-1	-4
	burnt	L1	H	M	VH	L	**VH**	11		
ULE01101	unburnt	M1	H	H	VH	L	**VH**	16	-2	-9
	burnt	L1	H	M	H	L	**M**	7		
ULE01201	unburnt	L1	H	M	H	L	**M**	7	0	-2
	burnt	L1	VH	M	L	L	**M**	5		
MUR00101	burnt	L1	VH	M	M	L	**M**	5		
MUR00201	burnt	L1	M	L	M	L	**L**	2		
MUR00301	burnt	L1	H	M	H	L	**M**	7		
WAN00101	burnt	L1	H	M	M	L	**M**	5		
WAN00201	burnt	L1	M	L	H	M	**L**	4		

The sites showed considerable variation in their overall hazard scores both pre- and post-fire reflecting the complexity and diverse nature of representative vegetation communities sampled. The nine sites assessed pre-fire showed fuel hazard levels ranging from 'Moderate' to 'Extreme'. Of the 14 burnt sites surveyed, three years after the fire, only five had a 'Low' *Overall Fuel Hazard*, while five had reached a fuel level of 'Medium', and four were 'Very High'.

[9] note these values are derived from the averages given for fuel classes in the Overall Fuel Hazard Guide for South Australia, and should be interpreted as broadly indicative rather than specific measures.

Management implications of fire responses

Although the fire removed all readily flammable biomass (including the ground litter layer) from all the 2004 sites, three years on, only five of these still had a lower overall fuel hazard level than they did pre-fire (Table 20, column 'overall hazard change'). It is a concern that only three years after the fire, five of the 14 burnt sites had reached a fuel level of 'Medium', and four had a 'Very High' *Overall Fuel Hazard*. The variability in the fuel hazard scores shows that an extreme fire still does not provide uniform or long term reduction of fuel hazard across the range of vegetation types sampled by this study.

Prolific post-fire regeneration of Rock Wattle, a resinous and flammable species, was observed in large areas of Wanilla CP (Figure 45) and provides a dramatic example of how fire-induced regeneration can escalate fuel loads within three years. Further details on this species' response to the fire are provided on p. 50 in the plant species observations section.

Figure 45: Prolific seedling regeneration of Rock Wattle (*Acacia rupicola*) on the northern boundary of Wanilla CP. The understorey in this view is almost entirely dominated by seedlings of this species which have grown to a height of around a metre in the two and a half years since the fire. The management implications for dealing with fuel loads in a reserve where a flammable species can respond so quickly and so vigorously are challenging. Attempting to avoid this problem by reducing the burning interval to less than two and a half years would result in the extermination of many of the reserve's native species due to lack of seedling recruitment.

Reptile species that appear to have been severely disadvantaged from the fire were the Striped Wall Skink (*Cryptoblepharus pulcher*), Delicate Skink (*Lampropholis delicata*) and Spinifex Snake-lizard (*Delma butleri*). These three species have characteristics that make them susceptible to very hot fast moving fires. The Striped Wall Skink is a mostly arboreal species that spend most of its time sheltering in crevices or under the bark of trees and fallen logs. The Delicate Skink is mostly near the soil surface inhabiting leaf litter and fallen timber, whilst the Spinifex Snake-lizards habit of sheltering under dense vegetation such as Spinifex (*Triodia* spp.) make it similarly vulnerable. The two native ground dwelling mammal species also disappeared from sites. The Bush Rat, (*Rattus fuscipes*), previously the most abundant mammal and present at four sites, now appears to be locally extinct in those habitat patches.

Regular monitoring of sites for all affected species is required to assess whether management actions such as relocations may be required in the future, given the fragmented nature of the native vegetation remnants in the area burnt by the fire. Also the potential for future impacts on these more fire sensitive species needs to be considered when planning fuel reduction burns and assessed in a regional and species distributional context.

It is suggested that the poor recruitment observed in this study for Desert Banksia (*Banksia ornata*) (see p 45) may be the result of dryer than normal seasons post-fire. This illustrates the importance of allowing for

seasonal variability in planning fire frequencies. Conditions may not always be favourable for predicted reproductive cycles, and may sometimes lead to recruitment failure. This can have serious consequences, especially where minimum cycles are implemented to maximise fuel reduction outcomes.

Management burns to reduce fuel hazard may be an unwarranted and wasted effort in some vegetation communities, given the very short-lived fuel reduction benefit. Increasing the frequency of burns would be difficult to achieve: firstly, because available resources are usually limited and secondly, because of the narrow and unpredictable window of opportunity provided by local weather conditions. Climate change may further reduce suitable opportunities. From a conservation perspective, increased fire frequency is likely to cause the local extinction of species not capable of reaching reproductive maturity within shorter time-spans, and lead to increasing opportunities for weed invasion and dominance of 'fire-increaser' species.

The results of this study raise concerns that highlight the need for: further monitoring of the recovery of biota from the impact of this fire; and research to provide a better understanding of how fragmented ecosystems are affected by fire, and to develop optimum strategies for management.

Value of the Biological Survey methodology for monitoring fire impacts and recovery.

The Biological Survey (BS) methodology was designed to provide a baseline inventory of vascular plant and vertebrate communities occurring in the major habitat types of a region. It involves the collection of largely qualitative data, and, in terms of monitoring, it is best suited for providing an indication of broad level changes. It is not designed for most monitoring situations which call for more detailed quantitative comparisons. Nevertheless in an area that has already been burnt, any pre-existing site survey data is inherently valuable. Consequently this study looked at a full range of standard Biological Survey data to investigate what information they could provide on changes to vegetation post-fire.

Values and limitations of pre-existing sampling.

The existing BS sites provided a representative and comprehensive array of pre-fire data allowing post fire comparisons of change and impact. They also provided defined photo points and a repeatable process for reassessing change.

An advantage is that this methodology records all species at a site (with field identifications supported by specimens). This means that impacts can be determined for less common and rare species provided these are present and active or visible during the sampling period. Surveys within agricultural areas are done at a time selected to pick up the maximum species diversity within some logistical constraints. The comparisons made in this report would have been a lot less informative if the vegetation survey had been done in summer or autumn, and the fauna survey had been done in winter.

As is the case for many Biological Survey sites, the existing survey sites were accurately relocatable, with steel droppers marking the photo points. These droppers survived the fire and enabled accurate relocation of quadrats with the support of GPS coordinates, site photo and location diagrams. However, not all BS sites are marked by steel droppers. For those sites without droppers, site photographs and GPS/map locations may allow relocation in many circumstances, although sometimes this may be compromised by factors such as the fire changing the vegetation structure and appearance.

Across most of the State, Biological Surveys do provide a representative and broad coverage of the range of communities present within a region, and this gives a reasonable likelihood of having some pre-fire sites within a study area. While the coverage of BS sites is very extensive, the disadvantage is that the sampling intensity is relatively low which means that there is poor replication of particular communities.

The sampling intensity of Biological Surveys is limited by the resources available, and it follows that BS data could be put to greater use if the density of quadrats was increased. Greater sampling intensity for this study would have strengthened the comparisons between burnt sites and controls. Just how critical a factor low sampling intensity is, will depend on the area of the fire. For a large fire there could be reasonable coverage for the communities present, but smaller fires may intercept no sites or only one or two, making a study such as this unfeasible.

Coupled with concerns about the level of sampling replication, is the limited area of a given community occurrence that is sampled by a single quadrat (with 30 x 30 m being the standard size for this study and other agricultural zone surveys, and 50 x 50 m or 100 x 100 m standard for semi-arid and arid systems). This is largely a constraint of the practicalities of having a fixed repeatable sample as opposed to non-repeatable or less easily-repeatable methods involving either lengthy transects, or an array or random spread of sub-samples. This restricts the ability to generalise from the quadrats to the surrounding local community. For example in this study it was suggested that the disappearance of some species from a small number of quadrats was inconclusive because of the possibility of patchiness in fire intensity at a scale not adequately sampled by the quadrat area (see pp. 30-31). Presence/absence of particular species is only likely to be significant if they are particularly abundant or the changes are replicated across a number of quadrats.

Sampling error

It should be noted that while permanently marked BS quadrats provide a repeatable sample, their precision could be improved. Hand-drawn plans are usually incorporated on datasheets to show quadrat locations and their layout in relation to the position of permanent photo point markers, but the quadrat boundaries themselves are not permanently marked. This contributes some error around quadrat margins concerning plants which may or may not be included in the sample area. Permanently marking the four corners of the quadrat with pegs could largely overcome this problem.

Another source of error is variation between observers, particularly in regard to estimates of foliage cover classes for species. In this survey we were able to use the same plant observers pre-and post-fire to help reduce noise from observer bias, but this won't always be possible.

For fauna, the comprehensiveness of BS records relies on observer skill to pick up additional animal species richness not detected by trapping techniques and standard sampling protocols. There is always a risk that comparable fauna monitoring will be compromised by the use of less skilled observers. To a lesser extent, variability in the botanical and observational skill levels of observers for pre and post fire vegetation monitoring may also influence the diversity of plant species found.

Modifications and additions to standard methodology

This study shows that useful fire hazard assessments can be made using the BS data and photos. However existing BS data does not provide direct scores for litter and bark etc that are needed for the standard Fire Hazard Assessment. Estimates for these attributes were derived from the photos and other data and may have caused some loss of precision. It is worth considering amending the standard BS methodology to include an estimate of mean litter depth for each quadrat (as an addition to the existing litter cover estimate). This would facilitate the use of BS data for Fuel Hazard Assessments in the future.

In this study much useful data was obtained from the post-fire visit by amending the standard BS method to record the regeneration mode (by seedling or by re-sprouting or both) against each species occurrence. This information cannot be obtained by the standard methods where the presence of small seedlings is usually recorded. as a life stage presence ('S'), but larger plants grown from seed or with evidence of having re-sprouted post-fire are only optionally recorded as a comment. Consideration should be given to amending the standard BS process, at least for recently burnt areas, to also consistently record regeneration mode. This involves only minor changes to datasheets but does increase the time taken in the field by about 50%.

General observations

A major deficiency of Biological Survey sampling, the lack of replicates, was circumvented to some degree by using summative measures such as species richness, by aggregating data into life form groups, and by combining data across all quadrats, when making comparisons. Species richness is an easily derived measure and the Biological Survey data is well suited for using this attribute to compare pre- and post-fire sites. Species richness is nevertheless is still an imprecise measure for comparisons over time as it displays substantial background variation between visits to the same site, as is demonstrated by the unburnt control sites.

A serious impediment in using BS data for comparisons is that cover/abundance information is recorded in a way that is hard to separate from floristics, life form and structure. The problem is twofold: firstly cover is estimated in very broad classes (for rapid surveying and to accommodate error and variability in observer skill) and secondly it is scored against individual species and against life form and structural classes. This prevents components of cover data from being evaluated independently and aggregated into more meaningful groupings. The detailed cover data collected on a species basis can't be summed to derive overall values of cover for structural vegetation layers. This is because the cover classes span such a wide range which is compounded if summed. (For example, four species each in the 5 -25% cover class, will have a total cover range of between 20 and 100 %). Furthermore, in the case of shrubs, species cover is only linked to the dominant or highest life form/structural class (eg shrubs 1.5 – 2.0 m tall whereas the species may span a number of the 0.5 m interval height classes for shrubs.)

The Structural Summary component of BS data does have cover information tied to classes across all species, but the classes are based largely on life-form and only partly structural. Also once again the cover estimates are recorded in broad classes that limit their aggregation. (For example if sedge species are assigned 1-10%, low grasses as 1-10%, tall grasses 1-10% and low shrubs 30-70%, these values cant be summed to generate a total ground layer cover score; whereas if actual cover scores were determined as 9% sedges, 11% grasses and 36% low shrubs, they could be summed to give a total ground layer cover, even if the error term was considerable.)

The broad cover classes used in Biological Survey quadrats enable broad qualitative comparisons but are not suited to detect more subtle changes that are often of concern from a monitoring perspective. Useful data can certainly be extracted from Biological Survey sites for pre and post fire comparisons, but the BS sites are not a substitute for quantitative sampling methods that are tailored to answer specific questions.

APPENDICES

Appendix 1: Vascular plant records from fire study survey.

KEY:
SU: Survey record from 30 x 30 m quadrat.
OP: Opportunistic collection from outside of quadrats.

SPECIES**: *** denotes an alien established plant species.

SPECIES	COMMON NAME	FAMILY	VOUCHERS [10] (BS128-)	SU quadrats[11]		OP
				2004	2007	
Acacia continua	Thorn Wattle	LEGUMINOSAE	4885		1	
Acacia euthycarpa	Wallowa	LEGUMINOSAE	4867		1	
Acacia farinosa	Mealy Wattle	LEGUMINOSAE	4803		1	
Acacia gillii	Gill's Wattle	LEGUMINOSAE	4743	3	7	
Acacia imbricata	Feathery Wattle	LEGUMINOSAE	3774	6	6	
Acacia mearnsii	Black Wattle	LEGUMINOSAE	3776	1	2	
Acacia microcarpa	Manna Wattle	LEGUMINOSAE	4872			1
Acacia myrtifolia	Narrow-leaf Myrtle Wattle	LEGUMINOSAE	4624	2	3	
Acacia paradoxa	Kangaroo Thorn	LEGUMINOSAE	4843	2	2	
Acacia pycnantha	Golden Wattle	LEGUMINOSAE	3775	6	8	
Acacia rupicola	Rock Wattle	LEGUMINOSAE	3716	6	9	
Acacia sclerophylla var. *sclerophylla*	Hard-leaf Wattle	LEGUMINOSAE	3308, 3809, 3810	1	1	
Acacia spinescens	Spiny Wattle	LEGUMINOSAE	4685	6	11	
Acaena echinata	Sheep's Burr	ROSACEAE	3758	3	1	
**Acetosella vulgaris*	Sorrel	POLYGONACEAE		1		
Acianthus pusillus	Mosquito Orchid	ORCHIDACEAE	3802, 3842	2		
Acrotriche cordata	Blunt-leaf Ground-berry	EPACRIDACEAE	4877	3	3	
Actinobole uliginosum	Flannel Cudweed	COMPOSITAE	3932	1	1	
Adenanthos terminalis	Yellow Gland-flower	PROTEACEAE	4640, 4879	3	6	
**Aira cupaniana*	Small Hair-grass	GRAMINEAE	4681, 4767		7	
Allocasuarina muelleriana ssp. *muelleriana*	Common Oak-bush	CASUARINACEAE	3780, 3781	2	3	
Allocasuarina pusilla	Dwarf Oak-bush	CASUARINACEAE	3303A	1		
Allocasuarina verticillata	Drooping Sheoak	CASUARINACEAE		4	6	
Alyogyne huegelii	Native Hibiscus	MALVACEAE			1	
**Anagallis arvensis*	Pimpernel	PRIMULACEAE	4643	6	9	
Angianthus preissianus	Salt Angianthus	COMPOSITAE	4718, 4719		1	
Apalochlamys spectabilis	Showy Firebush	COMPOSITAE			1	
Apium annuum	Annual Celery	UMBELLIFERAE	4747		1	
Apodasmia brownii	Coarse Twine-rush	RESTIONACEAE	3737	2	1	
**Arctotheca calendula*	Cape Weed	COMPOSITAE	4627	4	10	
Argentipallium obtusifolium	Blunt Everlasting	COMPOSITAE	4638, 4754		2	
**Asparagus asparagoides* f. *asparagoides*	Bridal Creeper	LILIACEAE	3811	8	8	
Asperula conferta	Common Woodruff	RUBIACEAE	3865	1	1	
Astroloma conostephioides	Flame Heath	EPACRIDACEAE	4669, 4802	7	11	
Astroloma humifusum	Cranberry Heath	EPACRIDACEAE	4706	4	6	

[1] All voucher specimens from the 2007 survey are cited here (BS128-4624 – 4900). Vouchers numbers from the same set of quadrats surveyed in 2004 (BS128-3000 series) are also included for species that were not re-vouchered in 2007. Note that some species not otherwise vouchered may be represented by vouchers collected from other quadrats on the 2004 survey.

[11] Gives numbers of fire study quadrat records for each species: pre-fire in 2004 and post-fire in 2007 and includes both burnt and unburnt quadrats. Note that the two sets of figures are not strictly comparable because five additional post-fire quadrats were surveyed in 2007.

SPECIES	COMMON NAME	FAMILY	VOUCHERS [10] (BS128-)	SU quadrats[11]		OP
				2004	2007	
Austrodanthonia fulva	Leafy Wallaby-grass	GRAMINEAE	3827	1	1	
Austrodanthonia setacea	Small-flower Wallaby-grass	GRAMINEAE	4805, 4826	2	2	
Austrodanthonia sp.	Spear-grass	GRAMINEAE		1	4	
Austrostipa acrociliata	Graceful Spear-grass	GRAMINEAE			1	
Austrostipa elegantissima	Feather Spear-grass	GRAMINEAE	4794, 4796	4	4	
Austrostipa flavescens	Coast Spear-grass	GRAMINEAE	4804		1	
Austrostipa mollis	Soft Spear-grass	GRAMINEAE	4631, 4714, 4742, 4761	3	5	
Austrostipa mollis group	Soft Spear-grass	GRAMINEAE	4852		1	
Austrostipa mundula	Neat Spear-grass	GRAMINEAE	4678		1	
Austrostipa nitida	Balcarra Spear-grass	GRAMINEAE	4806		1	
Austrostipa scabra ssp.	Rough Spear-grass	GRAMINEAE			1	
Austrostipa scabra ssp. *falcata*	Slender Spear-grass	GRAMINEAE	4793	1	2	
Austrostipa sp.	Spear-grass	GRAMINEAE		4	5	
**Avellinia michelii*	Avellinia	GRAMINEAE	4636		8	
**Avena barbata*	Bearded Oat	GRAMINEAE		2	3	
**Avena* sp.	Oat	GRAMINEAE			1	
Babingtonia behrii	Silver Broombush	MYRTACEAE	4695	6	10	
Baeckea crassifolia	Desert Baeckea	MYRTACEAE	4758	1	2	
Banksia marginata	Silver Banksia	PROTEACEAE			1	
Banksia ornata	Desert Banksia	PROTEACEAE	4862		1	
Baumea juncea	Bare Twig-rush	CYPERACEAE			1	
Billardiera sericophora	Silky Apple-berry	PITTOSPORACEAE	3866, 3924	2	2	
Billardiera sp.	Apple-berry	PITTOSPORACEAE			4	
Blennospora drummondii	Dwarf Button-flower	COMPOSITAE	4674	6	5	
Boronia coerulescens ssp. *coerulescens*	Blue Boronia	RUTACEAE	4670	2	3	
Boronia filifolia	Slender Boronia	RUTACEAE	4752, 4853	1	2	
Brachyscome perpusilla	Tiny Daisy	COMPOSITAE	3930	2	2	
**Briza maxima*	Large Quaking-grass	GRAMINEAE	4644	1	3	
**Briza minor*	Lesser Quaking-grass	GRAMINEAE	4657	1	10	
**Bromus diandrus*	Great Brome	GRAMINEAE	4840		1	
**Bromus madritensis*	Compact Brome	GRAMINEAE	4812, 4835		2	
Bulbine semibarbata	Small Leek-lily	LILIACEAE	4893			1
Burchardia umbellata	Milkmaids	LILIACEAE	4736	5	9	
Bursaria spinosa ssp. *spinosa*	Bursaria	PITTOSPORACEAE	4800	4	1	
Caladenia capillata	Wispy Spider-orchid	ORCHIDACEAE	3844	1		
Caladenia fuscata	Dusky Caladenia	ORCHIDACEAE	3824	2		
Caladenia latifolia	Pink Caladenia	ORCHIDACEAE	3729, 3803, 3826	5	1	
Caladenia pusilla	Pigmy Caladenia	ORCHIDACEAE	4775		1	
Caladenia septuosa	Eyre Peninsula Spider-orchid	ORCHIDACEAE	3282, 3302, 3760, 3797, 3814, 3825, 3843, 3925	8	4	
Caladenia sp.	Spider-orchid	ORCHIDACEAE		1		
Calandrinia calyptrata	Pink Purslane	PORTULACACEAE	3912	1	1	
Calandrinia granulifera	Pigmy Purslane	PORTULACACEAE	4732		1	
Callistemon rugulosus	Scarlet Bottlebrush	MYRTACEAE	4886	4	5	
Callitris gracilis	Southern Cypress Pine	CUPRESSACEAE	3275	1	1	
Calotis hispidula	Hairy Burr-daisy	COMPOSITAE	3933	1	1	
Calytrix involucrata	Cup Fringe-myrtle	MYRTACEAE	3727	1	1	
Calytrix sp.	Fringe-myrtle	MYRTACEAE		1	1	
Calytrix tetragona	Common Fringe-myrtle	MYRTACEAE	4771, 4883	2	4	

SPECIES	COMMON NAME	FAMILY	VOUCHERS [10] (BS128-)	SU quadrats[11]		OP
				2004	2007	
Carex breviculmis	Short-stem Sedge	CYPERACEAE	3918	2		
Carpobrotus modestus	Inland Pigface	AIZOACEAE	4750		1	
Cassinia complanata	Sticky Cassinia	COMPOSITAE	4698		2	
Cassytha glabella f. *dispar*	Slender Dodder-laurel	LAURACEAE	4739	8	7	
Cassytha peninsularis var. *peninsularis*	Peninsula Dodder-laurel	LAURACEAE	3856	2	2	
Centrolepis aristata	Pointed Centrolepis	CENTROLEPIDACEAE	4633	3	4	
Centrolepis polygyna	Wiry Centrolepis	CENTROLEPIDACEAE	4634, 4723		3	
Centrolepis strigosa ssp. *strigosa*	Hairy Centrolepis	CENTROLEPIDACEAE	4635		5	
**Cerastium glomeratum*	Common Mouse-ear Chickweed	CARYOPHYLLACEAE	4786		1	
Chamaescilla corymbosa var. *corymbosa*	Blue Squill	LILIACEAE	4737	9	9	
Cheilanthes austrotenuifolia	Annual Rock-fern	ADIANTACEAE	4884		1	
Cheiranthera alternifolia	Hand-flower	PITTOSPORACEAE	4876	1	2	
Choretrum glomeratum var. *glomeratum*	White Sour-bush	SANTALACEAE	4816	3	3	
Chorizandra enodis	Black Bristle-rush	CYPERACEAE	4690	2	2	
Chrysocephalum apiculatum	Common Everlasting	COMPOSITAE	4799	1	1	
Chrysocephalum baxteri	White Everlasting	COMPOSITAE	4888			1
Clematis microphylla var. *microphylla*	Old Man's Beard	RANUNCULACEAE	4645, 4839	8	4	
Comesperma calymega	Blue-spike Milkwort	POLYGALACEAE	4652	1	4	
Comesperma volubile	Love Creeper	POLYGALACEAE	4738	1	3	
Conospermum patens	Slender Smoke-bush	PROTEACEAE	4861		1	
Convolvulus remotus	Grassy Bindweed	CONVOLVULACEAE	4653		1	
Correa backhouseana var. *coriacea*	Thick-leaf Correa	RUTACEAE	4773	4	6	
**Cotula coronopifolia*	Water Buttons	COMPOSITAE	4735		1	
Craspedia variabilis	Billy-buttons	COMPOSITAE	3754	2	1	
Crassula closiana	Stalked Crassula	CRASSULACEAE	4703	1	3	
Crassula colligata ssp. *colligata*		CRASSULACEAE	3829, 3935	3	2	
Crassula colorata var. *acuminata*	Dense Crassula	CRASSULACEAE	4807		1	
Crassula colorata var. *colorata*	Dense Crassula	CRASSULACEAE	4792		1	
Crassula decumbens var. *decumbens*	Spreading Crassula	CRASSULACEAE	4696	5	8	
Crassula sp.	Crassula/Stonecrop	CRASSULACEAE		1		
Crassula tetramera	Australian Stonecrop	CRASSULACEAE	4808		1	
Cryptandra tomentosa	Heath Cryptandra	RHAMNACEAE	3783	2		
Cyrtostylis robusta	Robust Gnat-orchid	ORCHIDACEAE	3838	1		
Dampiera rosmarinifolia	Rosemary Dampiera	GOODENIACEAE	4847, 4848	2	3	
Daucus glochidiatus	Native Carrot	UMBELLIFERAE	4647	6	6	
Daviesia asperula ssp. *asperula*	Kangaroo Island Bitter-pea	LEGUMINOSAE	3271	1	1	
Daviesia asperula ssp. *obliqua*	Eyre Peninsula Bitter-pea	LEGUMINOSAE	4689, 4797	5	7	
Daviesia brevifolia	Leafless Bitter-pea	LEGUMINOSAE	4666	2	7	
Daviesia pectinata	Zig-zag Bitter-pea	LEGUMINOSAE	3921	1	1	
Dianella brevicaulis	Short-stem Flax-lily	LILIACEAE	4837	1	1	
Dianella revoluta var. *revoluta*	Black-anther Flax-lily	LILIACEAE		8	10	
Dichondra repens	Kidney Weed	CONVOLVULACEAE			2	
Dillwynia hispida	Red Parrot-pea	LEGUMINOSAE	4637	1	2	
Diuris orientis	Wallflower Donkey-orchid	ORCHIDACEAE	3731	1	1	
Diuris pardina	Spotted Donkey-orchid	ORCHIDACEAE	4751	6	4	
Dodonaea baueri	Crinkled Hop-bush	SAPINDACEAE	4830, 4832	1	1	
Dodonaea hexandra	Horned Hop-bush	SAPINDACEAE	4827	3	3	

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Dodonaea tepperi	Streaked Hop-bush	SAPINDACEAE	4823, 4833 (+3853, 3854, 3855)	1	1	
Drosera glanduligera	Scarlet Sundew	DROSERACEAE		2	4	
Drosera macrantha ssp. *planchonii*	Climbing Sundew	DROSERACEAE	3748	10	10	
Drosera peltata	Pale Sundew	DROSERACEAE	4768	1	1	
Drosera sp. Rigid (R.J.Bates 2268)	Erect Sundew	DROSERACEAE	4868	1	2	
**Ehrharta calycina*	Perennial Veldt Grass	GRAMINEAE	4870		1	
**Ehrharta longiflora*	Annual Veldt Grass	GRAMINEAE	4710	2	6	
Einadia nutans ssp. *nutans*	Climbing Saltbush	CHENOPODIACEAE	4841	1		
Elymus scaber var. *scaber*	Native Wheat-grass	GRAMINEAE	3820	1		
Eremophila behriana	Rough Emubush	MYOPORACEAE	3821	1	2	
Eriochilus cucullatus	Parson's Bands	ORCHIDACEAE		4	1	
**Erodium moschatum*	Musky Herons-bill	GERANIACEAE	4780		1	
Eucalyptus angulosa	Coast Ridge-fruited Mallee	MYRTACEAE	4762	1	4	
Eucalyptus calycogona ssp. *calycogona*	Square-fruit Mallee	MYRTACEAE	3823	2	2	
Eucalyptus cladocalyx	Sugar Gum	MYRTACEAE	4650, 4818	7	9	
Eucalyptus diversifolia ssp. *diversifolia*	Coastal White Mallee	MYRTACEAE	4763	1	2	
Eucalyptus dumosa complex	White Mallee	MYRTACEAE	3847	1	1	
Eucalyptus leptophylla	Narrow-leaf Red Mallee	MYRTACEAE	4875			1
Eucalyptus odorata	Peppermint Box	MYRTACEAE	3822	4	4	
Eucalyptus odorata x *Eucalyptus* sp.	Hybrid	MYRTACEAE	3922, 4801	1	1	
Eucalyptus petiolaris	Eyre Peninsula Blue Gum	MYRTACEAE	3807, 3808, 3809	2	2	
**Euphorbia peplus*	Petty Spurge	EUPHORBIACEAE			1	
Eutaxia microphylla	Common Eutaxia	LEGUMINOSAE	4649	6	9	
Exocarpos aphyllus	Leafless Cherry	SANTALACEAE	4887	1		1
Exocarpos sparteus	Slender Cherry	SANTALACEAE	4632, 4688	2	7	
Gahnia ancistrophylla	Curled Saw-sedge	CYPERACEAE	3726	5	7	
Gahnia trifida	Cutting Grass	CYPERACEAE		1	1	
**Galium murale*	Small Bedstraw	RUBIACEAE		1		
Genoplesium sp.	Midge Orchid	ORCHIDACEAE		2		
Geranium potentilloides var. *potentilloides*	Downy Geranium	GERANIACEAE	3869	1		
Geranium retrorsum	Grassland Geranium	GERANIACEAE	4788	1	2	
Glischrocaryon behrii	Golden Pennants	HALORAGACEAE	4672	2	2	
Gompholobium ecostatum	Dwarf Wedge-pea	LEGUMINOSAE	4654		2	
Gonocarpus mezianus	Broad-leaf Raspwort	HALORAGACEAE	3717	11	12	
Goodenia blackiana	Native Primrose	GOODENIACEAE	4895	2	3	1
Goodenia ovata	Hop Goodenia	GOODENIACEAE	4817	1	1	
Goodenia robusta	Woolly Goodenia	GOODENIACEAE	4668	3	5	
Goodenia sp.	Goodenia	GOODENIACEAE		1		
Goodenia varia	Sticky Goodenia	GOODENIACEAE			1	
Goodia medicaginea	Western Golden-tip	LEGUMINOSAE	4873			1
Gramineae sp.	Grass Family	GRAMINEAE		1		
Grevillea aspera	Rough Grevillea	PROTEACEAE	4705	1	1	
Grevillea halmaturina ssp. *laevis*	Prickly Grevillea	PROTEACEAE	4734	1	3	
Grevillea ilicifolia complex	Holly-leaf Grevillea	PROTEACEAE	3861, 3903	3	4	
Grevillea ilicifolia ssp. *ilicifolia*	Holly-leaf Grevillea	PROTEACEAE	4849		1	
Gyrostemon australasicus	Buckbush Wheel-fruit	GYROSTEMONACEAE	4864		2	
Gyrostemon thesioides	Broom Wheel-fruit	GYROSTEMONACEAE	4894, 4898			2

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Haeckeria cassiniiformis	Dogwood Haeckeria	COMPOSITAE	4661, 4890			2
Hakea cycloptera	Elm-seed Hakea	PROTEACEAE	4844, 4855	8	11	
Hakea rugosa	Dwarf Hakea	PROTEACEAE	4686	3	5	
Halgania cyanea	Rough Blue-flower	BORAGINACEAE	4891, 4899		1	2
Helichrysum leucopsideum	Satin Everlasting	COMPOSITAE	4659	7	6	
Hibbertia cinerea	Port Lincoln Guinea-flower	DILLENIACEAE	4900			1
Hibbertia crinita		DILLENIACEAE	3815	1	1	
Hibbertia platyphylla ssp. *major*	Large Guinea-flower	DILLENIACEAE	4874		2	1
Hibbertia riparia	Bristly Guinea-flower	DILLENIACEAE			1	
Hibbertia sp.	Guinea-flower	DILLENIACEAE			1	
Hibbertia sp. Glabriuscula (D.J.Whibley 9012)	Smooth Guinea-flower	DILLENIACEAE	4708	7	10	
Hibbertia virgata	Twiggy Guinea-flower	DILLENIACEAE	4859			1
Homoranthus homoranthoides	Port Lincoln Ground-myrtle	MYRTACEAE	4707, 4882	5	5	
Homoranthus wilhelmii	Wilhelm's Homoranthus	MYRTACEAE	4755	2	2	
Hyalosperma demissum	Dwarf Sunray	COMPOSITAE	4675	1	3	
Hybanthus floribundus ssp. *floribundus*	Shrub Violet	VIOLACEAE	4642, 4709, 4759	1	6	
Hydrocotyle callicarpa	Tiny Pennywort	UMBELLIFERAE	4692	3	5	
Hydrocotyle foveolata	Yellow Pennywort	UMBELLIFERAE	4693		1	
Hydrocotyle pilifera var. *glabrata*	Buttercup Pennywort	UMBELLIFERAE	3909	1	1	
Hydrocotyle sp.	Pennywort	UMBELLIFERAE		2		
**Hypochaeris glabra*	Smooth Cat's Ear	COMPOSITAE		5	7	
**Hypochaeris radicata*	Rough Cat's Ear	COMPOSITAE		1	5	
Hypolaena fastigiata	Tassel Rope-rush	RESTIONACEAE	3306, 3744	3	5	
Hypoxis glabella var. *glabella*	Tiny Star	HYPOXIDACEAE	3840	3	1	
Hypoxis vaginata var. *vaginata*	Yellow Star	HYPOXIDACEAE	3800	2	2	
Isolepis marginata	Little Club-rush	CYPERACEAE	4629, 4682, 4722, 4782	2	5	
Ixodia achillaeoides ssp. *alata*	Hills Daisy	COMPOSITAE	4889			1
Juncus bufonius	Toad Rush	JUNCACEAE	4728		1	
**Juncus capitatus*	Dwarf Rush	JUNCACEAE	4697		1	
Kennedia prostrata	Scarlet Runner	LEGUMINOSAE	4639		6	
Lachnagrostis aemula	Blown-grass	GRAMINEAE	4810		1	
Lagenophora huegelii	Coarse Bottle-daisy	COMPOSITAE	3738	7	6	
Lasiopetalum baueri	Slender Velvet-bush	STERCULIACEAE	4834	2	2	
Lawrencia spicata	Salt Lawrencia	MALVACEAE			1	
Laxmannia orientalis	Dwarf Wire-lily	LILIACEAE	4753	1	4	
Lepidosperma canescens	Hoary Rapier-sedge	CYPERACEAE	4860	1		1
Lepidosperma carphoides	Black Rapier-sedge	CYPERACEAE	4716	3	7	
Lepidosperma concavum	Spreading Sword-sedge	CYPERACEAE	4760	1	2	
Lepidosperma viscidum	Sticky Sword-sedge	CYPERACEAE	4655, 4684	9	10	
Leporella fimbriata	Fringed Hare-orchid	ORCHIDACEAE	3750	2	2	
Leptorhynchos squamatus ssp. *squamatus*	Scaly Buttons	COMPOSITAE		1	1	
Leptospermum coriaceum	Dune Tea-tree	MYRTACEAE	4863	2	4	
Leucopogon clelandii	Cleland's Beard-heath	EPACRIDACEAE	4626		1	
Leucopogon rufus	Ruddy Beard-heath	EPACRIDACEAE	4757	1	2	
Levenhookia dubia	Hairy Stylewort	STYLIDIACEAE	4701	1	1	
Levenhookia stipitata	Common Stylewort	STYLIDIACEAE	4676		2	
Linum marginale	Native Flax	LINACEAE		4	2	
Lissanthe strigosa ssp. *subulata*	Peach Heath	EPACRIDACEAE	4667	11	13	

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Lobelia sp.	Lobelia	CAMPANULACEAE			2	
Logania ovata	Oval-leaf Logania	LOGANIACEAE	4880		1	
**Lolium rigidum*	Wimmera Ryegrass	GRAMINEAE	4731, 4814, 4838	1	3	
Lomandra collina	Sand Mat-rush	LILIACEAE	3755	2	6	
Lomandra effusa	Scented Mat-rush	LILIACEAE		1	1	
Lomandra juncea	Desert Mat-rush	LILIACEAE	4857	2	3	
Lomandra micrantha ssp. *micrantha*	Small-flower Mat-rush	LILIACEAE	4842	1	1	
Lomandra micrantha ssp. *tuberculata*	Small-flower Mat-rush	LILIACEAE	4878	3	4	
Lomandra sororia	Sword Mat-rush	LILIACEAE	4822	1	2	
**Lotus subbiflorus*	Hairy Bird's-foot Trefoil	LEGUMINOSAE	4785		1	
Luzula meridionalis	Common Wood-rush	JUNCACEAE	3740	1		
**Malva parviflora*	Small-flower Marshmallow	MALVACEAE	4781		1	
**Medicago polymorpha* var. *polymorpha*	Burr-medic	LEGUMINOSAE	4787	1	2	
**Medicago* sp.	Medic	LEGUMINOSAE			1	
Melaleuca brevifolia	Short-leaf Honey-myrtle	MYRTACEAE	4745	2	2	
Melaleuca decussata	Totem-poles	MYRTACEAE	4699, 4744	4	7	
Melaleuca uncinata	Broombush	MYRTACEAE	4704, 4779	8	14	
**Melilotus indicus*	King Island Melilot	LEGUMINOSAE	4660		1	
Microseris lanceolata	Yam Daisy	COMPOSITAE	4725	2	2	
Microtis frutetorum		ORCHIDACEAE	4766		1	
Microtis sp.	Onion-orchid	ORCHIDACEAE		6	4	
Millotia muelleri	Common Bow-flower	COMPOSITAE	3929	1	1	
Millotia tenuifolia var. *tenuifolia*	Soft Millotia	COMPOSITAE	3928	2	2	
**Moenchia erecta*	Erect Chickweed	CARYOPHYLLACEAE	4783		1	
**Moraea setifolia*	Thread Iris	IRIDACEAE	4795		1	
Muehlenbeckia adpressa	Climbing Lignum	POLYGONACEAE	4679		5	
Neurachne alopecuroidea	Fox-tail Mulga-grass	GRAMINEAE	4715	6	11	
Olearia floribunda var. *floribunda*	Heath Daisy-bush	COMPOSITAE	4831	1	1	
Olearia ramulosa	Twiggy Daisy-bush	COMPOSITAE	4673, 4821	1	8	
Opercularia scabrida	Stalked Stinkweed	RUBIACEAE	4881	8	10	
Oxalis perennans	Native Sorrel	OXALIDACEAE	3805	8	7	
**Oxalis pes-caprae*	Soursob	OXALIDACEAE	4790	1	2	
Ozothamnus retusus	Notched Bush-everlasting	COMPOSITAE	4824	1	1	
**Parapholis incurva*	Curly Ryegrass	GRAMINEAE	4733		1	
**Parentucellia latifolia*	Red Bartsia	SCROPHULARIACEAE	3921	1		
Pelargonium littorale	Native Pelargonium	GERANIACEAE	4700		1	
Pelargonium sp.	Storks-bill	GERANIACEAE			1	
Pheladenia deformis	Bluebeard Orchid	ORCHIDACEAE		1		
Philotheca angustifolia ssp. *angustifolia*	Narrow-leaf Wax-flower	RUTACEAE	3923	1	1	
Phyllangium divergens	Wiry Mitrewort	LOGANIACEAE	4691, 4712, 4791, 4825	1	6	
Phylloglossum drummondii	Pigmy Clubmoss	LYCOPODIACEAE	4776		1	
Pimelea flava ssp. *dichotoma*	Diosma Riceflower	THYMELAEACEAE	4671, 4770	6	10	
Pimelea glauca	Smooth Riceflower	THYMELAEACEAE	4892	1	1	1
Pimelea octophylla	Woolly Riceflower	THYMELAEACEAE	4628, 4865	1	3	
**Plantago coronopus* ssp. *coronopus*	Bucks-horn Plantain	PLANTAGINACEAE	4727		1	
Plantago gaudichaudii	Narrow-leaf Plantain	PLANTAGINACEAE	3863	1	1	
Plantago hispida	Hairy Plantain	PLANTAGINACEAE	3917	1	1	
Plantago sp.	Plantain	PLANTAGINACEAE		1	2	

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Plantago sp. B (R.Bates 44765)	Little Plantain	PLANTAGINACEAE	4656, 4836		2	
Plantago varia	Variable Plantain	PLANTAGINACEAE	3828	1	1	
Platysace heterophylla var. *heterophylla*	Slender Platysace	UMBELLIFERAE	3297	1		
Poa poiformis var. *poiformis*	Coast Tussock-grass	GRAMINEAE	4741		1	
Pogonolepis muelleriana	Stiff Cup-flower	COMPOSITAE		1		
**Polypogon monspeliensis*	Annual Beard-grass	GRAMINEAE	4901		1	
Pomaderris flabellaris	Fan Pomaderris	RHAMNACEAE	3846	1	2	
Pomaderris paniculosa ssp. *paniculosa*	Mallee Pomaderris	RHAMNACEAE			1	
Poranthera leiosperma	Small Poranthera	EUPHORBIACEAE	4651		1	
Poranthera microphylla	Small Poranthera	EUPHORBIACEAE	4687	1	3	
Poranthera sp.	Poranthera	EUPHORBIACEAE			1	
Prasophyllum fecundum	Self-pollinating Leek-orchid	ORCHIDACEAE	4765	2	1	
Prasophyllum fitzgeraldii	Fitzgerald's Leek-orchid	ORCHIDACEAE	3284	1		
Prostanthera spinosa	Spiny Mintbush	LABIATAE	4774		2	
Pterostylis nana	Dwarf Greenhood	ORCHIDACEAE	3767, 3818, 3862	4	1	
Pterostylis plumosa	Bearded Greenhood	ORCHIDACEAE	3795	3	1	
Pterostylis sanguinea	Blood Greenhood	ORCHIDACEAE	3286, 3300, 3752	3	1	
Pterostylis sp.	Greenhood	ORCHIDACEAE		2	2	
Ptilotus beckerianus	Ironstone Mulla Mulla	AMARANTHACEAE	4713, 4871	2	2	1
Pultenaea acerosa	Bristly Bush-pea	LEGUMINOSAE	4850	1	2	
Pultenaea pedunculata	Matted Bush-pea	LEGUMINOSAE	3794, 3895	3	3	
Pultenaea tenuifolia	Narrow-leaf Bush-pea	LEGUMINOSAE	4764, 4851	1	4	
Pultenaea teretifolia var. *teretifolia*	Terete-leaf Bush-pea	LEGUMINOSAE	4772		1	
Pultenaea trinervis	Three-nerve Bush-pea	LEGUMINOSAE	4896	2	4	1
Pyrorchis nigricans	Black Fire-orchid	ORCHIDACEAE	3276, 3723	3	3	
Ranunculus sessiliflorus var. *sessiliflorus*	Annual Buttercup	RANUNCULACEAE	3816	1		
Rhagodia candolleana ssp. *candolleana*	Sea-berry Saltbush	CHENOPODIACEAE		1	1	
Rhodanthe laevis	Smooth Daisy	COMPOSITAE	3833	4	3	
**Romulea rosea* var. *australis*	Common Onion-grass	IRIDACEAE	3920	1		
**Romulea* sp.	Onion-grass	IRIDACEAE		1		
Sarcocornia quinqueflora	Beaded Samphire	CHENOPODIACEAE	3318	1	1	
Scaevola linearis ssp. *linearis*	Rough Fanflower	GOODENIACEAE	4665, 4897	1	6	1
Schoenus apogon	Common Bog-rush	CYPERACEAE	4694	2	4	
Schoenus breviculmis	Matted Bog-rush	CYPERACEAE	4866	6	7	
Schoenus nanus	Little Bog-rush	CYPERACEAE	4677		6	
Schoenus racemosus	Sandhill Bog-rush	CYPERACEAE	4858	1	2	
Schoenus sculptus	Gimlet Bog-rush	CYPERACEAE	4702, 4724		2	
Senecio picridioides	Purple-leaf Groundsel	COMPOSITAE	4819	2	2	
**Senecio pterophorus*	African Daisy	COMPOSITAE	3773	5	10	
Siloxerus multiflorus	Small Wrinklewort	COMPOSITAE	4777	2	1	
**Sonchus asper* ssp.	Rough Sow-thistle	COMPOSITAE		1	1	
**Sonchus oleraceus*	Common Sow-thistle	COMPOSITAE		2	5	
**Sparaxis bulbifera*	Sparaxis	IRIDACEAE	4726	1	1	
Spergularia marina	Salt Sand-spurrey	CARYOPHYLLACEAE	4729, 4740		2	
Sphaerolobium minus	Leafless Globe-pea	LEGUMINOSAE	4846		1	
Spyridium nitidum	Shining Spyridium	RHAMNACEAE	4756		2	
Spyridium phylicoides	Narrow-leaf Spyridium	RHAMNACEAE	4845		1	
Spyridium vexilliferum	Winged Spyridium	RHAMNACEAE	4769	1	2	

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var. *vexilliferum*						
Stackhousia aspericocca ssp. One-sided inflorescence (W.R.Barker 697)	One-sided Candles	STACKHOUSIACEAE	4641, 4663, 4856		5	
Stackhousia monogyna	Creamy Candles	STACKHOUSIACEAE	4798	3		
**Stellaria media*	Chickweed	CARYOPHYLLACEAE		1		
Stenanthemum leucophractum	White Cryptandra	RHAMNACEAE	4664	4	7	
Stuartina muelleri	Spoon Cudweed	COMPOSITAE	3938	1		
Thelymitra antennifera	Lemon Sun-orchid	ORCHIDACEAE	3934	1		
Thelymitra chasmogama	Globe-hood Sun-orchid	ORCHIDACEAE	4748	1	1	
Thelymitra flexuosa	Twisted Sun-orchid	ORCHIDACEAE	3273, 3316	2	2	
Thelymitra luteocilium	Yellow-tuft Sun Orchid	ORCHIDACEAE	3919	2	1	
Thelymitra megcalyptra	Scented Sun-orchid	ORCHIDACEAE	4749	2	2	
Thelymitra nuda	Scented Sun-orchid	ORCHIDACEAE			1	
Thelymitra rubra	Salmon Sun-orchid	ORCHIDACEAE		3	1	
Thelymitra sp.	Sun-orchid	ORCHIDACEAE		4	4	
Thelymitra rubra	Salmon Sun-orchid	ORCHIDACEAE		1		
Thysanotus baueri	Mallee Fringe-lily	LILIACEAE		1		
Thysanotus patersonii	Twining Fringe-lily	LILIACEAE	3734	12	13	
Trachymene cyanopetala	Purple Trachymene	UMBELLIFERAE	4658		2	
Trachymene ornata	Cotton-ball Trachymene	UMBELLIFERAE	3906	1		
Trachymene pilosa	Dwarf Trachymene	UMBELLIFERAE	4648	1	3	
Tricoryne tenella	Tufted Yellow Rush-lily	LILIACEAE	4662		4	
**Trifolium angustifolium*	Narrow-leaf Clover	LEGUMINOSAE		1	1	
**Trifolium arvense* var. *arvense*	Hare's-foot Clover	LEGUMINOSAE	4789		3	
**Trifolium campestre*	Hop Clover	LEGUMINOSAE	4683	1	4	
**Trifolium dubium*	Suckling Clover	LEGUMINOSAE			1	
**Trifolium fragiferum* var. *fragiferum*	Strawberry Clover	LEGUMINOSAE	4778		1	
**Trifolium subterraneum*	Subterranean Clover	LEGUMINOSAE	4746	1	3	
Triglochin minutissimum	Tiny Arrowgrass	JUNCAGINACEAE	4720		1	
Triglochin mucronatum	Prickly Arrowgrass	JUNCAGINACEAE	4717		1	
Triglochin nanum	Dwarf Arrowgrass	JUNCAGINACEAE	4721		1	
Triodia irritans	Spinifex	GRAMINEAE	4869	2	2	
Utricularia tenella	Pink Bladderwort	LENTIBULARIACEAE	3317	1		
**Vicia cracca*	Tufted Vetch	LEGUMINOSAE	4809		1	
Vittadinia australasica var. *australasica*	Sticky New Holland Daisy	COMPOSITAE	4820	1	3	
Vittadinia cuneata var. *cuneata* f. *cuneata*	Fuzzy New Holland Daisy	COMPOSITAE		1	1	
**Vulpia bromoides*	Squirrel-tail Fescue	GRAMINEAE	4784, 4813, 4828B	1	3	
**Vulpia muralis*	Wall Fescue	GRAMINEAE	4630A		1	
**Vulpia myuros* f. *myuros*	Rat's-tail Fescue	GRAMINEAE	4630B, 4680, 4811, 4828A		4	
**Vulpia* sp.	Fescue	GRAMINEAE		2	4	
Wahlenbergia gracilenta	Annual Bluebell	CAMPANULACEAE	4646	3	4	
Wahlenbergia sp.	Native Bluebell	CAMPANULACEAE		3	4	
Wahlenbergia stricta ssp. *stricta*	Tall Bluebell	CAMPANULACEAE		4	5	
**Watsonia* sp.	Watsonia	IRIDACEAE		1		
Wurmbea decumbens	Trailing Nancy	LILIACEAE	4815		2	
Wurmbea dioica ssp.	Early Nancy	LILIACEAE			1	
Wurmbea dioica ssp. *dioica*	Early Nancy	LILIACEAE	3908	1	1	
Wurmbea sp.	Nancy	LILIACEAE			5	

SPECIES	COMMON NAME	FAMILY	VOUCHERS [10] (BS128-)	SU quadrats[11]		OP
				2004	2007	
Xanthorrhoea semiplana ssp. [12]	Yacca	LILIACEAE		8	12	
Xanthosia huegelii	Hairy Xanthosia	UMBELLIFERAE	4625		2	
Xanthosia leiophylla	Cut-leaf Xanthosia	UMBELLIFERAE	4854		1	
**Zaluzianskya divaricata*	Spreading Night-phlox	SCROPHULARIACEAE	4711	2	4	

[12] some records were identified as *Xanthorrhoea semiplana* ssp. *tateana*, but the separation of ssp. tateana and ssp. *semiplana* is unclear.

Appendix 2: Regeneration records for plant species in quadrats.

KEY:

LS: **Life span: A** = annual/biennial**; P** = perennial**; R** = renascent perennial (regrowing annually above the ground**)**

LF: **Life form (modified Muir Codes):** see Table 18 for definitions.

C/A: **Cover/abundance score:**

Regen. mode: Regeneration: R = by regrowth; **S** = from seed; **U** = undetermined; **R?**= probably by regrowth; **S?** = probably by seed

SPECIES	LS	SITEID	burnt	LF	C/A	Regen. mode			Regeneration comments [13]
						R	S	U	
Acacia continua	P	WAN00201	Y	SD	N	R	S		Dead charred stem protruding.
Acacia euthycarpa	P	MUR00301	Y	SB	2		S		
Acacia farinosa	P	KOP00701	Y	SD	N		S		
Acacia gillii	P	KOP00201	Y	SA	2		S		Dense patches, 1.0 to 2.0 m tall.
"		KOP00301	Y	SC	T		S		
"		KOP00401	Y	SA	1		S		
"		MUR00301	Y	SC	T		S		
"		ULE01001	Y	SB	N		S		
"		WAN00101	Y	SB	T		S		
"		KOP00901		SB	N				
Acacia imbricata	P	KOP00401	Y	SB	2		S		Seedlings up to 1.2 m.
"		KOP00701	Y	SB	2		S		Seedlings 20 cm to 1.5 m tall.
"		KOP00801		SC	T				Seedlings approx. 20 cm.
"		KOP00901		SB	1				Seedlings approx. 10 cm.
"		KOP01001		SB	3				Seedlings approx. 20 cm+.
"		KOP01101		SC	2				Seedlings common 5 cm to 0.5 m.
**Acacia mearnsii*	P	KOP00401	Y	SB	N		S		Seedlings up to 1.5 m.
"		KOP00501	Y	SC	N		S		One seedling 40 cm tall.
Acacia myrtifolia	P	KOP00201	Y	SC	3		S		
"		MUR00201	Y	SB	3		S		Seedlings from 100 mm.
"		ULE01101	Y	SB	2		S		Abundant seedlings in dense patches, 5 cm to 1.5 m tall, most vegetative, some in flower.
Acacia paradoxa	P	KOP00701	Y	SC	N		S		
"		KOP01001		SB	2				Seedling approx. 20 cm.
Acacia pycnantha	P	KOP00201	Y	SD	N		S		
"		KOP00401	Y	SA	2		S		
"		KOP00501	Y	SB	2		S		Seedlings from 5 cm- 1.5 m.
"		KOP00601	Y	SC	4		S		All killed, dense seedlings from 5 cm to 1.2 m.
"		KOP00701	Y	SB	3		S		All killed, seedlings abundant, from 5 cm to 1.75 m tall.
"		MUR00301	Y	SD	1		S		Seedlings approx. 40 cm, all adults killed, not as many seedlings as other areas.
"		KOP00801		SC	N				
"		KOP00901		LB	N				
Acacia rupicola	P	KOP00201	Y	SC	3		S		
"		KOP00301	Y	SC	T		S		
"		KOP00401	Y	SC	N		S		
"		KOP00701	Y	SC	T		S		Seedlings up to approx. 1 m high down to approx. 30 cm.
"		WAN00101	Y	SC	1		S		
"		WAN00201	Y	SC	3		S		30 cm to 1.25 m tall seedlings, dense.
"		KOP00801		SC	1		S		Seedlings approx. 20 cm.
"		KOP00901		SC	1		S		Seedlings 5 cm.
"		KOP01101		SC	T		S		Seedlings approx. 10-20 cm.
Acacia sclerophylla var. *sclerophylla*	P	ULE01001	Y	SD	T		S		Seedling 35 cm.
Acacia spinescens	P	KOP00201	Y	SD	T	R	S		Plant with basal regrowth dug up. 45 cm high.

[13] Unless otherwise indicated, dimensions given refer to plant heights**.**

SPECIES	LS	SITEID	burnt	LF	C/A	Regen. mode			Regeneration comments [13]
						R	S	U	
"		KOP00601	Y	SD	T		S		
"		MUR00101	Y	SD	T	R	S		Burnt bases, regen to 50 cm, seedlings 20-30 cm.
"		MUR00201	Y	SD	N	R			Charred stems.
"		MUR00301	Y	SD	2	R	S		
"		ULE01001	Y	SC	1		S		Seedling with long tap root and pinnate juvenile foliage.
"		ULE01101	Y	SD	1	R	S		Charred stems at base of larger shrubs.
"		ULE01201	Y	SD	1		S		
"		KOP00901		SD	N				
"		KOP01001		SC	N				
"		KOP01101		SC	T				
Acaena echinata	P	KOP00501	Y	FP	N		S		
Acrotriche cordata	P	KOP00501	Y	SD	N	R			Single plant-charred stems.
"		WAN00101	Y	SD	N	R			Burnt-off basal stems.
"		KOP00901		SC	N				
Actinobole uliginosum	A	KOP01101		FA	N				
Adenanthos terminalis	P	KOP00201	Y	SD	N		S		Seedlings 3-10 cm.
"		MUR00101	Y	SD	T	R	S		Burnt base with regrowth (50 cm), one observed, seedlings c. 30 cm.
"		MUR00201	Y	SD	1	R	S		Burnt stems, abundant seedlings approx. 20 cm.
"		MUR00301	Y	SD	1		S		Seedlings 10-20 cm.
"		ULE01101	Y	SD	2		S		Seedlings 20-50 cm.
"		WAN00101	Y	SC	N	R			
Aira cupaniana	A	KOP00301	Y	GA	N		S		
"		KOP00401	Y	GA	N		S		
"		KOP00501	Y	GA	T		S		
"		KOP00701	Y	GA	T		S		
"		ULE01201	Y	GA	T		S		
"		KOP00901		GA	T				
"		KOP01101		GA	T				
Aira sp.	A	KOP00601	Y	GA	T		S		
Allocasuarina muelleriana ssp. *muelleriana*	P	KOP00501	Y	SC	T	R	S		Old charred stems and fruits remaining. Seedling 20 cm. Seedlings over 2 m tall killed - no basal regeneration.
"		MUR00101	Y	SD	N	R			Burnt stems.
"		ULE01101	Y	SC	N	R			Charred stems at base.
Allocasuarina verticillata	P	KOP00401	Y	SB	T		S		.
"		KOP00701	Y	SA	T		S		Seedling from approx. 60 cm to approx. 1.7 m.
"		MUR00301	Y	LB	2	R	S		Multiple stems regenerating from base of burnt trunks, seedlings rare approx. 1.2 m.
"		WAN00201	Y	SA	T	R			Trees c. 5 m tall, mostly dead, only occasional tree with basal regrowth, only 7 observed in quadrat. No seedlings.
"		KOP00901		SB	N				
"		KOP01101		LB	T		S		Seedlings approx. 50-100 cm.
Alyogyne huegelii	P	KOP00401	Y	SB	N		S		
Anagallis arvensis	A	KOP00201	Y	FA	1		S		
"		KOP00401	Y	FA	N		S		
"		KOP00701	Y	FA	T		S		
"		ULE01001	Y	FA	T		S		
"		ULE01201	Y	FA	N		S		
"		KOP00801		FA	N				
"		KOP00901		FA	T				
"		KOP01001		FA	T				
"		KOP01101		FA	N				
Angianthus preissianus	A	ULE01001	Y	FA	1		S		

SPECIES	LS	SITEID	burnt	LF	C/A	Regen. mode			Regeneration comments [13]
						R	S	U	
Apalochlamys spectabilis	A	WAN00201	Y	SB	1		S		
Apium annuum	A	ULE01001	Y	FA	N		S		
Apodasmia brownii	P	KOP00201	Y	CP	N	R?			
Arctotheca calendula	A	KOP00201	Y	FA	T		S		
"		KOP00301	Y	FA	N		S		Growing from kangaroo dung.
"		KOP00401	Y	FA	T		S		
"		KOP00501	Y	FA	N		S		
"		KOP00601	Y	FA	T		S		
"		KOP00701	Y	FA	T		S		
"		ULE01001	Y	FA	T		S		
"		ULE01201	Y	FA	T		S		
"		KOP01001		FA	N				
"		KOP01101		FA	N				
Argentipallium obtusifolium	P	KOP00201	Y	FP	N		S		
		ULE01101	Y	FP	N		S		
Asparagus asparagoides f. *asparagoides*	R	KOP00201	Y	V	N			U	
"		KOP00401	Y	V	1			U	
"		KOP00701	Y	V	T			U	
"		ULE01201	Y	V	N	R?		U	Original charred dead stems observed.
"		KOP00801		V	T				
"		KOP00901		V	N				
"		KOP01001		V	1				
"		KOP01101		V	N				
Asperula conferta	P	KOP01001		FP	N				
Astroloma conostephioides	P	KOP00301	Y	SD	T		S		
"		KOP00501	Y	SD	N		S		Single stem 5 cm.
"		KOP00701	Y	SD	N		S		Seedling approx. 10 cm.
"		MUR00201	Y	SD	N		S		Seedlings approx. 5 cm.
"		MUR00301	Y	SD	T		S		Seedlings approx. 10 cm.
"		ULE01101	Y	SD	N		S		Seedlings approx. 10 cm high.
"		ULE01201	Y	SD	1		S		
"		WAN00101	Y	SD	T		S		
"		WAN00201	Y	SD	N		S		
"		KOP00901		SD	N				
"		KOP01101		SC	T				
Astroloma humifusum	P	KOP00301	Y	SD	T		S		
"		KOP00501	Y	SD	T		S		
"		MUR00101	Y	SD	N	R			Burnt bases.
"		ULE01101	Y	SD	N		S		
"		WAN00201	Y	SD	T		S		Seedlings 3-4 cm tall.
"		KOP01101		SD	N				
Austrodanthonia fulva	P	KOP00801		GP	T				
Austrodanthonia setacea	P	KOP00701	Y	GP	2			U	
"		KOP00901		GP	N				
Austrodanthonia sp.	P	KOP00201	Y	GP	T		S		
"		KOP00501	Y	GP	N		S		
"		KOP00601	Y	GP	T		S?		
"		KOP01101		GP	T				
Austrostipa acrociliata	P	ULE01201	Y	GP	1			U	
Austrostipa elegantissima	P	KOP00801		GP	T				
"		KOP00901		GP	T				
"		KOP01001		GP	1				
"		KOP01101		GP	1				

SPECIES	LS	SITEID	burnt	LF	C/A	Regen. mode			Regeneration comments [13]
						R	S	U	
Austrostipa flavescens	P	KOP00701	Y	GP	T			U	
Austrostipa mollis	P	KOP00201	Y	GP	1		S		
"		KOP00501	Y	GP	T		S		
"		ULE01001	Y	GP	T		S		
"		ULE01101	Y	GP	1		S		
"		ULE01201	Y	GP	1			U	
Austrostipa mollis group	P	MUR00101	Y	GP	T		S		
Austrostipa mundula	P	ULE01201	Y	GP	1			U	
Austrostipa nitida	P	KOP00701	Y	GP	T			U	
Austrostipa scabra ssp.	P	MUR00101	Y	GP	1		S?		
Austrostipa scabra ssp. *falcata*	P	KOP01001		GP	N				
"		KOP01101		GP	2				
Austrostipa sp.	P	KOP00301	Y	GP	T		S		
"		KOP00401	Y	GP	N		S		
"		KOP00601	Y	GP	N		S		
"		KOP00901		GP	T				
"		KOP01001		GP	1				
Avellinia michelii	A	KOP00201	Y	GA	T		S		
"		KOP00401	Y	GA	N		S		
"		KOP00501	Y	GA	T		S		
"		KOP00601	Y	GA	T		S		
"		ULE01001	Y	GA	N		S		
"		ULE01201	Y	GA	T		S		
"		KOP01001		GA	T				
"		KOP01101		GA	T				
Avena barbata	A	KOP00701	Y	GA	N		S		
"		ULE01001	Y	GA	N		S		
"		KOP01001		GA	N				
Avena sp.	A	KOP01101		GA	N				
Babingtonia behrii	P	KOP00201	Y	SC	N	R			
"		KOP00301	Y	SC	2	R			Charred base, stems burnt off.
"		KOP00501	Y	SC	2	R			Old charred stems remaining.
"		KOP00601	Y	SD	N		S		.
"		MUR00101	Y	SB	2	R			Burnt bases.
"		MUR00301	Y	SC	2	R			
"		ULE01101	Y	SC	N	R			Burnt stems and bases observed.
"		ULE01201	Y	SC	2	R			Dead stems observed.
"		WAN00101	Y	SD	2	R			Tall burnt stems.
"		WAN00201	Y	SD	2	R	S		Burnt stem bases; seedlings 75 cm tall.
Baeckea crassifolia	P	MUR00201	Y	SD	1		S		Seedlings.
"		ULE01101	Y	SD	1		S		
Banksia marginata	P	MUR00101	Y	SC	T	R			Burnt trunks, stems, suckering 30-60 cm, burnt cones with high fruit set.
Banksia ornata	P	MUR00201	Y	SD	N	R	S		Dead parent plant, moderate fruit set on cones, nearly all regeneration seedlings approx. 20 cm. Rare basal resprouting plant observed.
Baumea juncea	P	ULE01001	Y	CP	T	R			Excavated rhizome and deep root system.
Billardiera sericophora	P	KOP01001		V	N				
"		KOP01101		V	N				
Billardiera sp.	P	KOP00201	Y	V	N		S		
"		KOP00401	Y	V	N		S		
"		KOP00501	Y	V	N			U	
"		KOP00701	Y	V	N	R?			
Blennospora drummondii	A	KOP00601	Y	FA	T		S		

SPECIES	LS	SITEID	burnt	LF	C/A	Regen. mode			Regeneration comments [13]
						R	**S**	**U**	
"		ULE01201	Y	FA	T		S		
"		KOP00901		FA	T				
"		KOP01001		FA	T				
"		KOP01101		FA	T				
Boronia coerulescens ssp. *coerulescens*	P	KOP00501	Y	SD	N		S?		
"		MUR00101	Y	SD	N	R			Burnt base.
"		ULE01201	Y	SD	T	R			
Boronia filifolia	P	MUR00101	Y	SD	N		S		
"		ULE01101	Y	SD	N		S		
Brachyscome perpusilla	A	ULE01201	Y	FA	N		S		
"		KOP01101		FA	N				
Briza maxima	A	KOP00201	Y	GA	N		S		
"		ULE01201	Y	GA	T		S		
"		KOP01101		GA	N				
Briza minor	A	KOP00201	Y	GA	N		S		
"		KOP00401	Y	GA	N		S		
"		KOP00501	Y	GA	N		S		
"		KOP00601	Y	GA	N		S		
"		KOP00701	Y	GA	N		S		
"		ULE01001	Y	GA	T		S		
"		ULE01201	Y	GA	N		S		
"		KOP00901		GA	T				
"		KOP01001		GA	N				
"		KOP01101		GA	N				
Bromus diandrus	A	KOP01001		GA	N				
Bromus madritensis	A	KOP00701	Y	GA	N		S		
"		KOP01001		GA	N				
Burchardia umbellata	R	KOP00201	Y	TB	N			U	
"		KOP00301	Y	TB	1			U	
"		KOP00401	Y	TB	N			U	
"		KOP00601	Y	TB	N			U	
"		MUR00101	Y	TB	1			U	
"		MUR00301	Y	TB	1			U	
"		ULE01001	Y	TB	1			U	
"		ULE01201	Y	TB	T			U	
"		WAN00101	Y	TB	T			U	
Bursaria spinosa ssp. *spinosa*	P	KOP00401	Y	SC	N		S		
"	P	KOP00801		SA	T				Seedling approx. 10 cm.
"		KOP00901		SA	1				Seedlings 5-30 cm.
"		KOP01001		SA	2				
"		KOP01101		SA	2				Seedlings 5 cm and 10 cm tall.
Caladenia latifolia	R	KOP00201	Y	TB	N			U	
Caladenia pusilla	R	KOP00301	Y	TB	N			U	
Caladenia septuosa	R	KOP00601	Y	TB	N			U	
"		ULE01101	Y	TB	N			U	
"		ULE01201	Y	TB	N			U	
"		KOP01101		TB	N				
Calandrinia calyptrata	A	KOP01101		FA	T				
Calandrinia granulifera	A	ULE01001	Y	FA	T		S		.
Callistemon rugulosus	P	KOP00401	Y	SB	1	R	S		Dead stems remaining, seedlings 20-30 cm.
"		KOP00601	Y	SC	N	R			Burnt base observed.
"		KOP00701	Y	SC	1	R	S		Burnt bases, seedlings approx. 25 cm.

SPECIES	LS	SITEID	burnt	LF	C/A	Regen. mode			Regeneration comments [13]
						R	**S**	**U**	
"		WAN00201	Y	SC	2	R	S		Projecting blackened stems 2.2 m tall and seedlings 10-25 cm tall.
"		KOP01001		SC	1				Seedlings approx. 15 cm.
Callitris gracilis	P	ULE01201	Y	LB	0				Dead. No regen observed.
Calotis hispidula	A	KOP01101		FA	N				
Calytrix involucrata	P	KOP00201	Y	SD	N	R			Resprouting from base - charred stem bases observed.
Calytrix sp.	P	KOP00501	Y	SD	N	R			
Calytrix tetragona	P	KOP00301	Y	SD	N	R			Burnt bases.
"		MUR00201	Y	SD	T	R			
"		MUR00301	Y	SD	T		S		Seedlings approx. 20 cm.
"		WAN00101	Y	SD	1	R			Burnt base.
Carpobrotus modestus	P	ULE01001	Y	V	N			U	
Cassinia complanata	P	KOP00501	Y	SC	N		S		
"		KOP00601	Y	SD	N		S		
Cassytha glabella f. *dispar*	P	KOP00301	Y	V	T			U	
"		KOP00501	Y	V	1			U	
"		ULE01001	Y	V	T			U	
"		ULE01101	Y	V	N			U	
"		ULE01201	Y	V	N			U	
"		KOP00801		V	N				
"		KOP00901		V	T				
Cassytha peninsularis var. *peninsularis*	P	ULE01001	Y	V	T			U	
"		KOP01001		V	1				
Centrolepis aristata	A	KOP00201	Y	CA	T		S		
"		KOP00301	Y	CA	N		S		
"		KOP00601	Y	CA	T		S		
"		ULE01201	Y	CA	N		S		
Centrolepis polygyna	A	KOP00201	Y	CA	T		S		
"		KOP00601	Y	CA	N		S		
"		ULE01001	Y	CA	1		S		
Centrolepis strigosa ssp. *strigosa*	A	KOP00201	Y	CA	1		S		
"		KOP00301	Y	CA	T		S		
"		KOP00601	Y	CA	1		S		
"		ULE01001	Y	CA	T		S		
"		ULE01201	Y	CA	T		S		
Cerastium glomeratum	A	KOP00401	Y	FA	N		S		
Chamaescilla corymbosa var. *corymbosa*	R	KOP00201	Y	TB	1			U	1.0 - 1.2 m tall. Heavy fruit set on most.
"		KOP00301	Y	TB	T			U	
"		KOP00501	Y	TB	T			U	
"		KOP00601	Y	TB	1			U	
"		ULE01001	Y	TB	T			U	
"		ULE01201	Y	TB	T			U	
"		KOP00801		TB	N				
"		KOP01001		TB	N				
"		KOP01101		TB	T				
Cheilanthes austrotenuifolia	P	WAN00201	Y	X	T	R?			
Cheiranthera alternifolia	P	WAN00101	Y	SD	T	R			Burnt-off basal stem.
"		KOP00901		SD	T				
Choretrum glomeratum var. *glomeratum*	P	KOP00801		SB	N				
"		KOP00901		SB	1				Seedling 30 cm.
"		KOP01001		SA	1				

SPECIES	LS	SITEID	burnt	LF	C/A	Regen. mode			Regeneration comments [13]
						R	S	U	
Chorizandra enodis	P	KOP00401	Y	CP	2			U	
"		KOP00601	Y	CP	N	R			Truncated burnt bases - browsed.
Chrysocephalum apiculatum	P	KOP01101		FP	T				
Clematis microphylla var. *microphylla*	P	KOP00201	Y	V	N		S?		Rhizomatous base excavated with last year's growth but no evidence of prefire growth.
"		KOP00701	Y	V	N			U	
"		KOP00801		V	T				
"		KOP01001		V	1				
Comesperma calymega	P	KOP00201	Y	FP	N		S		
"		KOP00301	Y	FP	T		S		
"		ULE01101	Y	FP	N		S		
"		ULE01201	Y	FP	N		S		
Comesperma volubile	P	KOP00401	Y	V	N			U	
"		ULE01001	Y	V	T			U	
"		KOP00901		V	T				
Conospermum patens	P	MUR00201	Y	SD	N		S		
Convolvulus remotus	P	KOP00201	Y	V	N		S		
Correa backhouseana var. *coriacea*	P	KOP00201	Y	SD	T	R	S		Seedlings under 5 cm, some rhizome regen.
"		KOP00301	Y	SD	N	R			Charred stems.
"		WAN00101	Y	SD	T	R			Burnt base.
"		KOP00801		SD	N				
"		KOP00901		SD	T				Seedling approx. 5 cm.
"		KOP01101		SD	N				Seedling approx. 10 cm.
Cotula coronopifolia	P	ULE01001	Y	FA	1		S		
Craspedia variabilis	P	KOP00201	Y	FP	N		S		
Crassula closiana	A	KOP00501	Y	FA	T		S		
"		KOP00601	Y	FA	N		S		
"		KOP01101		FA	N				
Crassula colligata ssp. *colligata*	A	KOP00801		FA	N				
"		KOP01101		FA	N				
Crassula colorata var. *acuminata*	A	KOP00701	Y	FA	T		S		
Crassula colorata var. *colorata*	A	KOP01101		FA	T				
Crassula decumbens var. *decumbens*	A	KOP00201	Y	FA	N		S		
"		KOP00401	Y	FA	T		S		
"		KOP00501	Y	FA	T		S		
"		KOP00601	Y	FA	T		S		
"		KOP00701	Y	FA	T		S		
"		ULE01001	Y	FA	T		S		
"		ULE01201	Y	FA	N		S		
"		KOP00801		FA	N				
Crassula tetramera	A	KOP00701	Y	FA	T		S		
Dampiera rosmarinifolia	P	MUR00101	Y	FP	T	R			Burnt bases visible on specimen
"		KOP00901		FP	T				
"		KOP01101		FP	T				
Daucus glochidiatus	A	KOP00201	Y	FA	T		S		
"		KOP00601	Y	FA	N		S		
"		KOP00801		FA	N				
"		KOP00901		FA	T				
"		KOP01001		FA	T				
"		KOP01101		FA	T				
Daviesia asperula ssp. *asperula*	P	ULE01201	Y	SD	T	R	S		

SPECIES	LS	SITEID	burnt	LF	C/A	Regen. mode			Regeneration comments [13]
						R	S	U	
Daviesia asperula ssp. *obliqua*	P	KOP00501	Y	SD	T	R			Charred stems.
"		KOP00601	Y	SD	N		S		
"		MUR00101	Y	SD	T	R	S		Burnt base (one observed); seedlings c. 15 cm.
"		MUR00301	Y	SD	1	R	S		Seedlings approx. 10 cm.
"		ULE01101	Y	SD	T		S		Seedlings approx. 10 cm high.
"		KOP01001		SB	T				
"		KOP01101		SC	N				Seedling approx. 3 cm.
Daviesia brevifolia	P	KOP00301	Y	SD	N		S		
"		KOP00501	Y	SD	T		S		
"		MUR00101	Y	SD	T		S		
"		MUR00301	Y	SD	1		S		No evidence of old bases found.
"		ULE01101	Y	SD	T		S		Seedling habit, much more common.
"		ULE01201	Y	SD	T		S		
"		WAN00101	Y	SD	1		S		
Daviesia pectinata	P	KOP01101		SA	T		S		Single seedlings approx. 40 cm tall.
Dianella brevicaulis	P	KOP01001		CP	T				
Dianella revoluta var. *revoluta*	P	KOP00301	Y	CP	N		S		
"		KOP00401	Y	CP	T		S	U	
"		KOP00501	Y	CP	N			U	
"		KOP00601	Y	CP	N		S?	U	
"		ULE01001	Y	CP	N		S	U	A seedling found, others not clear.
"		ULE01101	Y	CP	N			U	
"		ULE01201	Y	CP	N			U	
"		KOP00801		CP	N				
"		KOP00901		CP	T				
"		KOP01101		CP	T		S		
Dichondra repens	P	KOP00401	Y	FP	T		S?		
"		KOP01001		FP	N				
Dillwynia hispida	P	KOP00201	Y	SD	N		S		
"		ULE01201	Y	SD	T		S		
Diuris orientis	R	KOP00201	Y	TB	T			U	
Diuris pardina	R	KOP00501	Y	TB	N			U	
"		ULE01101	Y	TB	N			U	
"		ULE01201	Y	TB	N			U	
"		KOP01101		TB	N				
Dodonaea baueri	P	KOP00901		SC	N				
Dodonaea hexandra	P	WAN00101	Y	SD	N		S		
"		KOP00901		SD	N				
"		KOP01001		SD	N				
Dodonaea tepperi	P	KOP00901		SC	T				
Drosera glanduligera	A	KOP00301	Y	FA	N		S		
"		KOP00601	Y	FA	N		S		
"		MUR00101	Y	FA	T		S		
"		ULE01201	Y	FA	N		S		
Drosera macrantha ssp. *planchonii*	R	KOP00201	Y	TB	T			U	
"		KOP00301	Y	TB	N			U	
"		KOP00401	Y	TB	N		S	U	
"		KOP00501	Y	TB	T			U	
"		KOP00601	Y	TB	T			U	
"		ULE01001	Y	TB	T			U	
"		ULE01101	Y	TB	T			U	
"		ULE01201	Y	TB	T			U	

SPECIES	LS	SITEID	burnt	LF	C/A	Regen. mode			Regeneration comments [13]
						R	**S**	**U**	
"		KOP00901		TB	T				
"		KOP01101		TB	T				
Drosera peltata	R	KOP00301	Y	TB	T			U	
Drosera sp. Rigid (R.J.Bates 2268)	R	MUR00301	Y	TB	1			U	
"		ULE01001	Y	TB	1			U	
Ehrharta calycina	P	MUR00301	Y	GP	1		S		
Ehrharta longiflora	A	KOP00401	Y	GA	T		S		
"		KOP00501	Y	GA	N		S		
"		KOP00701	Y	GA	1		S		
"		ULE01001	Y	GA	N		S		
"		KOP01001		GA	T				
"		KOP01101		GA	N				
Einadia nutans ssp. *nutans*	P	KOP01001		V	N				
Eremophila behriana	P	KOP00801		SD	2				
"		KOP00901		SD	N				
Eriochilus cucullatus	R	KOP00501	Y	TB	N			U	
Erodium moschatum	A	KOP00401	Y	FA	N		S		
Eucalyptus angulosa	P	MUR00101	Y	KS	2	R	S		Seedlings approx. 20 cm, regrowth 1 to 2 m tall.
"		MUR00201	Y	KS	T	R	S		
"		MUR00301	Y	KS	2	R	S		Basal regrowth approx. 1.2 m high. Seedlings approx. 40 cm.
"		ULE01101	Y	KS	2	R	S		All mallee stems killed and regenerating from base, seedlings common, 20-50 cm. Basal regen flowering.
Eucalyptus calycogona ssp. *calycogona*	P	KOP00801		KS	1				
"		KOP00901		KS	N				Seedling 10 cm.
Eucalyptus cladocalyx	P	KOP00201	Y	LA	2	R	S		Most regen from lower 1/2 - 2/3 of main stems; some from base only, a few completely collapsed and regenerating from base, numerous seedlings 20-50 cm tall, over 30 seen in quadrat.
"		KOP00301	Y	LB	N	R	S		Regrowth from bases and stems. S. Seeding 20 cm.
"		KOP00401	Y	S	T		S		
"		KOP00501	Y	SA	2	R	S		Majority of occurrence in quadrat now seedlings 0.5-1.5 m. Emergent trees epicormic and basal resprouting.
"		KOP00601	Y	LA	3	R	S		About half regen from base only, half from lower 1/2-2/3 of stems. Dense seedlings 10 cm to 2 m.
"		KOP00701	Y	SA	N		S		
"		ULE01201	Y	LA	2	R	S		Seedlings from 0.2-1.5 m; mostly regen from stems, some from base, some with original canopy intact, some fallen.
"		KOP00801		LA	3				
"		KOP00901		LA	2				
Eucalyptus diversifolia ssp. *diversifolia*	P	MUR00201	Y	KS	2	R	S		Seedlings approx. 20 cm, basal resprout approx. 2 m.
"		ULE01101	Y	KS	2	R	S		All mallee stems killed and regenerating from base, seedlings common, 15-40 cm.
Eucalyptus dumosa complex	P	KOP00901		KT	1				
Eucalyptus odorata	P	KOP00801		LA	2				Seedling approx. 10 cm.
"		KOP00901		LA	2				
"		KOP01001		LA	3				
"		KOP01101		LA	2				
Eucalyptus odorata hybrid	P	KOP01101		KT	T				
Eucalyptus petiolaris	P	KOP00701	Y	S	3	R	S		Most regeneration from base, a few with regrowth from trunk and stems, seedlings common 0-3 to 1.5 m tall.
"		KOP01001		LA	2				
Euphorbia peplus	A	KOP00401	Y	FA	N		S		
Eutaxia microphylla	P	KOP00201	Y	SD	N		S		

SPECIES	LS	SITEID	burnt	LF	C/A	Regen. mode			Regeneration comments [13]
						R	S	U	
"		KOP00301	Y	SD	N		S		
"		KOP00601	Y	SD	1		S		Small size, single tap root.
"		ULE01001	Y	SD	T		S		
"		ULE01201	Y	SD	N		S		Seedlings - single stem no old bases.
"		KOP00801		SD	N				
"		KOP00901		SD	N				
"		KOP01001		SD	T				
"		KOP01101		SD	1				Seedling approx. 10 cm.
Exocarpos sparteus	P	KOP00201	Y	SB	N		S		Seedling 25cm - 1.3 m.
"		KOP00501	Y	SD	N		S		Seedlings 40 cm high.
"		KOP00601	Y	SB	T		S		
"		ULE01101	Y	SC	1		S		Seedlings approx 40cm - 1.2 m.
"		ULE01201	Y	SC	T		S		
"		WAN00101	Y	SB	N	R			Arising adjoining dead fire-scarred stem 1.5 m tall.
"		WAN00201	Y	SC	N		S		
Gahnia ancistrophylla	P	KOP00201	Y	CP	T	R			
"		KOP00301	Y	CP	1	R			Charred bases.
"		KOP00501	Y	CP	T	R			Extremely large tussock 50 cm diameter.
"		MUR00101	Y	CP	T	R			Burnt bases.
"		ULE01101	Y	CP	N	R			Charred basal material (must have been previously overlooked).
"		ULE01201	Y	CP	T	R			Old bases.
"		WAN00101	Y	CP	N	R			Burnt bases.
Gahnia trifida	P	ULE01001	Y	CP	3	R	S		New stems from old burnt bases observed, but many seedlings.
Geranium retrorsum	P	KOP00401	Y	TB	T		S		
"		KOP00701	Y	TB	T			U	
Glischrocaryon behrii	P	KOP00201	Y	FP	T	R			Dug out charred base.
"		ULE01201	Y	FP	T	R			
Gompholobium ecostatum	P	KOP00201	Y	SD	T		S		Seedlings 10-20 cm.
"		MUR00101	Y	SD	T		S		
Gonocarpus mezianus	P	KOP00201	Y	FP	3			U	
"		KOP00301	Y	FP	2			U	
"		KOP00401	Y	FP	T			U	
"		KOP00501	Y	FP	T			U	
"		KOP00601	Y	FP	1			U	Growing from rhizomes, but no evidence of burn.
"		KOP00701	Y	FP	N	R	S		Seedlings. Old bases and clumped stems.
"		ULE01201	Y	FP	1			U	
"		WAN00201	Y	FP	1			U	
"		KOP00801		FP	T				
"		KOP00901		FP	1				
"		KOP01001		FP	T				
"		KOP01101		FP	T				
Goodenia blackiana	P	KOP00201	Y	FP	T		S		
"		KOP00501	Y	FP	T		S		
"		KOP00601	Y	FP	T			U	
Goodenia ovata	P	KOP00801		FP	N				
Goodenia robusta	P	MUR00301	Y	FP	2		S		
"		ULE01201	Y	FP	1		S		
"		KOP00901		FP	T				
"		KOP01001		FP	N				
"		KOP01101		FP	T				
Goodenia varia	P	ULE01001	Y	FP	N		S		
Grevillea aspera	P	KOP00501	Y	SD	1		S		Seedlings 10-40 cm.

SPECIES	LS	SITEID	burnt	LF	C/A	Regen. mode			Regeneration comments [13]
						R	**S**	**U**	
Grevillea halmaturina ssp. *laevis*	P	MUR00101	Y	SD	T		S		Seedlings approx. 20 -30 cm.
"		MUR00301	Y	SD	1		S		Seedlings from 20 cm.
"		ULE01001	Y	SD	N		S		
Grevillea ilicifolia complex	P	WAN00101	Y	SD	N	R	S		Growing from out of burnt dead bush.
"		KOP00901		SC	T				
"		KOP01001		SB	T				
"		KOP01101		SC	2		S		Seedlings 2 cm - abundant.
Grevillea ilicifolia ssp. *ilicifolia*	P	MUR00101	Y	SD	T	R	S		Burnt bases, seedlings approx. 20 cm.
Gyrostemon australasicus	P	ULE01101	Y	SC	N		S		Seedlings, most mature plants dead.
Gyrostemon ramulosus	P	MUR00201	Y	SB	N		S		
Hakea cycloptera	P	KOP00201	Y	SD	T	R			15-30 cm charred base observed.
"		KOP00301	Y	SD	N	R			Charred old branches.
"		KOP00501	Y	SC	T	R			Burnt basal remnants.
"		KOP00601	Y	SC	T	R			Old burnt base observed.
"		MUR00101	Y	SC	1	R	S		Burnt bases (photo). Seedlings approx. 20 cm.
"		ULE01101	Y	SC	T	R			Burnt stems and bases observed.
"		ULE01201	Y	SC	T	R			Charred base observed.
"		WAN00101	Y	SD	T	R			
"		WAN00201	Y	SC	N	R			Old burnt plant still present.
"		KOP00901		SC	N				Leaves show characters of *D. humilis*.
"		KOP01101		SD	N				
Hakea rugosa	P	KOP00501	Y	SC	T	R			Charred stems.
"		MUR00301	Y	SC	N	R			
"		ULE01201	Y	SD	N	R			Burnt stems from original plant present.
"		WAN00101	Y	SD	N	R			Old burnt stem.
"		KOP01001		SA	T				
Halgania cyanea	P	KOP00201	Y	SD	N		S		
Helichrysum leucopsideum	P	KOP00201	Y	FP	N	R?			
"		KOP00601	Y	FP	N			U	
"		KOP00801		FP	N				
"		KOP00901		FP	1				
"		KOP01001		FP	T				
"		KOP01101		FP	1				
Hibbertia crinita	P	KOP00701	Y	SD	T	R	S		Old burnt stems visible.
Hibbertia platyphylla ssp. *major*	P	WAN00101	Y	SD	T	R	S		Mostly seedlings 5-10 cm tall; several regrowth shrubs upslope.
"		WAN00201	Y	SD	1	R	S		Burnt stem bases observed.
Hibbertia riparia	P	MUR00101	Y	SD	2	R			Burnt bases.
Hibbertia sp.	P	KOP00401	Y	SD	N		S		
Hibbertia sp. Glabriuscula (D.J.Whibley 9012)	P	KOP00201	Y	SD	1	R	S		Dug out some rhizomes, seedlings 10-15 cm.
"		KOP00301	Y	SD	2	R			Charred bases.
"		KOP00501	Y	SD	1	R			Charred base of old stems observed (see specimen).
"		MUR00201	Y	SD	2	R	S		Burnt stems, seedlings approx. 150 mm.
"		MUR00301	Y	SD	2	R			Burnt bases.
"		ULE01101	Y	SD	2	R	S		Burnt old stems observed; seedlings 5 cm tall with tap root.
"		ULE01201	Y	SD	2	R			Charred stems.
"		WAN00101	Y	SD	2	R	S		Burnt base; seedlings with fine taproots 8 cm tall.
"		WAN00201	Y	SD	T	R	S		Large blackened stems protruding. Seedlings 5-10 cm tall.
"		KOP00901		SD	N				
Homoranthus homoranthoides	P	KOP00301	Y	SD	1	R	S		Blackened burnt off bases of old stems.
"		KOP00501	Y	SD	1		S		Small seedlings with thin roots dug up, c. 3 cm

SPECIES	LS	SITEID	burnt	LF	C/A	Regen. mode			Regeneration comments [13]
						R	S	U	
									diameter.
"		MUR00101	Y	SD	T		S		
"		ULE01201	Y	SD	N	R	S		On soil mound with old stems.
"		WAN00101	Y	SD	T	R			Burnt prostrate stems in centre of ring of live growth.
Homoranthus wilhelmii	P	MUR00201	Y	SD	T		S		
"		ULE01101	Y	SD	1		S		Abundant seedlings 5 cm tall with tap root.
Hyalosperma demissum	A	KOP00601	Y	FA	N		S		
"		ULE01201	Y	FA	N		S		
"		KOP01101		FA	N				
Hybanthus floribundus ssp. *floribundus*	P	KOP00201	Y	SD	N		S		
"		KOP00301	Y	SD	N		S		
"		KOP00501	Y	SD	N	R			
"		ULE01101	Y	SD	N		S		
"		WAN00101	Y	SD	N	R	S		Burnt off stem at base.
"		KOP00901		SD	N				
Hydrocotyle callicarpa	A	KOP00201	Y	FA	N		S		
"		KOP00301	Y	FA	T		S		
"		KOP00501	Y	FA	1		S		
"		KOP00601	Y	FA	1		S		
"		ULE01201	Y	FA	N		S		
Hydrocotyle foveolata	A	KOP00601	Y	FA	T		S		
Hydrocotyle pilifera var. *glabrata*	A	KOP01101		FA	N				
Hypochaeris glabra	A	KOP00201	Y	FA	T		S		
"		KOP00601	Y	FA	N		S		
"		ULE01001	Y	FA	N		S		
"		ULE01201	Y	FA	N		S		
"		KOP00901		FA	N				
"		KOP01001		FA	N				
"		KOP01101		FA	N				
Hypochaeris radicata	P	KOP00201	Y	FP	N		S?		Old flower stalk from last year.
"		KOP00401	Y	FP	N			U	
"		KOP00601	Y	FP	N		S		
"		KOP00701	Y	FP	N			U	
"		ULE01201	Y	FP	N			U	
Hypolaena fastigiata	P	KOP00201	Y	CP	T	R			Excavated.
"		MUR00101	Y	CP	T			U	
"		MUR00201	Y	CP	2			U	
"		ULE01001	Y	CP	2	R			Burnt bases observed.
"		ULE01101	Y	CP	2			U	
Hypoxis glabella var. *glabella*	R	KOP00901		TB	N				
Hypoxis vaginata var. *vaginata*	R	KOP00401	Y	TB	N			U	
"		KOP00601	Y	TB	N			U	
Isolepis marginata	A	KOP00201	Y	CA	1		S		
"		KOP00401	Y	CA	1		S		
"		KOP00601	Y	CA	1		S		
"		ULE01001	Y	CA	T		S		
"		ULE01201	Y	CA	T		S		
Juncus bufonius	A	ULE01001	Y	CA	T		S		
Juncus capitatus	A	KOP00601	Y	CA	T		S		
Kennedia prostrata	P	KOP00201	Y	V	T		S		
"		KOP00501	Y	V	1		S		

SPECIES	LS	SITEID	burnt	LF	C/A	Regen. mode			Regeneration comments [13]
						R	**S**	**U**	
"		KOP00601	Y	V	1		S		
"		MUR00301	Y	V	T		S		
"		ULE01201	Y	V	N			U	
"		WAN00201	Y	V	T		S		
Lachnagrostis aemula	A	KOP00701	Y	GA	N		S		
Lagenophora huegelii	R	KOP00201	Y	FP	N		S		
"		KOP00701	Y	FP	N		S		
"		KOP00801		FP	1				
"		KOP00901		FP	1				
"		KOP01001		FP	1				
"		KOP01101		FP	T				
Lasiopetalum baueri	P	KOP00901		SD	N				
"		KOP01001		SC	T				Seedlings 20 cm.
Lawrencia spicata	P	ULE01001	Y	FP	T		S		Charring on plant stems (1.5 m + high) appear to have been killed by fire - no regen.
Laxmannia orientalis	P	KOP00201	Y	CP	N		S		
"		KOP00301	Y	CP	N		S		
"		ULE01101	Y	CP	N			U	
"		ULE01201	Y	CP	N			U	
Lepidosperma carphoides	P	KOP00501	Y	CP	N	R			Charred remnants on base.
"		MUR00101	Y	CP	2	R			Burnt bases.
"		MUR00201	Y	CP	1	R			Burnt bases.
"		MUR00301	Y	CP	N	R			
"		ULE01101	Y	CP	1	R			Charred butts observed.
"		ULE01201	Y	CP	N	R			Charred base observed.
"		WAN00101	Y	CP	N	R			
Lepidosperma concavum	P	MUR00101	Y	CP	2	R			Burnt bases.
"		ULE01101	Y	CP	1	R			Charred leaf bases.
Lepidosperma viscidum	P	KOP00201	Y	CP	1	R			Charred leaf bases observed below soil - evidence of regrowth.
"		KOP00301	Y	CP	N			U	
"		KOP00501	Y	CP	T	R?			
"		KOP00601	Y	CP	N		S		
"		KOP00701	Y	CP	N		S		Present as a young plant
"		ULE01201	Y	CP	T	R			Old burnt bases visible on regenerated clumps.
"		KOP00801		CP	T				
"		KOP00901		CP	1				
"		KOP01001		CP	1				
"		KOP01101		CP	1				
Leporella fimbriata	R	KOP00201	Y	TB	N			U	
"		ULE01101	Y	TB	N			U	
Leptorhynchos squamatus ssp. *squamatus*	P	KOP01001		FP	T				
Leptospermum coriaceum	P	KOP00201	Y	SD	T	R			
"		MUR00101	Y	SC	1	R			Burnt stems.
"		MUR00201	Y	SC	2	R	S		Burnt bases, seedlings approx. 10 cm.
"		ULE01101	Y	SC	2	R			Burnt old stems observed.
Leucopogon clelandii	P	KOP00201	Y	SD	1		S		Seedling 10 cm.
Leucopogon rufus	P	MUR00201	Y	SD	T		S		Seedlings approx. 15 cm.
		ULE01101	Y	SD	N		S		Seedlings approx. 15 cm.
Levenhookia dubia	A	KOP00601	Y	FA	N		S		
Levenhookia stipitata	A	KOP00301	Y	FA	N		S		
"		ULE01201	Y	FA	N		S		
Linum marginale	P	KOP00801		FP	N				
"		KOP01101		FP	T				

SPECIES	LS	SITEID	burnt	LF	C/A	Regen. mode			Regeneration comments [13]
						R	S	U	
Lissanthe strigosa ssp. *subulata*	P	KOP00201	Y	SD	T	R			Charred bases.
"		KOP00301	Y	SD	N	R			Charred base and stems.
"		KOP00401	Y	SD	1	R	S		S, Seedling approx. 5 cm, charred stem remnants at base.
"		KOP00501	Y	SD	T	R			Blacked stems at base.
"		KOP00601	Y	SD	1	R			Charred base observed.
"		KOP00701	Y	SD	1	R			Burnt bases.
"		ULE01201	Y	SD	T	R			Dead burnt stem bases observed.
"		WAN00101	Y	SD	T	R			Dead stems.
"		WAN00201	Y	SD	1	R			Blackened bases.
"		KOP00801		SD	3				
"		KOP00901		SD	2				
"		KOP01001		SD	2				
"		KOP01101		SC	2				
Lobelia sp.	A	KOP00901		FA	N				
"		KOP01101		FA	N				
Logania ovata	P	WAN00101	Y	SD	N		S		
Lolium rigidum	A	KOP00701	Y	GA	N		S		
"		ULE01001	Y	GA	N		S		
"		KOP01001		GA	N				
Lomandra collina	P	KOP00201	Y	CP	N	R?			
"		KOP00301	Y	CP	N	R			Blackened butt observed.
"		KOP00501	Y	CP	N			U	
"		ULE01201	Y	CP	N			U	
"		KOP00801		CP	N				
"		KOP00901		CP	N				
Lomandra effusa	P	KOP01101		CP	T		S		Seedling approx. 100 mm tall.
Lomandra juncea	P	KOP00201	Y	CP	N	R?			
"		MUR00101	Y	CP	N			U	
"		ULE01101	Y	CP	N	R?			
Lomandra micrantha ssp.	P	KOP00501	Y	CP	T		S		
Lomandra micrantha ssp. *micrantha*	P	KOP01001		CP	1				
Lomandra micrantha ssp. *tuberculata*	P	KOP00201	Y	CP	1	R?			
"		KOP00601	Y	CP	T			U	
"		ULE01201	Y	CP	T			U	
"		WAN00101	Y	CP	N	R			Burnt-off dead stems.
Lomandra sororia	P	KOP00801		CP	N				
"		KOP00901		CP	T				
Lotus subbiflorus	A	KOP00401	Y	FA	2		S		
Malva parviflora	A	KOP00401	Y	FA	N		S		
Medicago polymorpha var. *polymorpha*	A	KOP00401	Y	FA	N		S		
"		KOP00701	Y	FA	T		S		
Medicago sp.	A	KOP00601	Y	FA	N		S		
Melaleuca brevifolia	P	KOP00701	Y	SC	T		S		Seedlings approx. 10-60 cm.
"		ULE01001	Y	SC	2	R	S		
Melaleuca decussata	P	KOP00401	Y	SC	4		S		Seedlings to 50 cm - no basal regen found.
"		KOP00501	Y	SD	1		S		Seedlings approx. 40 cm.
"		KOP00601	Y	SD	N		S		Single stem.
"		MUR00301	Y	SD	1		S		Seedlings approx. 30 cm +. Dead adults (approx. 1.2 m) showing no regeneration.
"		ULE01001	Y	SC	3		S		Seedlings only.
"		WAN00101	Y	SD	N		S		

SPECIES	LS	SITEID	burnt	LF	C/A	Regen. mode			Regeneration comments [13]
						R	**S**	**U**	
"		KOP00901		SD	T				
Melaleuca uncinata	P	KOP00301	Y	SC	3	R	S		Blackened dead stems with old fruits remaining, seedlings approx. 10-15 cm.
"		KOP00501	Y	SB	2	R			Charred bases, some charred stems remaining.
"		KOP00601	Y	SC	1	R			
"		KOP00701	Y	SD	N		S		
"		MUR00101	Y	SC	2	R			
"		MUR00301	Y	SC	2	R			
"		ULE01101	Y	SC	T	R			Burnt old stems observed.
"		ULE01201	Y	SC	T	R			
"		WAN00101	Y	SC	2	R			Burnt stems 2 m tall with fruits.
"		WAN00201	Y	SC	2	R	S		Regrowth from base of blackened stems 3 m tall; abundant seedlings 10-30 cm tall.
"		KOP00801		S	1				
"		KOP00901		S	3				
"		KOP01001		S	T				
"		KOP01101		S	2				
Melilotus indicus	A	KOP00201	Y	FA	N		S		
Microseris lanceolata	R	ULE01001	Y	FP	T			U	
"		KOP01001		FP	N				
Microtis frutetorum	R	KOP00301	Y	TB	N			U	
Microtis sp.	R	KOP00201	Y	TB	N			U	
"		KOP00601	Y	TB	N			U	
"		ULE01001	Y	TB	N			U	
"		ULE01201	Y	TB	N			U	
Millotia muelleri	A	KOP01101		FA	N				
Millotia tenuifolia	A	KOP00201	Y	FA	N		S		
"		KOP00801		FA	T				
"	A	KOP00901		FA	N				
"		KOP01101		FA	N				
Moenchia erecta	A	KOP00401	Y	FA	N		S		
Moraea setifolia	R	KOP01101		TB	N				
Muehlenbeckia adpressa	P	KOP00401	Y	V	T		S		
"		KOP00701	Y	V	N		S?		
"		ULE01001	Y	V	N			U	
"		ULE01201	Y	V	N			U	
"		WAN00201	Y	V	2		S	U	Seedling 10 cm tall.
Neurachne alopecuroidea	P	KOP00201	Y	GP	1			U	
"		KOP00301	Y	GP	2			U	
"		KOP00401	Y	GP	N		S?		
"		KOP00501	Y	GP	1			U	
"		KOP00601	Y	GP	N			U	
"		ULE01101	Y	GP	N	R?			
"		ULE01201	Y	GP	2	R?		U	No burnt bases found but some clumps on old soil mounds suggesting basal regeneration.
"		WAN00101	Y	GP	1	R			Burnt base.
"		KOP00901		GP	T				
"		KOP01001		GP	T				
"		KOP01101		GP	2				
Olearia floribunda var. *floribunda*	P	KOP00901		SC	N				
Olearia ramulosa	P	KOP00501	Y	SD	N		S		
"		KOP00601	Y	SC	T		S		
"		MUR00301	Y	SB	2		S		
"		ULE01001	Y	SC	T		S		

SPECIES	LS	SITEID	burnt	LF	C/A	Regen. mode			Regeneration comments [13]
						R	S	U	
"		ULE01201	Y	SC	T		S		Tap root observed.
"		KOP00801		SC	N				Seedlings approx. 5 cm.
"		KOP00901		SC	N				
"		KOP01001		SD	N				
Opercularia scabrida	P	KOP00201	Y	FP	2	R?			Dug out some rhizomes.
"		KOP00301	Y	FP	2			U	
"		KOP00501	Y	FP	2			U	
"		KOP00601	Y	FP	2			U	
"		MUR00101	Y	FP	2			U	
"		MUR00301	Y	FP	1		S		
"		ULE01201	Y	FP	3	R?			
"		WAN00101	Y	FP	2	R		U	Burnt off upright stem arising from rhizome; fine rhizomes.
"		KOP00901		FP	T				
"		KOP01101		FP	1				
Oxalis perennans	P	KOP00201	Y	FP	N	R?			
"		KOP00401	Y	FP	N			U	
"		KOP00601	Y	FP	T	R?			
"		KOP00801		FP	T				
"		KOP00901		FP	1				
"		KOP01001		FP	N				
"		KOP01101		FP	N				
Oxalis pes-caprae	R	KOP00401	Y	TB	N		S		
"		KOP00701	Y	TB	1			U	
Ozothamnus retusus	P	KOP00901		SB	N				Seedling 10 cm.
Parapholis incurva	A	ULE01001	Y	GA	N		S		
Parentucellia latifolia	A	KOP01101		FA	N				
Pelargonium littorale	P	KOP00601	Y	FP	N			U	
Pelargonium sp.	P	KOP00401	Y	FP	N		S		
Philotheca angustifolia ssp. *angustifolia*	P	KOP01101		SC	N		S		Seedlings approx. 3 cm tall.
Phyllangium divergens	A	KOP00301	Y	FA	N		S		
"		KOP00401	Y	FA	N		S		
"		KOP00501	Y	FA	T		S		
"		KOP00601	Y	FA	T		S		
"		KOP00901		FA	N				
"		KOP01101		FA	N				
Phylloglossum drummondii	P	KOP00301	Y	X	N		S		
Pimelea flava ssp. *dichotoma*	P	KOP00201	Y	SD	T		S		Seedlings 30-40 cm.
"		KOP00301	Y	SD	1		S		
"		KOP00501	Y	SD	T		S		
"		KOP00601	Y	SC	1		S		Single stem and tap root.
"		MUR00101	Y	SC	T		S		
"		MUR00301	Y	SD	1		S		
"		ULE01001	Y	SC	T		S		
"		ULE01201	Y	SD	T		S		
"		WAN00101	Y	SD	N		S		
"		KOP00801		SC	T				
Pimelea glauca	P	KOP00901		SD	N				
Pimelea octophylla	P	KOP00201	Y	SC	N		S		
"		MUR00201	Y	SD	1		S		
"		ULE01101	Y	SC	T		S		Simple tap root observed.
Plantago coronopus ssp. *coronopus*	A	ULE01001	Y	FA	N		S		
Plantago gaudichaudii	P	KOP01001		FP	1				

SPECIES	LS	SITEID	burnt	LF	C/A	Regen. mode			Regeneration comments [13]
						R	**S**	**U**	
Plantago hispida	P	KOP01101		FP	1				
Plantago sp.	P	KOP00801		FP	N				
"		KOP00901		FP	1				
Plantago sp. B (R.Bates 44765)	A	KOP00201	Y	FA	N		S		
"		KOP01001		FA	T				
Plantago varia	P	KOP00801		FP	N				
Poa poiformis var. *poiformis*	P	ULE01001	Y	GP	N	R			Deep root network and charred remnants in base.
Polypogon monspeliensis	A	ULE01001	Y	GA	N		S		
Pomaderris flabellaris	P	WAN00101	Y	SC	T	R			Burnt stems.
"		KOP00901		SC	T				
Pomaderris paniculosa ssp. *paniculosa*	P	KOP00401	Y	SD	N		S?		
Poranthera leiosperma	A	KOP00201	Y	FA	N		S		
Poranthera microphylla	A	KOP00601	Y	FA	T		S		
"		KOP00901		FA	N				
"		KOP01101		FA	N				
Poranthera sp.	A	KOP00501	Y	FA	T		S		
Prasophyllum fecundum	R	KOP00301	Y	TB	N			U	
Prostanthera spinosa	P	KOP00301	Y	SD	N		S		
"		WAN00101	Y	SD	2		S		
Pterostylis nana	R	KOP01001		TB	N				
Pterostylis plumosa	R	KOP00901		TB	N				
Pterostylis sanguinea	R	KOP00201	Y	TB	N			U	
Pterostylis sp.	R	KOP00501	Y	TB	N			U	
"		KOP01101		TB	N				
Ptilotus beckerianus	P	KOP00501	Y	FP	T	R?			
"		ULE01201	Y	FP	T			U	
Pultenaea acerosa	P	MUR00101	Y	SD	1		S		
"		ULE01201	Y	SD	1		S		
Pultenaea pedunculata	P	KOP00601	Y	SD	1		S		
"		KOP00801		SD	2				
"		KOP00901		SD	2				Seedlings approx. 150 mm.
Pultenaea tenuifolia	P	KOP00601	Y	SC	N		S		
"		MUR00101	Y	SD	T		S		
"		MUR00201	Y	SD	T		S		Seedlings approx. 20 cm.
"		ULE01101	Y	SD	N		S		
Pultenaea teretifolia var. *teretifolia*	P	KOP00301	Y	S	N		S		
Pultenaea trinervis	P	KOP00501	Y	SD	1		S		
"		KOP00601	Y	SD	N		S		
"		ULE01201	Y	SD	2		S		
"		WAN00101	Y	SD	1		S		
Pyrorchis nigricans	R	KOP00201	Y	TB	1			U	
"		ULE01101	Y	TB	T			U	
"		ULE01201	Y	TB	T			U	
Rhagodia candolleana ssp. *candolleana*	P	ULE01001	Y	SD	N		S		Single stem.
Rhodanthe laevis	A	KOP00801		FA	T				
"		KOP01001		FA	T				
"		KOP01101		FA	T				
Sarcocornia quinqueflora	P	ULE01001	Y	SC	T	R	S		
Scaevola linearis ssp. *linearis*	P	KOP00501	Y	SD	N		S		
"		KOP00601	Y	SD	T		S		
"		KOP00701	Y	SD	N		S		

SPECIES	LS	SITEID	burnt	LF	C/A	Regen. mode			Regeneration comments [13]
						R	S	U	
"		ULE01001	Y	SD	T		S		
"		ULE01101	Y	SD	N		S		
"		ULE01201	Y	SD	N	R			
Schoenus apogon	A	KOP00201	Y	CA	N		S		
"		KOP00401	Y	CA	1		S		
"		KOP00601	Y	CA	1		S?		
"		KOP01001		CA	N				
Schoenus breviculmis	P	KOP00301	Y	CP	1			U	
"		KOP00501	Y	CP	T			U	
"		MUR00201	Y	CP	N	R			Charred bases visible.
"		ULE01201	Y	CP	1	R			Old butts.
"		KOP00801		CP	T				
"		KOP00901		CP	1				
"		KOP01101		CP	2				
Schoenus nanus	A	KOP00301	Y	CA	T		S		
"		KOP00501	Y	CA	1		S		
"		KOP00601	Y	CA	N		S		
"		ULE01201	Y	CA	T		S		
"		KOP00901		CA	T				
"		KOP01101		CA	T				
Schoenus racemosus	P	MUR00101	Y	CP	T			U	
"		ULE01101	Y	CP	2	R?			
Schoenus sculptus	A	KOP00601	Y	CA	N		S		
"		ULE01001	Y	CA	N		S		
Senecio picridioides	P	KOP00801		FP	N				
"		KOP00901		FP	N				
Senecio pterophorus	P	KOP00201	Y	SB	T		S		Mostly 1 m tall, many younger plants already dead.
"		KOP00401	Y	SB	2		S		
"		KOP00501	Y	SB	N		S		
"		KOP00601	Y	SB	T		S		
"		KOP00701	Y	SB	2		S		Seedlings approx. 150 mm.
"		MUR00301	Y	SB	T		S		
"		ULE01001	Y	SC	N		S		
"		ULE01101	Y	SC	N		S		
"		ULE01201	Y	SB	N		S		
"		WAN00201	Y	SB	1		S		
Siloxerus multiflorus	A	KOP00301	Y	FA	N		S		
Sonchus asper ssp.	A	KOP00401	Y	FA	N		S		
Sonchus oleraceus	A	KOP00401	Y	FA	N		S		
"		KOP00601	Y	FA	N		S		
"		KOP00701	Y	FA	N		S		
"		ULE01001	Y	FA	N		S		
"		KOP01001		FA	N				
Sparaxis bulbifera	R	ULE01001	Y	TB	T			U	
Spergularia marina	A	ULE01001	Y	FA	T		S		
Sphaerolobium minus	P	MUR00101	Y	SD	N		S		
Spyridium nitidum	P	MUR00201	Y	SD	N		S		Seedlings up to 40 cm.
"		ULE01101	Y	SC	N		S		
Spyridium phylicoides	P	MUR00101	Y	SD	N		S		
Spyridium vexilliferum var. *vexilliferum*	P	KOP00301	Y	SD	1		S		
"		WAN00101	Y	SD	1		S		
Stackhousia aspericocca ssp. One-sided inflorescence (W.R.Barker 697)	P	KOP00201	Y	FP	N		S		

SPECIES	LS	SITEID	burnt	LF	C/A	Regen. mode			Regeneration comments [13]
						R	**S**	**U**	
"		KOP00301	Y	FP	N		S		
"		MUR00101	Y	FP	N		S		
"		ULE01201	Y	FP	N		S		Seedling with undeveloped tap root.
"		WAN00101	Y	FP	T			U	
Stackhousia monogyna	R	KOP00801		FP	N				
"		KOP01001		FP	N				
"		KOP01101		FP	T				
Stenanthemum leucophractum	P	KOP00301	Y	SD	T		S		
"		KOP00501	Y	SD	2		S		
"		MUR00101	Y	SD	1		S		
"		MUR00201	Y	SD	T		S		
"		ULE01101	Y	SD	N		S		
"		ULE01201	Y	SD	1		S		
"		WAN00101	Y	SD	T		S		
Thelymitra chasmogama	R	ULE01001	Y	TB	N			U	
Thelymitra flexuosa	R	KOP00301	Y	TB	N			U	
"		ULE01001	Y	TB	N			U	
Thelymitra luteocilium	R	ULE01201	Y	TB	N			U	
Thelymitra megcalyptra	R	ULE01001	Y	TB	N			U	
"		KOP01101		TB	N				
Thelymitra nuda	R	ULE01101	Y	TB	N			U	
Thelymitra rubra	R	KOP00501	Y	TB	N			U	
Thelymitra sp.	R	KOP00301	Y	TB	N			U	
"		KOP00801		TB	N				
"		KOP00901		TB	N				
Thelymitra sp. *(T. rubra/ T. pauciflora* complex*)*	R	KOP00201	Y	TB	N			U	
Thysanotus patersonii	R	KOP00201	Y	TB	T			U	
"		KOP00301	Y	TB	T			U	
"		KOP00401	Y	TB	N			U	
"		KOP00501	Y	TB	N			U	
"		KOP00601	Y	TB	N			U	
"		KOP00701	Y	TB	N			U	
"		ULE01001	Y	TB	T			U	
"		ULE01101	Y	TB	T			U	
"		ULE01201	Y	TB	N			U	
"		KOP00801		TB	T				
"		KOP00901		TB	T				
"		KOP01001		TB	1				
"		KOP01101		TB	1				
Trachymene cyanopetala	A	KOP00201	Y	FA	N		S		
"		ULE01201	Y	FA	N		S		
Trachymene pilosa	A	KOP00201	Y	FA	N		S		
"		ULE01001	Y	FA	N		S		
"		KOP01101		FA	T				
Tricoryne tenella	P	KOP00501	Y	FP	N		S?		
"		ULE01101	Y	FP	N		S	U	
"		ULE01201	Y	FP	N			U	
"		KOP00901		FP	N				
Trifolium angustifolium	A	KOP00701	Y	FA	T		S		
Trifolium arvense var. *arvense*	A	KOP00401	Y	FA	N		S		
"		KOP00601	Y	FA	N		S		
"		KOP00701	Y	FA	N		S		

SPECIES	LS	SITEID	burnt	LF	C/A	Regen. mode			Regeneration comments [13]
						R	S	U	
Trifolium campestre	A	KOP00401	Y	FA	N		S		
"		KOP00601	Y	FA	N		S		
"		KOP00701	Y	FA	T		S		
"		ULE01201	Y	FA	N		S		
Trifolium dubium	A	KOP00701	Y	FA	T		S		
Trifolium fragiferum var. *fragiferum*	P	KOP00301	Y	FA	N		S		Growing from kangaroo dung.
Trifolium subterraneum	A	KOP00401	Y	FA	T		S		
"		MUR00301	Y	FA	1		S		
"		ULE01001	Y	FA	N		S		
Triglochin minutissimum	A	ULE01001	Y	CA	T		S		
Triglochin mucronatum	A	ULE01001	Y	CA	1		S		
Triglochin nanum	A	ULE01001	Y	CA	N		S		
Triodia irritans	P	MUR00301	Y	H	N	R			Old burnt bases visible.
"		ULE01101	Y	H	T	R	S		Burnt leaf bases observed, seedlings smaller bases.
Vicia cracca	P	KOP00701	Y	V	N		S		
Vittadinia australasica var. *australasica*	P	KOP00701	Y	FP	N		S		
"		KOP00801		FP	T				
"		KOP00901		FP	N				
Vittadinia cuneata var. *cuneata* f. *cuneata*	P	KOP01101		FP	T		S		Seedling 2 cm.
Vulpia bromoides	A	KOP00401	Y	GA	2		S		
"		KOP00701	Y	GA	T		S		
"		KOP00901		GA	T				
Vulpia muralis	A	KOP00201	Y	GA	T		S		
Vulpia myuros f. *myuros*	A	KOP00201	Y	GA	T		S		
"		KOP00701	Y	GA	2		S		
"		ULE01201	Y	GA	N		S		
"		KOP00901		GA	T				
Vulpia sp.	A	MUR00301	Y	GA	1		S		
"		ULE01001	Y	GA	T		S		
"		KOP01001		GA	T				
"		KOP01101		GA	N				
Wahlenbergia gracilenta	A	KOP00201	Y	FA	N		S		
"		KOP00501	Y	FA	N		S		
"		KOP00601	Y	FA	T		S		
"		KOP01101		FA	T				
Wahlenbergia sp.	P	KOP00201	Y	FP	N		S		
"		KOP00501	Y	FP	N			U	
"		KOP00601	Y	FP	N		S		
"		KOP00901		FP	N				
Wahlenbergia stricta ssp. *stricta*	P	KOP00201	Y	FP	T		S		
"		KOP00601	Y	FP	T			U	
"		WAN00201	Y	FP	N			U	
"		KOP00901		FP	N				
"		KOP01101		FP	T				
Wurmbea decumbens	R	KOP00801		TB	T				
"		KOP00901		TB	1				
Wurmbea dioica ssp.	R	KOP00801		TB	N				
Wurmbea dioica ssp. *dioica*	R	KOP01101		TB	1				
Wurmbea sp.	R	KOP00201	Y	TB	N			U	
"		KOP00501	Y	TB	N			U	
"		KOP00601	Y	TB	T			U	

SPECIES	LS	SITEID	burnt	LF	C/A	Regen. mode			Regeneration comments [13]
						R	**S**	**U**	
"		ULE01001	Y	TB	T			U	
"		ULE01201	Y	TB	T			U	
Xanthorrhoea semiplana	P	ULE01101	Y	SB	2	R			
"		ULE01201	Y	SA	2	R			Dead stems observed. Some killed by fire, many dead flowering stems post-fire, as well as new stems flowering now.
"		WAN00101	Y	SB	2	R			Dead flowers formed since fire.
"		WAN00201	Y	SB	2	R			Old flower spikes post fire.
"	P	MUR00101	Y	SB	2	R			Flowered post fire.
"		MUR00301	Y	SA	1	R			Flowered after fire.
Xanthorrhoea semiplana ssp. *semiplana*	P	KOP00201	Y	SC	1	R	S?		Most with dead flower stalks grown after fire. Possibly some seedlings 0.5-1.2 m tall, patchy.
"		KOP00301	Y	SB	T	R			Some killed by fire, some died after flowering.
"		KOP00401	Y	SB	2	R	S		Most killed by fire, some surviving to flower then dying, seedling approx 40 cm.
"		KOP00501	Y	SB	2	R			Most flowered post fire, some still flowering, a few killed, some pre-fire, most post fire.
"		KOP00601	Y	SA	2	R			Blackened stems. Dead flower stems produced since fire.
Xanthorrhoea semiplana ssp. *tateana*	P	MUR00201	Y	SA	2	R			
Xanthosia huegelii	P	KOP00201	Y	FP	T		S		
"		MUR00101	Y	FP	T			U	
Xanthosia leiophylla	P	MUR00101	Y	FP	N		S		
Zaluzianskya divaricata	A	KOP00201	Y	FA	N		S		
"		KOP00401	Y	FA	T		S		
"		KOP00501	Y	FA	N		S		
"		KOP00701	Y	FA	T		S		

Appendix 3: Mammal captures at sites

SITEID	SUBFAMILY NAME	SPECIES	COMMON NAME	ISINDIGENOUS	2004	2007
KOP00301	MACROPODIDAE	*Macropus fuliginosus*	Western Grey Kangaroo	Y	1	
"	MURIDAE Murinae	*Mus musculus*	House Mouse	N	1	3
"	"	*Rattus fuscipes*	Bush Rat	Y	9	
Conclusions:				species count	3	1
lost bush rat				indigenous	2	0
				total individuals	11	3
KOP00401	CANIDAE	*Vulpes vulpes*	Fox	N		1
"	LEPORIDAE	*Oryctolagus cuniculus*	Rabbit	N	1	2
"	MACROPODIDAE	*Macropus fuliginosus*	Western Grey Kangaroo	Y		1
"	MURIDAE Murinae	*Mus musculus*	House Mouse	N	4	4
"	"	*Rattus fuscipes*	Bush Rat	Y	15	
"	"	*Rattus rattus*	Black Rat	N	3	2
Conclusions:				species count	4	5
lost bush rat				indigenous	2	1
				total individuals	23	10
KOP00501	CANIDAE	*Vulpes vulpes*	Fox	N	1	1
"	MACROPODIDAE	*Macropus fuliginosus*	Western Grey Kangaroo	Y	1	2
"	MURIDAE Murinae	*Mus musculus*	House Mouse	N	1	
"	"	*Rattus fuscipes*	Bush Rat	Y	8	
"	PHALANGERIDAE	*Trichosurus vulpecula*	Common Brushtail Possum	Y		2
Conclusions:				species count	4	3
lost bush rat, gained possum				indigenous	2	1
				total individuals	11	5
KOP00601	CANIDAE	*Vulpes vulpes*	Fox	N	1	
"	LEPORIDAE	*Oryctolagus cuniculus*	Rabbit	N		2
"	MACROPODIDAE	*Macropus fuliginosus*	Western Grey Kangaroo	Y	1	1
"	MURIDAE Murinae	*Mus musculus*	House Mouse	N		1
"	"	*Rattus fuscipes*	Bush Rat	Y	1	
"	PHALANGERIDAE	*Trichosurus vulpecula*	Common Brushtail Possum	Y	1	2
"	VESPERTILIONIDAE Nyctophilinae	*Nyctophilus geoffroyi*	Lesser Long-eared Bat	Y	1	na
Conclusions:				species count	5	4
lost bush rat, gained rabbit				indigenous	4	2
				total individuals	5	6
ULE01101	BOVIDAE	*Ovis aries*	Sheep	N	1	
"	CANIDAE	*Vulpes vulpes*	Fox	N		1
"	LEPORIDAE	*Oryctolagus cuniculus*	Rabbit	N		3
"	MACROPODIDAE	*Macropus fuliginosus*	Western Grey Kangaroo	Y	4	2
"	MURIDAE Murinae	*Mus musculus*	House Mouse	N	4	2
Conclusions:				species count	3	4
gained rabbits				indigenous	1	1
				total individuals	9	8
ULE01201	BURRAMYIDAE	*Cercartetus concinnus*	Western Pygmy-possum	Y	1	
"	MACROPODIDAE	*Macropus fuliginosus*	Western Grey Kangaroo	Y	1	2
"	MURIDAE Murinae	*Mus musculus*	House Mouse	N		2
"	VESPERTILIONIDAE Vespertilioninae	*Chalinolobus gouldii*	Gould's Wattled Bat	Y	1	na
"	"	*Vespadelus regulus*	Southern Forest Bat	Y	12	na
Conclusions:				species count	4	2
lost western pygmy possum				indigenous	3	1
				total individuals	15	4

Appendix 4: Reptile captures at sites

SITEID	SUBFAMILY NAME	SPECIES	COMMON NAME	2004	2007
KOP00201	ELAPIDAE	*Pseudonaja inframacula*	Peninsula Brown Snake		1
"	GEKKONIDAE Gekkoninae	*Christinus marmoratus*	Marbled Gecko	1	
"	GEKKONIDAE Pygopodinae	*Delma australis*	Barred Snake-lizard		1
"	SCINCIDAE	*Cryptoblepharus pulcher clarus*	Striped Wall Skink	3	
"	"	*Ctenotus orientalis*	Eastern Spotted Ctenotus	3	
"	"	*Hemiergis peronii*	Four-toed Earless Skink	3	5
"	"	*Lampropholis delicata*	Delicate Skink	3	
"	"	*Lerista bougainvillii*	Bougainville's Skink	1	
"	"	*Menetia greyii*	Dwarf Skink		2
"	"	*Morethia obscura*	Mallee Snake-eye	1	9
			species count	7	5
			total individuals	15	17
KOP00301	GEKKONIDAE Diplodactylinae	*Diplodactylus granariensis*	Western Stone Gecko		1
"	GEKKONIDAE Pygopodinae	*Delma australis*	Barred Snake-lizard		1
"	"	*Delma butleri*	Spinifex Snake-lizard	2	
"	SCINCIDAE	*Ctenotus orientalis*	Eastern Spotted Ctenotus	2	1
"	"	*Menetia greyii*	Dwarf Skink	4	
"	"	*Morethia obscura*	Mallee Snake-eye	3	2
"	"	*Tiliqua rugosa*	Sleepy Lizard	1	2
			species count	5	5
			total individuals	12	7
KOP00401	GEKKONIDAE Gekkoninae	*Christinus marmoratus*	Marbled Gecko	1	2
"	GEKKONIDAE Pygopodinae	*Aprasia striolata*	Lined Worm-lizard		1
"	SCINCIDAE	*Hemiergis peronii*	Four-toed Earless Skink	3	1
"	"	*Lampropholis delicata*	Delicate Skink	1	
"	"	*Lerista bougainvillii*	Bougainville's Skink		2
"	"	*Morethia adelaidensis*	Adelaide Snake-eye		4
"	"	*Tiliqua rugosa*	Sleepy Lizard		1
			species count	3	6
			total individuals	5	11
KOP00501	GEKKONIDAE Gekkoninae	*Christinus marmoratus*	Marbled Gecko	1	
"	GEKKONIDAE Pygopodinae	*Delma australis*	Barred Snake-lizard	1	
"	SCINCIDAE	*Ctenotus orientalis*	Eastern Spotted Ctenotus	1	1
"	"	*Hemiergis peronii*	Four-toed Earless Skink	9	5
"	"	*Lampropholis delicata*	Delicate Skink	2	
"	"	*Lerista bougainvillii*	Bougainville's Skink	2	1
"	"	*Menetia greyii*	Dwarf Skink	4	
"	"	*Morethia adelaidensis*	Adelaide Snake-eye		1
"	"	*Tiliqua rugosa*	Sleepy Lizard	3	
			species count	8	4
			total individuals	23	8
KOP00601	ELAPIDAE	*Pseudonaja inframacula*	Peninsula Brown Snake		1
"	GEKKONIDAE Gekkoninae	*Christinus marmoratus*	Marbled Gecko		3
"	SCINCIDAE	*Ctenotus orientalis*	Eastern Spotted Ctenotus		1
"	"	*Hemiergis peronii*	Four-toed Earless Skink		2
"	"	*Lampropholis delicata*	Delicate Skink	1	
"	"	*Menetia greyii*	Dwarf Skink		3
"	"	*Morethia obscura*	Mallee Snake-eye	2	4
			species count	2	6
			total individuals	3	14
ULE01101	ELAPIDAE	*Pseudonaja inframacula*	Peninsula Brown Snake	2	
"	GEKKONIDAE Gekkoninae	*Christinus marmoratus*	Marbled Gecko	1	3
"	SCINCIDAE	*Bassiana trilineata*	Western Three-lined Skink	1	
"	"	*Ctenotus euclae*	Bight Coast Ctenotus	1	2
"	"	*Egernia multiscutata*	Bull Skink	1	
"	"	*Hemiergis peronii*	Four-toed Earless Skink	1	

SITEID	SUBFAMILY NAME	SPECIES	COMMON NAME	2004	2007
"	SCINCIDAE	*Menetia greyii*	Dwarf Skink	2	
"	"	*Morethia obscura*	Mallee Snake-eye	5	1
"	"	*Tiliqua occipitalis*	Western Bluetongue	1	
"	"	*Tiliqua rugosa*	Sleepy Lizard	5	
			species count	10	3
			total individuals	20	6
ULE01201	AGAMIDAE	*Pogona barbata*	Eastern Bearded Dragon	1	
"	GEKKONIDAE Gekkoninae	*Christinus marmoratus*	Marbled Gecko	4	2
"	GEKKONIDAE Pygopodinae	*Delma australis*	Barred Snake-lizard	2	2
"	SCINCIDAE	*Cryptoblepharus pulcher clarus*	Striped Wall Skink	6	
"	"	*Ctenotus orientalis*	Eastern Spotted Ctenotus		1
"	"	*Hemiergis peronii*	Four-toed Earless Skink	9	8
"	"	*Lampropholis delicata*	Delicate Skink	1	
"	"	*Lerista bougainvillii*	Bougainville's Skink	2	2
"	"	*Menetia greyii*	Dwarf Skink	7	3
"	"	*Morethia obscura*	Mallee Snake-eye	13	1
"	"	*Tiliqua rugosa*	Sleepy Lizard	6	
			species count	10	7
			total individuals	51	19

Appendix 5: Site photographs (pre- and post-fire).

KOP00201 Sep 2004, unburnt
Eucalyptus cladocalyx Woodland over *Xanthorrhoea semiplana*, *Gonocarpus mezianus*, *Chamaescilla corymbosa*, *Pyrorchis nigricans*

KOP00201 Dec 2004, unburnt

KOP00201 Sep 2007, burnt
Eucalyptus cladocalyx Woodland over *Acacia rupicola, A. myrtifolia, A. gillii, Gonocarpus mezianus, Opercularia scabrida*

KOP00301 Sep 2004, unburnt
Melaleuca uncinata Shrubland, with emergent *Eucalyptus cladocalyx*, over *Babingtonia behrii*, *Hibbertia* sp. Glabriuscula (D.J.Whibley 9012), *Homoranthus homoranthoides*, *Opercularia scabrida*

KOP00301 Dec 2004, unburnt

KOP00301 Sep 2007, burnt
Melaleuca uncinata – Babingtonia behrii Low Shrubland, with emergent *Eucalyptus cladocalyx,* over *Hibbertia* sp. Glabriuscula (D.J.Whibley 9012), *Opercularia scabrida, Neurachne alopecuroidea*

KOP00401 Sep 2004 unburnt
Melaleuca decussata – Callistemon rugulosus – Xanthorrhoea semiplana Closed Shrubland, with emergent *Acacia pycnantha, Allocasuarina verticillata*, over *Lissanthe strigosa, Chorizandra enodis*

KOP00401 Dec 2004, unburnt

KOP00401 Sep 2007, burnt
*Acacia pycnantha – *Senecio pterophorus* Low Shrubland over *Melaleuca decussata, Chorizandra enodis, *Lotus subbiflorus, *Vulpia* sp.

KOP00501 Sep 2004, unburnt
Acacia pycnantha Very Low Woodland, with emergent *Eucalyptus cladocalyx*, over *Allocasuarina muelleriana*, *Melaleuca uncinata*, *Babingtonia behrii*, *Xanthorrhoea semiplana*, *Homoranthus homoranthoides*

KOP00501 Dec 2004, unburnt

KOP00501 Sep 2007, burnt
Eucalyptus cladocalyx – Acacia pycnantha – Xanthorrhoea semiplana Open Shrubland over *Babingtonia behrii, Stenanthemum leucophractum, Opercularia scabrida*

KOP00601 Sep 2004, unburnt
Eucalyptus cladocalyx – Acacia pycnantha Woodland over *Xanthorrhoea semiplana*, *Opercularia scabrida*

KOP00601 Dec 2004, unburnt

KOP00601 Sep 2007, burnt
Eucalyptus cladocalyx Open Woodland over *Acacia pycnantha, Xanthorrhoea semiplana, Opercularia scabrida*

KOP00701 Sep 2004, unburnt
Eucalyptus petiolaris Woodland over *Acacia pycnantha, A. imbricata, Lissanthe strigosa, *Oxalis pes-caprae*

KOP00701 Dec 2004, unburnt

KOP00701 Sep 2007, burnt
Eucalyptus petiolaris Tall Very Open Shrubland over *Acacia pycnantha, A. imbricata,*Senecio pterophorus, Austrodanthonia setacea,*Vulpia myuros*

KOP00801 Sep 2004, unburnt
Eucalyptus cladocalyx – Eucalyptus odorata Woodland over *Lissanthe strigosa, Eremophila behriana, Pultenaea pedunculata, Lagenophora huegelii*

KOP00801 Dec 2004, unburnt

KOP00801 Sep 2007, unburnt
Eucalyptus cladocalyx – Eucalyptus odorata Woodland over *Lissanthe strigosa, Eremophila behriana, Pultenaea pedunculata*

KOP00901 Sep 2004, unburnt
Eucalyptus cladocalyx – Eucalyptus odorata Low Woodland over *Melaleuca uncinata, Lissanthe strigosa, Acacia imbricata, Pultenaea pedunculata*

KOP00901 Dec 2004, unburnt

KOP00901 Sep 2007, unburnt
Eucalyptus cladocalyx – Eucalyptus odorata Low Woodland over *Melaleuca uncinata, Lissanthe strigosa, Pultenaea pedunculata*

KOP01001 Sep 2004, unburnt
Eucalyptus odorata – Eucalyptus petiolaris Woodland over *Acacia imbricata, Bursaria spinosa Acacia paradoxa, Lissanthe strigosa*

KOP01001 Dec 2004, unburnt

KOP01001 Sep 2007, unburnt
Eucalyptus odorata – Eucalyptus petiolaris Woodland over *Acacia imbricata, Bursaria spinosa, Acacia paradoxa, Lissanthe strigosa*

KOP01101 Sep 2004, unburnt
Eucalyptus odorata Woodland over *Bursaria spinosa, Melaleuca uncinata, Acacia imbricata, Grevillea ilicifolia* complex, *Helichrysum leucopsideum*

KOP01101 Dec 2004, unburnt

KOP01101 Sep 2007, unburnt
Eucalyptus odorata Woodland over *Bursaria spinosa, Melaleuca uncinata, Acacia imbricata, Grevillea ilicifolia* complex

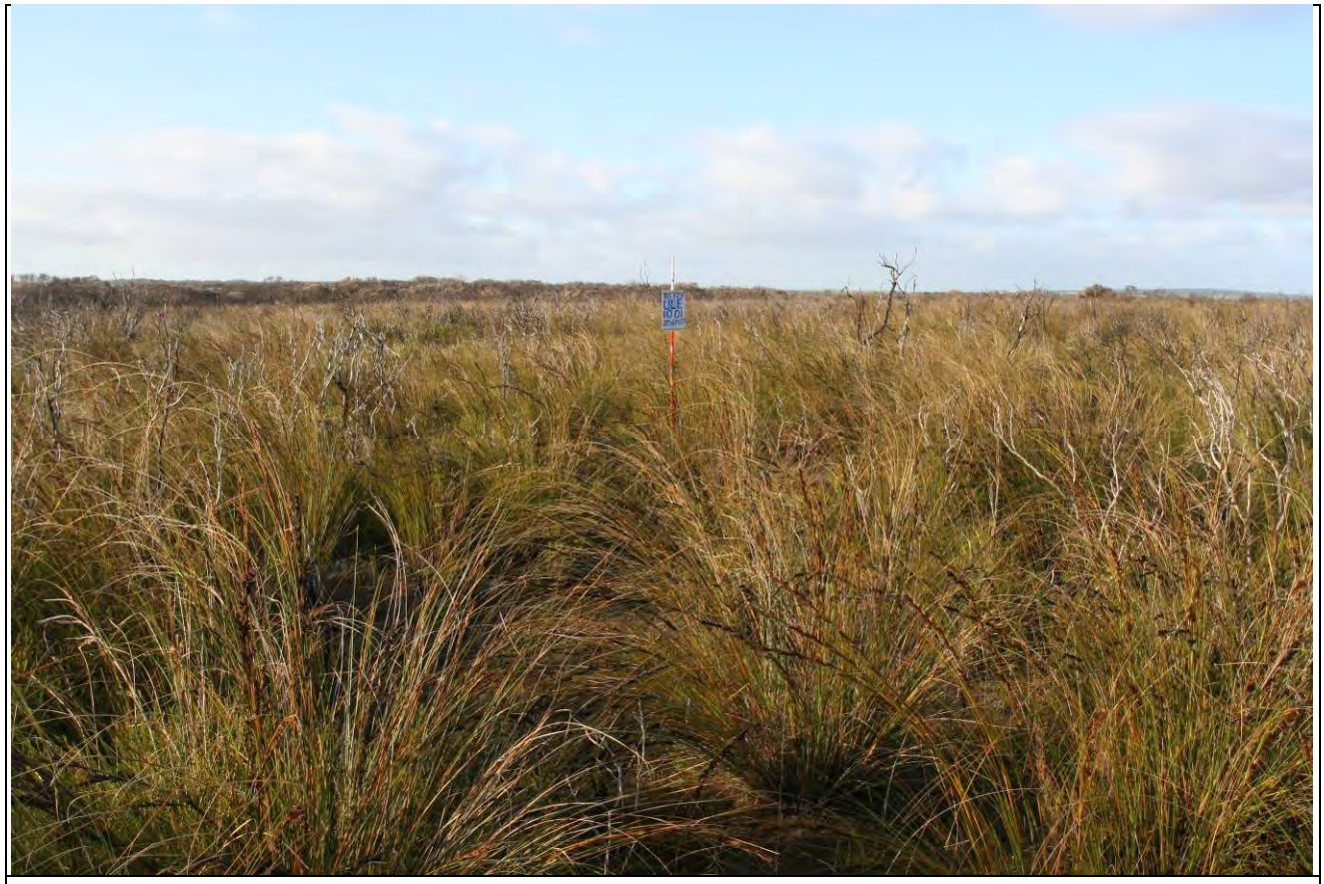
MUR00101 Sep 2007, burnt
Eucalyptus angulosa Low Mallee over *Xanthorrhoea semiplana, Melaleuca uncinata, Hibbertia riparia, Lepidosperma carphoides, L. concavum*

MUR00201 Sep 2007, burnt
Eucalyptus diversifolia Low Open Mallee over *Acacia myrtifolia, Xanthorrhoea semiplana, Leptospermum coriaceum, Hypolaena fastigiata*

MUR00301 Sep 2007, burnt
Eucalyptus angulosa – Allocasuarina verticillata Low Mallee over *Acacia euthycarpa, Olearia ramulosa, Babingtonia behrii, Melaleuca uncinata, Hibbertia* sp. Glabriuscula (D.J.Whibley 9012)

ULE01001 Sep 2004, unburnt
Melaleuca decussata – M. brevifolia – Gahnia trifida Shrubland over *Hypolaena fastigiata*

ULE01001 Dec 2004, unburnt



ULE01001 Sep 2007, burnt
Gahnia trifida Sedgeland over *Melaleuca decussata, M. brevifolia, Hypolaena fastigiata*

ULE01101 Sep 2004, unburnt
Eucalyptus angulosa – Eucalyptus diversifolia Open Mallee over *Melaleuca uncinata, Leptospermum coriaceum, Hibbertia* sp. Glabriuscula (D.J.Whibley 9012), *Hypolaena fastigiata, Triodia irritans*

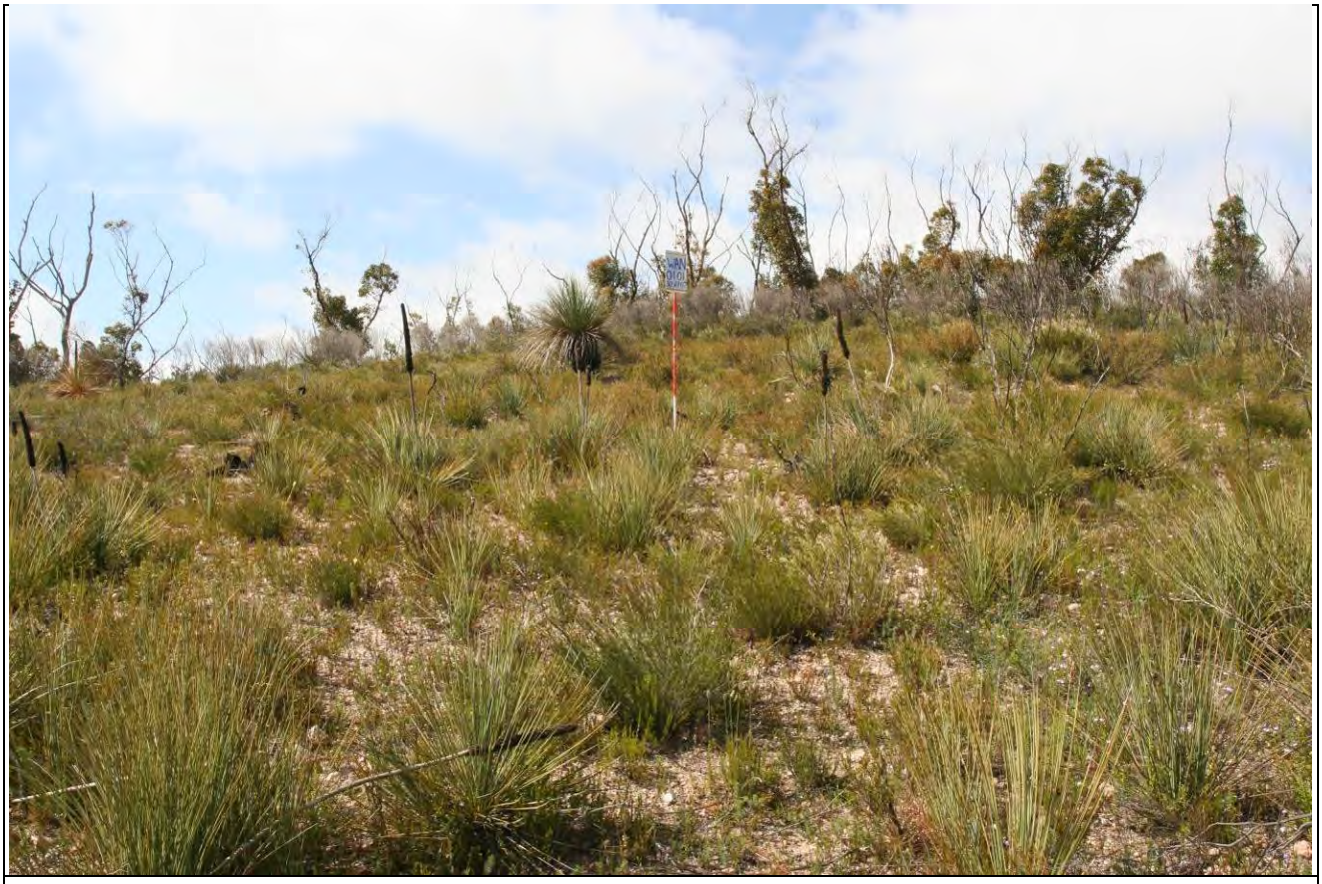
ULE01101 Dec 2004, unburnt

ULE01101 Sep 2007, burnt
Eucalyptus angulosa – Eucalyptus diversifolia Open Low Mallee over *Acacia myrtifolia, Hibbertia* sp. Glabriuscula (D.J.Whibley 9012), *Hypolaena fastigiata*

ULE01201 Sep 2004, unburnt
Eucalyptus cladocalyx Woodland over *Babingtonia behrii, Xanthorrhoea semiplana, Hibbertia* sp. Glabriuscula (D.J.Whibley 9012), *Opercularia scabrida, Neurachne alopecuroidea*

ULE01201 Dec 2004, unburnt

ULE01201 Sep 2007, burnt
Eucalyptus cladocalyx Woodland over *Babingtonia behrii*, *Astroloma conostephioides*, *Hibbertia* sp. Glabriuscula (D.J.Whibley 9012), *Opercularia scabrida*



WAN00101 Sep 2004, burnt
Xanthorrhoea semiplana – Melaleuca uncinata – Babingtonia behrii Low Shrubland over *Hibbertia* sp. Glabriuscula (D.J.Whibley 9012), *Prostanthera spinosa*, *Opercularia scabrida*

WAN00201 Dec 2004, burnt
Acacia rupicola – Callistemon rugulosus – Babingtonia behrii Shrubland with emergent (mostly dead) *Allocasuarina verticillata*

REFERENCES

Brandle, R., Lang, P.J. & Canty, P.D. (2009, in prep.). '*Vegetation*.' In '*A Biological Survey of Eyre Peninsula, South Australia*.' (Ed. Brandle, R.), (Science Resource Centre, Department for Environment and Heritage, SA).

Crocker, R.L. (1946). An introduction to the soils and vegetation of Eyre Peninsula, South Australia. *Trans. Roy. Soc. S. Aust.* 70(1): 83-107.

Davies, R.J.-P. (1995). '*Threatened plant species management in National Parks & Wildlife Act reserves in South Australia*.' 184 pp. (Black Hill Flora Centre: Athelstone).

Department for Environment & Heritage (2006). '*Overall Fuel Hazard Guide for South Australia First Edition April 2006.*' (Fire Management Section, Regional Conservation, SA Department for Environment and Heritage).

Forward, L.R. and Robinson, A.C. (eds) (1996). 'A biological survey of the South Olary Plains, South Australia, 1991 – 1992.' (Biological Survey and Research, Natural Resources Group, Department of Environment and Natural resources, SA.)

Heard, L. and Channon, B. (Eds.) (1997). *'Guide to a Native Vegetation Survey (Agricultural Region) Using the Biological Survey of South Australia Methodology'*. (Geographic Analysis and Research Unit, Information and Data Analysis Branch, Department of Housing and Urban Development).

Muir, B.G. (1977). '*Biological Survey of Western Australian Wheatbelt. Part 2– Vegetation and habitat of Bendering Reserve '*. Records of the Western Australian Museum. Supplement No: 3. (WA Museum, Perth).

Owens, H. (Ed.) (2000). *'Guidelines for Vertebrate Surveys in South Australia Using the Biological Survey of South Australia'*. (Biological Survey and Research Section, National Parks and Wildlife SA, Department for Environment and Heritage).

Smith, D.F. (1963). The plant ecology of lower Eyre Peninsula, South Australia. *Trans. Roy. Soc. S. Aust.* 87: 93-120.

Specht, R.L. (1972). '*The Vegetation of South Australia. (second Edition)*' (A.B. James, Government Printer: Adelaide).