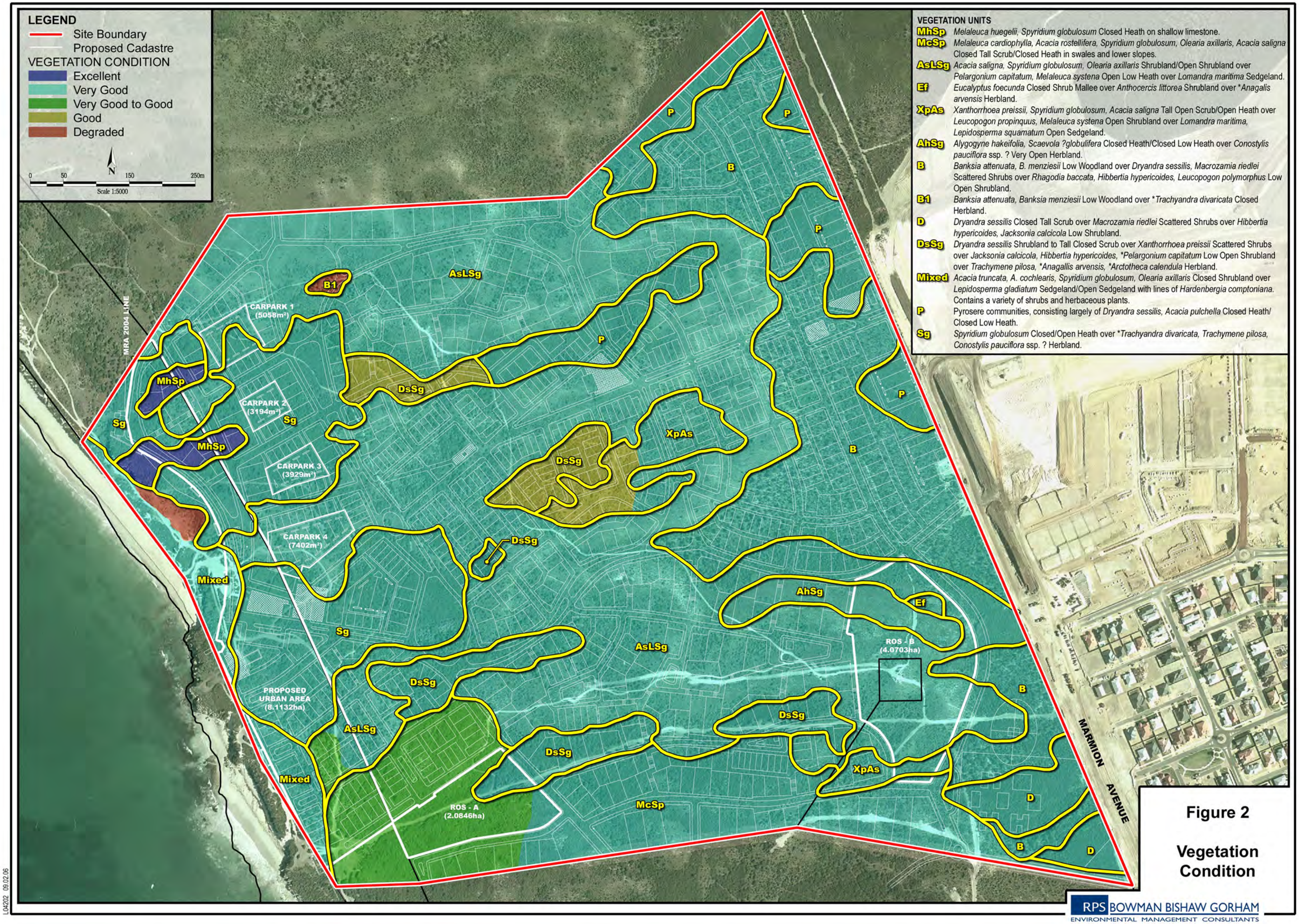

Figure 2

Vegetation Condition

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L04202 09.02.06

APPENDIX A

FCT Analysis, EA Griffin and Associates.

1.0 INTRODUCTION

1.1 Purpose of this report

The current report is intended to help clarify the assignment of Floristic Community type (FCT) designation to vegetation community (site) data. FCTs were defined by Gibson et al (1994) based on site data collected from vegetation on the Swan Coastal Plain. In particular, the potential that a Threatened Ecological Community (English and Blyth 1997) is represented by the data collected needs to be clarified.

1.2 Location of Jindalee Sites

The sites were apparently from the coastal dunes in the northern metropolitan area.

1.3 Brief background to floristic analysis of vegetation on the Swan Coastal Plain

Floristic analysis (ie., analysis of variation in vegetation based on the species present, rather than description of structural variation and dominance) as a significant component of the understanding of the variation present in the native vegetation of the Swan Coastal Plain dates to Gibson *et al* (1994 – all references to the SCP survey in the current report refer to this publication), the first publication to document the floristics of the vegetation of a large part of the Swan Coastal Plain. While the SCP survey is based on a very significant amount of work, it must be viewed as a "first pass" survey, limited, in the context of the great variety of vegetation present in the very large area surveyed, by the relatively limited number (509) of sites (quadrats) it is based on. To a limited degree, this limitation has subsequently been addressed in an "update" to the work of the SCP survey (which describes additional units). However, there is no detailed publication of the results of this update available and the additional data used are not readily available in an appropriate form (ie., one that would enable ready comparison of new data to the overall data set).

The units described by the SCP survey are a series of "floristic community types", a "unit" whose rank is defined by the use within a study. The SCP survey surveyed a very large survey area and defined a relatively small number of floristic community types. Consequently, the floristic community types they have described are of a very high order (see Trudgen 1999, volume 1, for further discussion of this point). This is an extremely important point to fully grasp in interpreting the analysis presented by the SCP survey and in understanding the meaning of analysis of other data sets when they are compared to the floristic community types of the SCP survey.

The important effects of the limited size data set used by the SCP survey and of the relatively small number of floristic community types defined by them, can be summarised by the following points:

1. the definition of all but two of the Threatened Ecological Communities for vegetation on the Swan Coastal Plain (English and Blyth 1997) has been based on the floristic community types of the SCP survey. It therefore follows, that with two exceptions, only vegetation units from one study that are different at a very high order of floristics are treated as rare by Government. No account is taken of other important differences, such as differences in structure and dominance;

2. for the definition of floristic community types to be robust, a sufficient sized database is needed to give adequate precision in their definition. About half of the floristics community types (or sub types) of the SCP survey are based on less than 10 sites. It is likely that with a larger data set there would be significant alteration in the classification of those floristic community types from the SCP survey based on small numbers of sites.

3. as noted above, many (if not most) of the floristic community types defined by the SCP survey are very broad. They contain very significant variation in floristics, structure and dominance. Some (or in more highly cleared parts of the Swan Coastal Plain much) of this variation may be rare by any reasonable definition, but it is currently "buried" within larger groups;

4. there is likely to be significant variation not sampled by the SCP survey. This includes some variation at a high level of floristic difference (see Trudgen 1999, volume 1, for an example of this) and undoubtedly quite significant (large!) amounts of variation at "medium" and "low" levels.

5. the document, and its use by Government, has focussed attention in the environmental impact assessment process on the high level of units described, deflecting attention from the layers of variation beneath these units that also have significant conservation value.

From these points it is obvious that there is a need for a major "upgrade" to the floristic analysis of the vegetation of the Swan Coastal Plain to provide a more detailed floristic classification that considers not only more of the variation present, but explicitly recognises more of the variation present in formally described units.

Obviously, such a reworking would have some effect on what vegetation is considered rare on the Swan Coastal Plain. It needs to be stressed that it would be very unlikely to find that any of the vegetation currently considered to be rare on the basis of the SCP survey*'s* classification was not rare. On the other hand, it is likely that such a review would very probably consider to be rare some vegetation which is not currently considered rare.

1.4 Data provided

It is very important in comparing different sets of floristic data that they are comparable in the application of names, in the intensity of the survey (ie., the effort of searching resulting in similar proportion of the flora at sites being recorded) and in the size of the site recorded. If the data from different data sets is not comparable in these ways, it reduces the clarity of the results of the analyses carried out. If the discrepancy in the comparability of the data sets is large, the results may become meaningless.

The releves had about a quarter the number of species recorded in the quadrats provided. Thus, an analysis with the releves is unlikely to provide reliable interpretation. While preliminary scanning suggested that the quadrats appeared to have a reasonable number of species, an inspection of the Appendix suggested that there were probably a number of small generally annual species that may have been not recorded. These include species from Triglochin, Isolepis, Parietaria, Calandrinia,

Stellaria, Apium and Hydrocotyle. If true, there will be some influence on the interpretation by recording quality.

2.0 METHODS

2.1 Data Preparation

The data from the Jindalee quadrats and releves were provided in a spreadsheet table. These were incorporated into a standard MS Access based database designed for this type of data. One virtue of the database is that the species recorded at each site are stored against standard codes (numbers, those used by the Western Australian Herbarium) for each species. This facilitates ready comparison of data from different surveys stored in the same system.

After the data were incorporated into the database, a process of reconciliation of flora species names with those used in the SCP survey was undertaken. This step was necessary at least because of changes in nomenclature over the last ten years and the potential of survey specific variations in the application of names. The reconciliation involved:

- reducing some infra-specific names to the relevant species name, and
- combining some taxa where confusion is known to have occurred in field observations and identifications.

The reconciliation process was relatively straight forward as most of the names had already been standardised. Most reconciliation was to conform with the methods that the SCP survey used to manage confusing taxa plus some nomenclatural changes.

2.2 Comparability of datasets

It was concluded that the quadrat datasets were probably reasonably compatible in nomenclature but there appeared to be few taxa overlooked in the quadrats and many in the releves.

2.3 Comparisons made

Two separate data sets were analysed; one with quadrats and one with quadrats and releves. This was because it was feared that the presence of the (poor quality) releves might disrupt the classification and increase the difficulty in making a fair interpretation of the quadrats. The analysis of both was only to provide an indication of what the releves might relate to.

The data threrfore from the four quadrats plus the 509 sites from the SCP survey of the southern part of the Swan Coastal Plain (south of Gingin) were combined. This enabled various analyses to be performed.

The main purpose was intended to assign the individual sites to the Floristic Community Types (FCTs) defined in the SCP survey. These data are provided in BBG_JIN.mdb.)

2.4 Analyses carried out

The approach was the use of numerical classification techniques (PATN) based on the similarity of the floristic composition of the Jindalee quadrats (or releves) to sites in the SCP survey data set.

2.4.1 PATN

Several modules of the numerical classification package PATN (Belbin 1987) were used for the analyses. The parameter values were the same as used by the SCP survey used to ensure consistency of analysis with that study.

The PATN modules used were ASO (calculation of similarity matrix), FUSE (classification based on the results of ASO), DEND (representation of classification) and NNB (determination of sites most similar to each site – nearest neighbours). The results of the analyses were imported into a database (BBG_JIN.mdb) so that site characteristics and previous classifications (eg., Floristic Community Types derived in earlier classifications) could be associated and various analyses based on these data could be performed.

The assignment of floristic community types to the Jindalee quadrats was made by summarising the results of two different methods:

- the classification, and
- the ten nearest neighbours.

Experience demonstrates that the results of these are likely to vary, but that from nearest neighbours is likely to make more sense for it is not directly influenced by group membership.

To the classification dendrogram of the combined dataset the FCT assigned by the SCP survey was associated with the SCP survey sites. The apparent FCTs were assigned to the Jindalee quadrats by interpreting the position of these sites in the dendrogram (particularly by the way they joined to the SCP sites.

The 10 sites in the combined data set that were most similar to each of Jindalee quadrats were obtained from the nearest neighbour method (NNB). By associating those nearest neighbours from the SCP survey, the most likely FCTs for each of the Jindalee quadrats were determined.

An attempt was then made to reconcile these different assignments of a Floristic Community Type.

3.0 LIMITATIONS

It has been found in earlier projects that the addition of new sites to the SCP survey data set to produce a combined classification disrupts the original classification. The more data added, the higher the level of the disruption. This problem can make it difficult to assign Floristic Community Types to new sites using this method.

Secondly, it is common for new data to group to their cohorts. In some cases this has proven to result from common deficiencies in the data, ie. whole groups of species missing. This absence tend to draw them together. The more sites in the added batch, the tighter they draw together.

The analyses are conducted without personal knowledge of the sites and no photographs were provided.

4.0 RESULTS

4.1 Determination of floristic community type by classification

The emphasis in the interpretation is on the quadrats. A brief presentation is made at the end on the results from the releve analysis.

The classifications indicated that the quadrats appeared to be the same plant community being located in one part of the dendrogram (Figure 1)

Figure 1. Relevant portions of Dendrogram

```
                          05/23/05  05:50:50.96 dend  Jindalee SCP Sites 22May05
                          0.2050      0.3656      0.5261      0.6867      0.8472      1.0078
                          |           |           |           |           |           |
BURN-1    29a   41        )
SEAB-8    29a   47        )                     |
Jin1        34            )                           |
SEAB-4    29a   63        )_______________             |
SEAB-5    29a   56        )               |           |
NAVB-2    29a   50        )                                 |
Jin2        40            )_______                            |
Jin3        46            )      |                            |
Jin4        41            )                 |                |
BURN-2    29a   25        )_____________________________________|____
```

This portion of the dendrogram includes 6 of the 9 SCP quadrats assigned to 29a. This indicates that the presence of the Jindalee sites had a disruptive effect on the classification. The Jin1 grouped with bulk of 29a. Jin2, 3 and 4 appeared a bit removed from 29a, but so did the SCP site BURN-2.

4.2 Determination of floristic community type using Nearest Neighbour method

The nearest neighbour analysis suggests that the quadrats belong to different communities even though they were more similar to each other than any other sites by a modest amount. Some of the similarity values for sites from the SCP data sets were low enough (values less than about 0.55) to give confidence in the analysis (Table 1).

The similarity of the Jindalee quadrats with the FCT quadrats is generally lower than would allow confident assignment to a FCT. Jin1 and Jin2 appeared to be probably FCT 29a but is modestly similar to some 29b quadrats. Jin3 appeared related to FCT 29b or 24 and Jin4 appeared related to 24, 29b or 29a. For Jin3 and 4 the similarity values were not as strong to have confidence that they belonged to a particular FCT.

It needs to be appreciated that some SCP quadrats appear transitional between FCTs so some of the above ambiguity is to be expected.

Table 1. Results of Nearest Neighbour analysis

s	s1	v1	s2	f2	v2	s3	f3	v3	s4	f4	v4	s5	f5	v5
Jin1	Jin4	0.4933	BURN-1	29a	0.52	PB-4	29b	0.5313	SEAB-5	29a	0.5333	Jin3		0.55
Jin2	Jin3	0.2791	Jin4		0.3827	BURN-1	29a	0.5062	PB-4	29b	0.5143	PB-3	29b	0.5455
Jin3	Jin2	0.2791	Jin4		0.4253	PB-4	29b	0.5263	MTB-2	24	0.5294	Jin1		0.55
Jin4	Jin2	0.3827	Jin3		0.4253	Jin1		0.4933	MTB-2	24	0.5	BURN-1	29a	0.5366

Table 1 (cont)

s	s6	f6	v6	s7	f7	v7	s8	f8	v8	s9	f9	v9	s10	f10	v10
Jin1	SEAB-2	29b	0.555	SHE-5	26a	0.5696	NWIL-3	29b	0.5775	PB-5	29b	0.5932	Jin2		0.5946
Jin2	SEAB-3	29b	0.552	cool 08	24	0.5676	PB-2	29b	0.5714	cool 02	24	0.5714	NWIL-1	29b	0.5789
Jin3	PB-3	29b	0.555	BURN-1	29a	0.5632	WHILL-1	29b	0.5682	cool 02	24	0.5789	NWIL-1	29b	0.5854
Jin4	cool 08	24	0.573	PB-4	29b	0.5775	NEER-1	24	0.5862	cool 02	24	0.6056	WHILL-5	26b	0.6082

s – the site being compared
s1 to s10 – the 1st to 10th most similar sites
f1 to f10 – the FCT of the similar sites (only for SCP sites)
v1 to v10 – the dissimilarity value between the site and the similar sites (values above 0.6 tend to indicate low similarity)

4.3 Combining the results

It is common for the classification to indicate a simple result and the nearest neighbour analysis to be less conclusive. This is more a product of the classification process than of inconsistency of the analyses.

The different results are quite consistent, however, the message from the nearest neighbour is probably clearer. The quadrats are largely FCT29 and probably 29a fro Jin 1 and Jin2. The others are probably closer to 29a but could be 29b or 24.

The apparently unrecorded annual species may have had an influence on the analysis and caution must be taken in using these interpretations.

4.4 Releves

The releves had just a minor effect on the classification of the quadrats. This is largely because they were quite different from the quadrats.

All releves grouped together and ended in a new cluster somewhat related to FCTs 29 and 30. In doing so they draw the BURN-2 quadrat away from 29a. This result is largely not useful except for confirming that they are coastal communities.

The relationship of the releves to each other is not easy to determine from these analyses. This is hardly surprising as they had so few species.

Figure 2 Relevant portions of Dendrogram for data set including releves

site	FCT	no	data
			05/23/05 05:58:39.31 dend Jindalee SCP Sites all 22May05
			0.2050 0.3656 0.5261 0.6867 0.8472 1.0078
			| | | | | |
BURN-1	29a	41	)_____
SEAB-8	29a	47	)_____|_____
Jin1		34	)_____|_
SEAB-4	29a	63	)_____ |
SEAB-5	29a	56	)_____|_____|____
NAVB-2	29a	50	)_____|_____
Jin2		40	)_____ |
Jin3		46	)_____|_____ |
Jin4		41	)_____|_____|_____
NPRES-1	29b	46	)_____ |
WHILL-1	29b	42	)_____|_____ |
NWIL-1	29b	36	)_ | |
NWIL-3	29b	37	)|_____ | |
SEAB-7	29b	50	)_____|__ | |
SEAB-2	29b	47	)_____ | | |
SEAB-3	29b	45	)_____|_____|__|_____ |
PB-2	29b	30	)_____ | |
PB-4	29b	30	)_____|____ | |
PB-5	29b	25	)_____|__ | |
PB-3	29b	26	)_____|_____ | |
WHILL-2	29b	21	)_____|_____|__ |
TRIG-1	29b	25	)_____|_____|_____
BURN-2	29a	25	)_____ |
JinR1		8	)_____ | |
JinR2		8	)_____|_____ | |
JinR5		8	)_____|_____ | |
JinR4		7	)_____|____| |
JinR3		10	)_____||_____ |
GARDEN-1	30a	20	)_____ | |

5.0 REFERENCES

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APPENDIX

Tabulation of Species by Quadrats for Jindalee Quadrats and selected ones from SCP selected from Dendrogram (Figure 1)

FCode	name	BURN-1	SEAB-8	Jin1	SEAB-4	SEAB-5	NAVB-2	Jin2	Jin3	Jin4	BURN-2
026	Triglochin calcitrapum		Y			Y					
026	Triglochin trichophorum		Y								
031	Aira caryophyllea/cupaniana group	Y			Y						
031	Austrodanthonia acerosa		Y								
031	Austrodanthonia occidentalis				Y	Y					
031	Austrostipa flavescens	Y	Y	Y	Y	Y	Y	Y	Y		Y
031	Avena barbata/fatua						Y			Y	
031	Briza maxima						Y				
031	Bromus arenarius				Y			Y	Y	Y	
031	Bromus diandrus	Y	Y	Y		Y	Y	Y	Y	Y	
031	Bromus rubens							Y			
031	Catapodium rigidum	Y		Y			Y	Y	Y	Y	
031	Ehrharta longiflora	Y	Y							Y	Y
031	Lagurus ovatus	Y	Y				Y				
031	Lolium rigidum						Y				
031	Poa drummondiana				Y	Y					
031	Poa poiformis/porphyroclados	Y	Y		Y	Y	Y				
031	Poa serpentum			Y				Y	Y	Y	
031	Sporobolus virginicus										Y
031	Vulpia bromoides								Y		
031	Vulpia myuros	Y	Y		Y			Y			
032	Carex preissii					Y					
032	Isolepis cernua						Y				
032	Isolepis marginata	Y			Y						Y
032	Isolepis nodosa						Y				Y
032	Lepidosperma angustatum/squamatum				Y						
032	Lepidosperma sp. (Coastal terete BJK &			Y						Y	
032	Lepidosperma squamatum							Y	Y	Y	
039	Desmocladus flexuosus	Y		Y	Y	Y	Y	Y	Y	Y	
054C	Acanthocarpus preissii	Y	Y	Y	Y	Y	Y		Y		
054C	Lomandra maritima	Y		Y	Y	Y	Y	Y	Y	Y	
054D	Xanthorrhoea preissii									Y	
054E	Dianella revoluta				Y						
054F	Thysanotus arenarius				Y						
054F	Thysanotus patersonii/manglesianus		Y	Y	Y	Y			Y		
054F	Thysanotus sparteus					Y					
054F	Tricoryne elatior	Y				Y		Y		Y	
054G	Trachyandra divaricata				Y	Y					
054J	Wurmbea dioica								Y		
055	Conostylis aculeata	Y						Y	Y	Y	Y
055	Conostylis pauciflora		Y		Y	Y		Y			
060	Romulea rosea	Y					Y	Y	Y	Y	
066	Caladenia latifolia				Y	Y					
066	Monadenia bracteata						Y				
088	Parietaria debilis	Y	Y		Y	Y					
090	Dryandra nivea					Y	Y				
090	Dryandra sessilis			Y							Y
090	Grevillea thelemanniana subsp. preissii					Y	Y		Y		
092	Santalum acuminatum				Y						
105	Rhagodia baccata subsp. baccata	Y	Y	Y	Y	Y	Y			Y	

105	Threlkeldia diffusa		Y			Y	Y				
110	Carpobrotus edulis						Y				
110	Carpobrotus virescens					Y					Y
110	Tetragonia decumbens						Y				
111	Calandrinia calyptrata		Y		Y		Y				
111	Calandrinia corrigioloides				Y						Y
111	Calandrinia liniflora			Y						Y	
113	Arenaria serpyllifolia	Y									
113	Cerastium glomeratum	Y			Y	Y	Y			Y	
113	Minuartia hybrida								Y	Y	
113	Petrorhagia velutina						Y		Y	Y	
113	Sagina maritima					Y	Y				
113	Silene gallica						Y				
113	Stellaria media						Y				Y
131	Cassytha aurea				Y						
131	Cassytha flava							Y	Y		
131	Cassytha glabella				Y						
131	Cassytha racemosa			Y	Y	Y	Y				Y
138	Heliophila pusilla				Y	Y		Y	Y	Y	
138	Lepidium rotundum		Y								
138	Stenopetalum robustum				Y						
149	Crassula colorata	Y		Y	Y	Y	Y	Y	Y		Y
149	Crassula glomerata	Y	Y	Y			Y	Y	Y	Y	Y
149	Crassula peduncularis					Y					
163	Acacia cyclops	Y			Y				Y		
163	Acacia lasiocarpa		Y		Y						
163	Acacia saligna							Y	Y	Y	
163	Acacia truncata			Y							
165	Chorizema varium				Y	Y					
165	Gompholobium tomentosum				Y	Y		Y	Y		
165	Hardenbergia comptoniana	Y	Y	Y	Y	Y			Y		Y
165	Isotropis cuneifolia								Y		
165	Kennedia coccinea						Y				
165	Kennedia prostrata							Y	Y	Y	
165	Melilotus indicus	Y				Y	Y				
165	Nemcia reticulata	Y	Y		Y	Y	Y	Y	Y		
165	Templetonia biloba		Y								
165	Templetonia retusa	Y		Y	Y	Y					
165	Trifolium arvense					Y					
165	Trifolium campestre			Y						Y	
167	Erodium botrys								Y	Y	
167	Erodium cicutarium					Y					
167	Geranium molle			Y							
167	Pelargonium capitatum	Y						Y		Y	Y
173	Zygophyllum fruticulosum		Y								
183	Comesperma confertum				Y						
185	Euphorbia peplus						Y				
185	Phyllanthus calycinus							Y	Y	Y	
185	Poranthera microphylla		Y	Y							
207	Diplopeltis huegelii								Y		
215	Cryptandra mutila							Y			
215	Spyridium globulosum	Y	Y	Y	Y	Y		Y	Y	Y	Y
215	Trymalium albicans				Y	Y					
223	Thomasia cognata		Y			Y					
223	Thomasia triphylla			Y							
226	Hibbertia racemosa							Y	Y		
226	Hibbertia spicata subsp. leptotheca				Y						
236	Frankenia pauciflora						Y				

243	Hybanthus calycinus							Y			
263	Pimelea calcicola				Y						
263	Pimelea ferruginea								Y		
273	Calothamnus quadrifidus										Y
273	Chamelaucium uncinatum					Y					
273	Melaleuca acerosa			Y	Y	Y		Y	Y	Y	
273	Melaleuca cardiophylla	Y	Y								
273	Melaleuca huegelii			Y	Y	Y	Y				Y
281	Apium annuum	Y					Y				
281	Apium prostratum						Y				
281	Daucus glochidiatus	Y	Y		Y			Y		Y	Y
281	Homalosciadium homalocarpum				Y						
281	Hydrocotyle hispidula		Y		Y	Y					
281	Hydrocotyle tetragonocarpa		Y			Y					
281	Trachymene pilosa	Y	Y	Y	Y	Y		Y	Y	Y	Y
288	Leucopogon insularis							Y	Y		
288	Leucopogon parviflorus	Y	Y	Y	Y		Y	Y	Y	Y	
288	Leucopogon racemulosus				Y						
293	Anagallis arvensis	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
302	Phyllangium paradoxum		Y								
303	Centaurium erythraea						Y				
307A	Cuscuta epithymum			Y	Y	Y				Y	
313	Hemiandra pungens/linearis		Y					Y	Y		
313	Westringia dampieri		Y								
315	Solanum nigrum										Y
316	Bellardia trixago				Y		Y				
316	Dischisma arenarium				Y	Y		Y	Y	Y	Y
316	Parentucellia latifolia				Y						
316	Parentucellia viscosa						Y				
320	Orobanche minor		Y		Y	Y	Y		Y		
326	Eremophila glabra	Y	Y		Y		Y				
326	Myoporum insulare		Y			Y					
331	Galium murale	Y					Y				
331	Opercularia vaginata		Y		Y	Y			Y		
340	Lobelia tenuior									Y	
341	Scaevola crassifolia	Y	Y								Y
341	Scaevola thesioides		Y	Y	Y	Y					
343	Stylidium junceum				Y						
345	Gnaphalium indutum		Y								
345	Helipterum corymbosum	Y									
345	Hypochaeris glabra			Y		Y				Y	
345	Leptorhynchos scabrus				Y						
345	Millotia tenuifolia				Y	Y				Y	
345	Olearia axillaris	Y	Y	Y				Y	Y	Y	Y
345	Podolepis canescens							Y			
345	Podotheca angustifolia		Y								
345	Podotheca gnaphalioides							Y	Y	Y	
345	Senecio lautus	Y	Y	Y	Y	Y	Y	Y	Y		
345	Sonchus asper						Y				
345	Sonchus oleraceus	Y	Y	Y		Y	Y			Y	
345	Vellereophyton dealbatum						Y				

APPENDIX B

Tables of Significant Flora from the Broader Alkimos Area (AS Weston)

APPENDIX A

Significant Flora
with Distributions which may include the Broader Alkimos Area
(compiled August 2004 – January 2005)

Introduction

Table A1 lists 12 taxa (species, subspecies, varieties, forms) of Declared Rare and Priority Flora recorded in the broader vicinity of Alkimos, and Table A2 lists 13 other significant taxa (plus four of the Priority Flora taxa listed in Table A1), most of which had been recorded in Alkimos.

Table A1 - Declared Rare and Priority Flora Taxa with Distributions which may include the Broader Alkimos Area (August 2004 - January 2005)

Table A1 also has information about conservation codes of the listed taxa, and localities where they have been recorded and their distributions, growth forms, habitats and flowering times. The basic table was compiled from results of searches of three databases carried out by the Wildlife Branch of Department of Conservation and Land Management in August 2004. These three Department of Conservation and Land Management (CALM) databases are *Threatened (Declared Rare) Flora, Declared Rare and Priority Flora List* and *Western Australian Herbarium Specimen* (WAHERB). The searches were for Declared Rare and Priority Flora taxa. The parameters used for the searches are:

Coordinates:	31^33'00" - 31^44'00" and 115^37'00" – 115^43 (requested 115^42'30")
Names:	Alkimos, Clarkson, Burns, Butler, Eglington (also searched for 'Eglinton'), Jindalee, Merriwa, Mindarie, Quinns, Yanchep

The results of the searches are 13 taxa of Declared Rare and Priority Flora.

The printouts of CALM rare flora database search results provided some information for Table A1 about conservation codes, localities and distributions, plant feature, habitats and flowering times. Additional information for the tables was obtained from examination of herbarium specimens and their labels in the Western Australian Herbarium, consultations with other botanists and information in various publications, principally Paczkowska and Chapman (2000), Atkins (2004), Marchant *et al.* (1987), Olde and Marriott (1995), Brown *et al.* (1998), Hopper *et al.* (1987) and Weston (2003). These references are listed in the report to which this is Appendix A.

The information about distributions, localities, growth forms, habitats and flowering times is not always comprehensive. For instance, the localities are often selections and do not include all of the localities given for a listed species in the CALM printouts, which are often, if not usually, also only selections. Information about habitat and growth form is at least indicative and should be useful in assessing how likely rare flora is to occur in particular habitats and at particular locations in the Alkimos study area and distinguishing it in the field.

Table A2 - Significant Flora which have been recorded in the Alkimos (and Eglinton) Area

Table A2 is based upon the Significant Flora Legend list of 17 taxa that is on ATA Environmental (2004) vegetation maps of Alkimos and Eglinton, and it lists the numbers used there to indicate locations on the maps where these taxa were recorded. The table gives *Bush Forever* significance codes for the 11 of the taxa that are listed in Table 13 of *Bush Forever* (Volume 2, pp. 51-55). The table also has three other taxa that are listed in the *Bush Forever* description of Bush Forever Site 397 as significant ("typical of Tamala Limestone taxa": 'limestone taxon' in the table) and three other taxa that are listed by Trudgen and Keighery (1990a) as "Species of Particular Interest" ('tk' in the table). Four of the taxa in Table A2 are Priority Flora and are also listed in Table A1.

Discussion

Bush Forever also lists a few other taxa as being significant or as typical of Tamala Limestone, including, on p. 383, *Melaleuca huegelii*, *Jacksonia calcicola* and *Acacia xanthina*, and Trudgen and Keighery (1990a, pp. 10-12, and Appendix 2a in ATA Environmental 2003) and ATA Environmental (2003, pp. 58-60) list a few taxa as "Species of particular interest" and "Other Significant Flora", respectively.

During field work done for preparation of the ATA Environmental (2004) maps, Bennett (pers. comm. 2005) recorded 16 of the 17 taxa of significant flora listed in Table A2, including three Priority Flora taxa that are in the results of the CALM database searches. She did not find the *Crassula*.

The name '*Grevillea elongata*' was in the results of the search of the *Declared Rare and Priority Flora List* database, for the name 'Butler', but this species was not entered in Table A1 because it is restricted to the Ruabon-Busselton area (Olde and Marriott 1995, Volume 2), including Butler State Forest.

The name '*Astroloma microcalyx*' (P2) should probably not be in Table A1. Though *Astroloma microcalyx* has been a species since 1845, it did not become conservation coded, as Priority Two, until October 2002, after *Astroloma* sp. Yalgorup had been submerged into *Astroloma microcalyx*. Apparently, by oversight, the conservation code of *Astroloma* sp. Yalgorup was transferred to *Astroloma microcalyx*. *Astroloma microcalyx* has been much better collected south of Fremantle, especially in the Yalgorup area, since 1997, when Trudgen (1997) wrote that it had not previously been recorded south of the Fremantle area.

The name '*Thomasia triloba*' should not be Table A1 either. Its inclusion in the results of the CALM rare searches is based upon misidentified collections of *Thomasia triphylla* from the Yanchep area. *Thomasia triloba* is restricted to very few areas on the south coast (Bennett pers. comm. 2005).

Bush Forever (2000, Volume 2, pp. 51-57) describes ways in which flora may be significant and lists, in the publication's Table 13, 178 vascular plant taxa (species, subspecies, varieties and forms) in the Swan Coastal Plain part of the Perth Metropolitan Region which are considered to be significant. These are considered significant because they are rare, poorly known or restricted in distribution or for reasons related to aspects of geographical variation or limits and regional ecological preferences. The taxa listed include Declared Rare Flora and Priority Flora taxa. Also, in descriptions of some individual Bush Forever sites, *Bush Forever* lists some taxa not in Table 13 as significant, for instance taxa that are typical of limestone.

Atkins (2004) lists all taxa in Western Australia currently designated as Priority and Declared Rare Flora and gives definitions of the various categories of Declared Rare and Priority. Department of Conservation and Land Management databases can be searched to provide listings of Priority and Declared Rare Flora for specific areas defined by sets of coordinates or by locality names.

ATA Environmental (2004) draft maps of vegetation units of the Alkimos and Eglinton areas list 17 significant species and indicate locations where 16 of them were found during the spring 2004 field work by Eleanor Bennett.

ATA Environmental (2003, pp. 39, 40, 42) recorded two taxa of Priority Three flora in limestone heath vegetation in ROS Amendment Area 5, but only in the vegetation type that ATA Environmental identified as corresponding to FCT 26a, MhMsAt. *Stylidium maritimum* was recorded by ATA only in their westernmost population of MhMsAt, outside of the buffer zones study area. *Hibbertia spicata* subsp. *leptotheca* plants were recorded by ATA Environmental in all three of their hilltop populations of *Melaleuca huegelii*, one of which is partly just inside the Site A buffer zone study area.

Trudgen and Keighery (1990) consider the *Stylidium* and eleven other taxa they found in Alkimos to be of particular interest. One of these 11, *Conostylis pauciflora* subsp. *euryrhipis*, is now Priority Flora (Priority 3) but appears to be largely restricted to Quindalup Dunes. The other taxa appear also to have been found in sandy habitats, and most appear to be of interest for taxonomic reasons, because they are rare or uncommon in Alkimos or because they are at the northern or southern ends of their distributions. Two of the 11, *Veronica* aff. *calycina* and *Petrophile serruriae* subsp. nov., are listed in Table 13 (*Bush Forever* 2000, Volume 2) as significant.

Definitions of Conservation and Significance Codes

CONSERVATION CODES

A summary of Department of Conservation and Land Management definitions of their DECLARED RARE AND PRIORITY FLORA LIST Conservation Codes (Atkins 2004), used in Table A1, is given below.

R: Declared Rare Flora – Extant Taxa
Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such.

1: Priority One – Poorly Known Taxa
Taxa which are known from one or a few (generally <5) populations which are under threat, . . . Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.

2: Priority Two – Poorly Known Taxa
Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat, . . . Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.

3: Priority Three – Poorly Known Taxa
Taxa which are known from several populations, and the taxa are not believed to be under immediate threat, . . . Such taxa are under consideration for declaration as 'rare flora', but are in need of further survey.

4. Priority Four – Rare Taxa
Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

SIGNIFICANCE CODES

A summary of *Bush Forever* (2000, Volume 2, pp. 51-55, Table 13) definitions of the Significance Codes used in Table A2 is given below. Some other taxa are listed in Bush Forever Site descriptions of Significant Flora, some of which are "typical of Tamala Limestone taxa" ('limestone taxon', 'lt'). Others are just 'significant'.

P2, P3 Priority 2 and 3: Poorly Known Taxa
e taxa endemic to the Swan Coastal Plain
p considered to be poorly reserved
r populations at the northern or southern limit of their known geographic range
s significant populations
X considered lost in the Perth Metropolitan Region

Other significance codes used in this report are:

lt limestone taxon, typical of Tamala Limestone taxon
tk not listed in *Bush Forever* (2000), but listed in Trudgen and Keighery (1990a; Section 3.4 Species of particular interest); also see ATA Environmental (2003, pp. 58-60).

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Table A1 - Declared Rare and Priority Flora Taxa with Distributions which may include the Broader Alkimos Area (August 2004 - January 2005)

WA-HERB	Threat. Flora	DRF & Priority Flora	Species Family	Cons. Code	Distribution and Localities	Growth Form. Habitat(s).	Flowering Times
1	-	x	*Astroloma microcalyx* * EPACRIDACEAE	P3	Yanchep – Yalgorup NP, Cervantes	Erect or straggling shrub 0.2–0.6 m tall; fls red, white. Sand over limestone.	Jun-Sep
3	-	-	*Comesperma acerosum* POLYGALACEAE	P3	Alkimos, Eneabba, Gairdner Range, Badgingarra, Lancelin	Glabr, rigid, erect peren. herb or shrub ~0.5 m tall; lvs linear, erect, pungent, strongly keeled; fls blu, ppl or ppl-red, keel petal horned. Sand over limestone, lateritic gravelly soils, sandplains, lateritic ridges. Alkimos area: dense coastal heath, mainly on limestone ridge slopes; collected in Nov 1996 by ecologia.	Sep-Dec
-	-	x	*Conostylis bracteata* HAEMODORACEAE	P3	Yanchep, Perth - Lancelin	~ to *C. pauciflora* (and to *C. aculeata* ssp. *cygnorum*) w. hybrids, but robust & *C. b.* stems are lnger, to 20 cm, and lvs lnger, 20- 50 cm, and wider, 4-10 mm. Coastal heath on sand, "usually in well-watered depressions in undulating dunes close to limestone" (Hopper *et al.* 1987, p. 74).	Jul-Sep
2	-	x	*Conostylis pauciflora* subsp. *euryrhipis* HAEMODORACEAE	P3	Alkimos, Yanchep-Cervantes, Lancelin, Seabird	Stoloniferous much-branched herb; infl capitulate cymose; fls yl, <10; scape simple, = or > lvs. ~ to *C. aculeata* but lvs narrower (<2.5 mm), 6-18 (-35) cm long, green, sword-shaped, in flattened broadly fan-shaped clusters, with soft, short, tomentose, fewer marginal bristles. "Common in heath on consolidated dunes between Cervantes and Yanchep" (Hopper *et al.* 1987, p. 80).	Jul -Oct
1	2	x	*Eucalyptus argutifolia* MYRTACEAE	R V,V	Yanchep-Jurien, W of Lake Clifton	Yanchep Mallee. To 3 m tall; lvs thick, glossy; buds 7-11; frts ribbed. Over heath, on shallow sand on limestone ridges and slopes.	Mar-Apr
-	-	x	*Grevillea evanescens* PROTEACEAE	P1	Yanchep, Gingin-Lancelin, , mainly ~W of Gingin	Erect, 1-stemmed shrub to 4 m tall; lvs simple, 3-4 cm by 4-9 mm, entire, shortly mucronate, veins evident; fls on short, axillary side branches, 8-12, red, styles long, green-tipped. cf. *G. obtusifolia*. Brown calcareous Spearwood sandy soils on ridges in banksia woodland. Sometimes with *G. preissii*.	winter, spring -Oct
1	-	-	*Hibbertia spicata* subsp. *leptotheca* DILLINEACEAE	P3	Alkimos, Yanchep, Lancelin – Yalgorup NP, Burns Beach	Mound or semi-prostrate small shrub. Mainly limestone heath.	Sep-Nov (Jul-Dec)
-	-	x	*Lasiopetalum membranaceum* STERCULEACEAE	P3	Yanchep-Ludlow	Small shrub with cordate leaves. Sand, mainly over limestone and in tuart woodland.	Sep-Dec
-	-	x	*Lepdium pseudotasmanicum* BRASSICACEAE	P4	Yanchep, Wongan Hills–Esperance, eastern states	Herb to 50 cm tall. Various habitats, including tuart forest on sand over limestone.	Oct-Jun
-	-	x	*Sarcozona bicarinata* AIZOACEAE	P3	Alkimos, Yanchep, Lancelin, Esperance, S. Aust. (Eyre Penins)	Small erect or semiprostrate, annual or short-lived perennial shrubs, leaves often dull, dark red, triquetrous and densely covered with small warts or pelucid dots, flowers pale pink to white, styles 5 (to 4). Stabilised dunes or limestone; more common after fire.	Aug
1	-	-	*Stylidium maritimum* STYLIDIACEAE	P3	Alkimos, Yalgorup – Breton Bay, Cervantes, Nilgen	Tufted triggerplant; lvs narrow lanc., 20-40 cm long, 2-5 mm wide, often reddish in autumn, margins curved but not revolute; infl paniculate, 40-55 cm long (incl scape), densely glandular-pubescent; peduncles 3-6 flowered; corolla rse-pnk; ~ *S. caricifolium* and *S. affine* but allopatric. White coastal dunes and depressions in limestone; low coastal heath. See Lowrie, Coates and Kenneally (1998).	Sep-Dec
-	-	x	*Thomasia triloba* STERCULIACEAE	P3	Alkimos, Yanchep, Boranup – Walpole Nornalup, Esperance	Multi-stemmed, hispid shrub to 1.2 m tall; lvs 4-5 cm by ~ 2 cm, lobed, sprinkled w rigid stellate hairs, veins not prominent; stipules lobed or reniform; fls pnk-mauve (or cream), w/o petals. Calcareous sand, coastal limestone and dunes.	Jul-Nov

Columns 1 and 2: The numbers refer to numbers of specimen labels (in the first column) or populations (in the second column) in the printouts of CALM database search results.

***** *Astroloma microcalyx* should probably not be a Priority species (see **Introduction** for reasons why).

Table A2 - Significant Flora which have been recorded in the Alkimos (and Eglinton) Area

T&K 1990 a	BF Site 397	Number on ATA maps	Species / Family	Codes *Bush Forever* Table 13	Notes	Flowering Times
-	-	3	*Allocasuarina lehmanniana* CASUARINACEAE	s	A dominant in two ATA Environmental (2004) vegetation types. Alkimos/Eglinton	?
x	-	9	*Conospermum triplinervium* PROTEACEAE	p, s	Alkimos/Eglinton	Aug-Jan
x	x	17	*Conostylis. pauciflora* subsp. *euryrhipis*	P3, p, s	See Table A1. Listed on ATA Environmental (2004) maps of vegetation types as simply *Conostylis* sp. *C. teretifolia* subsp. *planescens* is in Trudgen and Keighery (1990a), but not *Bush Forever*, as significant, and as found in *Banksia* woodland. Alkimos	Jul -Oct
-	-	10	*Crassula colorata* var. *miriamiae* CRASSULACEAE	P2, ?X	Listed in *Bush Forever* Table 13 as subsp. instead of as var. Listed in tables on ATA Environmental (2004) maps of vegetation types as simply *Crassula colorata*, but it should have been deleted from there. Distribution given in Atkins (2004) is Perth, Stirling Range.	Aug-Oct?
-	x	15	*Diplopeltis huegelii* subsp. *huegelii* SAPINDACEAE	limestone taxon	Listed in tables on ATA Environmental (2004) maps of vegetation types as simply *Diplopeltis huegeli*. Ningana (listed in Trudgen and Keighery (1990b), but as *Diplopeltis huegelii*).	Aug-Nov
x	x	8	*Grevillea preissii* PROTEACEAE	limestone taxon	Listed in Trudgen and Keighery (1990a) as *Grevillea thelemanniana*. Alkimos	Jun-Sep
x	-	16	*Hibbertia spicata* subsp. *leptotheca*	P3, p, s, e	See Table A1. Listed in Trudgen and Keighery (1990a) as *Hibbertia spicata*. Listed in tables on ATA Environmental (2004) maps of vegetation types as simply *Hibbertia spicata*. Alkimos	Sep-Nov (Jul-Dec)
x	x	7	*Lechenaultia linarioides* GOODENIACAE	p	Alkimos	Mar / Jun-Dec
x	-	6	*Leptorhynchos scaber* ASTERACEAE	tk	Listed in Trudgen and Keighery (1990a) as *Leptorhynchos scabrus* and as significant. Listed in tables on ATA Environmental (2004) maps of vegetation types as *Leptorhynchos scabrous*. Alkimos	Aug-Dec
x	x	13	*Melaleuca cardiophylla* MYRTACEAE	r,s	Alkimos	Aug-Jan
x	-	12	*Persoonia comata* PROTEACEAE	tk	Listed by Trudgen and Keighery (1990a), but not in *Bush Forever*, as significant. Possibly Alkimos is at near the south end of its range. Alkimos	Nov-Feb
x	-	1	*Petrophile serruriae* subsp. nov ? PROTEACEAE	p, s, r	*Petrophile serruriae* subsp. nov. (GLK 11421), a pink-flowered form of *Petrophile serruriae* (the 'subsp.' is not now listed in the MAX database). Listed on ATA Environmental (2004) maps of vegetation types as simply *Petrophile serruriae*. Alkimos	Jul-Dec?
x	-	11	*Pimelea calcicola* THYMELEACEAE	s	Alkimos	Sep-Nov
-	-	14	*Sarcozona bicarinata*	P3, p, s	See Table A1. Listed in tables on ATA Environmental (2004) maps of vegetation types as *Carpobrotus* sp. Alkimos	Aug
x	-	2	*Stylidium* aff. *repens* STYLIDIACEAE	tk	Listed in tables on ATA Environmental (2004) maps of vegetation types as simply *Stylidium repens*. Alkimos	Jan-Dec?
x	x	5	*Stylidium maritimum*	P3, p, s	See Table A1. Listed on ATA Environmental (2004) maps of vegetation types and in Trudgen and Keighery (1990a) as *Stylidium maritima*. Alkimos	Sep-Dec
x	x	4	*Trymalium ledifolium* var. *ledifolium* RHAMNACEAE	limestone taxon	Listed in tables on ATA Environmental (2004) maps of vegetation types as *Trymalium ledifolium* var. *Ledifolium*, and in Trudgen and Keighery (1990a) as *Trymalium albicans*, "a species of particular interest". It is not in the current MAX database; it has been synonymised with *Trymalium ledifolium* var. *ledifolium*. Alkimos	Jul-Nov

Columns 2: Listed in *Bush Forever* description of Bush Forever Site 397 as significant there. **3:** The Eleanor Bennett and Significant Flora Legend number on the ATA Environmental (2004) Workplans 2a and 3a. **5:** 'tk' = not listed in *Bush Forever* (2000), but listed in Trudgen and Keighery (1990a); Section 3.4 Species of particular interest.

APPENDIX B

Limestone Floristic Community Types Species Table

Table B1 - Taxa to use in distinguishing FCTs 24, 26a, 26b and 27 from each other and other FCTs

(from Gibson *et al.* 1994, Table 12 (pp. 31, 35, 36), pp. 43-46 and Appendix 1; Note: this information may have been updated, though not printed or available, since 1994)

Taxon Name	**Species Group**	**Family**	**Form**	**Taxa Frequencies in Plots of Floristic Community Types**							**Number of other FCTs / =** (referred to in Gibson *et al*. (1994) as**:)**
				24	**26a**	**26b**	**27**	**29a**	**29b**	**other highest**	
Acacia lasiocarpa var. *lasiocarpa*	A	163	Sh vs	28	82	16	57	22	85	**30c**: 67	+ 7 other FCTs (incl. **19**: 33)
Acacia rostellifera	A	163	Sh m-t	32	9	16	--	11	54	**30b**: 38	+ 2 other FCTs (**19**: 33; **30a**: 29)
Acacia truncata	A	163	Sh s	8	36	--	86	--	15	--	in no other FCT
Acanthocarpus preissii	A	054C	He p	40	--	16	--	78	85	**30b**: 75	+ 4 other FCTs
Astroloma microcalyx	A	288	Sh vs	--	36	16	100	--	8	--	in no other FCT
Austrostipa compressa	Q	031	Gr p	--	55	42	--	--	--	**20c**: 78	+ 10 other FCTs / =*Stipa compressa*
Austrostipa flavescens	A	031	Gr p	56	91	42	--	78	92	**30b**: 63	+ 8 other FCTs / =*Stipa flavescens*
Conostylis candicans	A	055	He p	24	18	37	--	22	62	**30c**: 33	+ 2 other FCTs (**28**: 26; **30a**: 14)
Desmocladus flexuosus	Q	039	He p (gr)	72	100	79	100	44	92	**21a**: 69	+ 15 other FCTs / =*Loxocarya flexuosa*
Dianella revoluta	A	054E	He p	56	--	32	14	11	8	**30c**: 100	+ 13 other FCTs
Dryandra sessilis	A	090	Sh t	28	91	42	29	11	--	**30c**: 67	+ 2 other FCTs (**28**: 11; **30a**: 14)
Grevillea preissii	A	090	Sh vs	40	100	32	100	22	--	**30a**: 14	+ **28**: 3 / =*G. thelemanniana* subsp. *preissii*
Hibbertia spicata subsp. *leptotheca*	A	226	Sh vs	12	9	--	71	11	15	--	in no other FCT
Leucopogon parviflorus	A	288	Sh m	48	64	37	86	67	62	**18**: 100	+ 7 other FCTs
Lomandra maritima	A	054C	He p (gr)	64	45	37	86	44	92	**19**: 13	+ 2 other FCTs (**30a**: 14; **28**: 8)
Melaleuca huegelii	A	273	Sh m-t	12	82	11	29	44	--	**30a**: 14	in no other FCT
Melaleuca systena	A	273	Sh s-m	52	82	68	100	22	92	**30a**: 14	+ 7 other FCTs / =*Melaleuca acerosa*
**Petrorhagia dubia*	A	113	He a	68	9	26	--	11	--	**25**: 91	+ 5 other FCTs / =*Petrorhagia velutina*
Phyllanthus calycinus	A	185	Sh vs	56	45	47	--	--	62	**25**: 82	+ 9 other FCTs
Rhagodia baccata	A	105	Sh s-m	20	45	21	--	78	77	**30b**: 88	+ 5 other FCTs
Spyridium globulosum	A	215	Sh m-t	4	9	16	29	78	46	**30**: >85	(**30a**: 86, **30b**: 100, **30c**: 100) + **25**: 9
Stylidium maritimum	A	343	He p (gr)	--	73	5	--	--	8	--	in no other FCT
Templetonia retusa	A	165	Sh m	20	64	16	86	33	8	**30c**: 67	+ 4 other FCTs
**Trachyandra divaricata*	A	054G	He	4	--	5	--	22	--	**30b**: 63	+ 2 other FCTs (**30a**: 57; **25**: 9)
Trymalium ledifolium var. *ledifolium*	A	215	Sh s-m	4	91	11	71	22	8	**30a**: 14	+ 1 other FCT (**28**: 3) / =*T. albicans*?
**Vulpia myuros*	Q	031	Gr a	24	100	47	--	44	--	**18**: 50	+ 17 other FCTs

* Alien sp. **Form**: Gr (grass), He (herb), Sh (shrub). a (annual), p (perennial), gr (graminoid). vs (very small: <0.5m), s (small: 0.5-1m), m (medium: 1-2m), t (tall: 2-4m), vt (very tall: >4m)

FCT 26a *Melaleuca huegelii – M. acerosa* shrublands of limestone ridges (Spearwood)
FCT 26b Woodlands and mallees on limestone (Spearwood: Cottesloe unit)
FCT 27 Species poor mallees and shrublands on limestone (mainly Yalgorup area) (Spearwood)
FCT 24 'heaths' Northern Spearwood shrublands (with *Dryandra sessilis*)
FCT 29a Coastal shrublands on shallow sands (over limestone: Quindalup)
FCT 29b *Acacia* shrublands on taller dunes (Quindalup)
FCT 30a *Callitris preissii* (or *Melaleuca lanceolata*) forests and woodlands (Perth, Quindalup)
FCT 30b Quindalup [southern] tuart and / or peppermint woodlands
FCT 30c Other mallees & scrubs (Quindalup-Spearwood) (on Spearwood dunes: only three plots [1 *Eucalyptus argutifolia* and 2 *Dryandra sessilis* plots], near Swan estuary)

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APPENDIX C

Quadrat and Releve Data

PLOT AND RELEVE RECORDS FOR LOT 10 JINDALEE

Jin1

50J 0374806
UTM 6498513

Gentle midslope above limestone cliff.
Soil: Dark brown sand with organic matter.
Bare ground: 10%. Limestone outcrop possibly 15-20% of surface.
Condition: Excellent

Vegetation Description
Melaleuca huegelii, Spyridium globulosum Closed Heath on shallow limestone.

Species List
Melaleuca huegelii
Spyridium globulosum
Olearia axillaris
Cassytha racemosa forma racemosa
Templetonia retusa
Thomasia triphylla
Dryandra sessilis
Acanthocarpus preissii
Leucopogon parviflorus
Rhagodia baccata subsp baccata
*Geranium molle
Thysanotus patersonii
Crassula glomerata
Calandrinia sp. SW Coastal
*Trifolium campestre
*Anagallis arvensis
*Hypochaeris glabra
Crassulata colorata var colorata
Poranthera microphylla
Senecio pinnatifolius
Hardenbergia comptoniana
Austrostipa flavescens
Poa serpentum
*Sonchus oleraceus
*Bromus diandrus
Desmocladus flexuosus
Scaevola thesioides
Acacia truncata
Melaleuca systena

Jin2

50J 0375530
UTM 6498305

Midslope of stable dune approx 1.4 km from beach.
Soil: Light brown sand.
Bare Ground: 20%
Condition: Very Good – Excellent.

Vegetation Description
Acacia saligna, Spyridium globulosum, Olearia axillaris Open Heath over *Pelargonium capitatum, Melalauca systena* Shrubland over *Lomandra maritima, Conostylis pauciflora* subsp *pauciflora*.

Species List
Olearia axillaris
Spyridium globulosum
Acacia saligna
*Pelargonium capitatum
Melaleuca systena
Leucopogon insularis
Hybanthus calycinus
Austrostipa flavescens
Lomandra maritima
Conostylis pauciflora usbsp pauciflora P4
*Romulea rosea
Desmocladus flexuosa
Podotheca gnaphalioides
Trachymene pilosa
*Anagallis arvensis
Lepidospermum squamatum
Crassula colorata var colorata
*Vulpia myuros
*Bromus arenarius
*Heliophila pusilla
Phyllanthus calycinus
*Desmazeria rigida
*Bromus rubens
Cassytha flava
Crassula glomerata
Gastrolobium nervosum
Leucopogon parviflorus
Podolepis canescens
Kennedia prostrata

Jin3

50J 0374997
UTM 6498348

Upper northern midslope of stable dune approximately 250 metres from beach.
Soil: White sand.

Bare Ground: 15-20%
Condition: Good – Very Good

Vegetation Description
Spyridium globulosum, Olearia axillaris Open Shrubland over *Leucopogon insularis* Low Open Shrubland over *Lomandra maritima, Desmocladus flexuosus* Sedgeland.

Species List
Spyridium globulosum
Olearia axillaris
Leucopogon insularis
Lomandra maritima
Acacia saligna
Leucopogon parviflorus
Thysanotus patersoni
Opercularia vaginata
Hibbertia racemosa
Gastrolobium nervosum
Conostylis pauciflora subsp pauciflora
Pimelea ferruginea
Kennedia prostrata
Senecio pinnatifolius
Hardenbergia comptoniana
Acacia cyclops
Diplopeltis huegelii subsp huegelii
*Anagallis arvensis
Phyllanthus calycinus
*Romulea rosea
Melaleuca systena
Isotropis cuneifolia subsp cuneifolia
Crassula glomerata
Trachymene pilosa
Crassula colorata var colorata
*Heliophila pusilla
Desmocladus flexuosus
*Bromus diandrus
Wurmbea dioica
*Erodium botrys
*Petrorhagia dubia

Jin4

50J 0375877
UTM 6498012

Valley floor.
Soil: Grey-brown sand.
Bare ground: 15-20%.

Condition: Good – Very Good.

Vegetation Description
Xanthorrhoea preissii, Acacia saligna Open Heath with scattered *Spyridium globulosum* over *Melaleuca systena, Leucopogon parviflorus* scattered shrubs over *Lomandra maritima* sedgeland.

Species List
Xanthorrhoea preissii
Acacia saligna
Spyridium globulosum
Melaleuca systena
Leucopogon parviflorus
Rhagodia baccata subsp baccata
Lepidosperma ?pubisquameum
*Erodium botrys
Lomandra maritima
Lepidosperma squamatum
*Pelargonium capitatum
Calandrinia sp. SW Coastal
Olearia axillaris
*Dischisma arenarium
Millotia tenuifolia var tenuifolia
*Romulea rosea
*Anagallia arvensis
Crassula glomerata
*Ehrharta longiflora
Conostylis aculeata subsp. aculeata
*Bromus diandrus
*Trifolium campestre
*Hypochaeris glabra
Trachymene pilosa

RELEVES

JinR1
50J 0375132
UTM 6498005

Melaleuca cardiophylla, Spyridium globulosum Closed Scrub over **Anagallis arvensis, Trachymene pilosa, Desmocladus flexuosus* Open Herbland/Sedgeland.

Spyridium globulosum
Melaleuca cardiophylla
Trachymene pilosa
*Anagallis arvensis
Desmocladus flexuosus
Ficinia nodosa
*Ehrharta longiflora
Olearia axillaris

JinR2
50J 0375233
UTM 6497938

Melaleuca cardiophylla, Acacia rostellifera Closed Scrub over **Anagallis arvensis, Trachymene pilosa, *Ehrharta longiflora* Very Open Herbland/Grassland

Melaleuca cardiophylla
Acacia rostellifera
Spyridium globulosum
Rhagodia baccata subsp baccata
Dryandra sessillis
Trachymene pilosa
*Anagallis arvensis
*Ehrharta longiflora

JinR3
50J 0375075
UTM 6498065

Spyridium globulosum, Melaleuca cardiophylla, Acacia saligna, Olearia axillaris Tall Open Heath over *Leucopogon insularis, Melaleuca systena* Very Open Shrubland over *Desmocladus flexuosus, Conostylis aculeata* subsp. *aculeata, Lomandra maritima, Austrostipa flavescens* Sedgeland/Grassland.

Olearia axillaris
Spyridium globulosum
Melaleuca cardiophylla
Acacia saligna
Leucopogon insularis
Melaleuca systena
Lomandra maritima
Austrostipa flavescens
Conostylis aculeata subsp aculeata
*Anagallis arvensis
Calandrinia sp. SW Coastal

JinR4
50J 0375996
UTM 6498281

Eucalyptus foecunda Woodland.

This site was burnt approx 2-3 years ago and is very degraded.

Eucalyptus foecunda
Anthocercis littorea
Phyllanthus calycinus

*Anagallis arvensis
Spyridium globulosum
Trachymene pilosa
*Pelargonium capitatum

JinR5
50J 0374890
UTM 6498407

Spyridium globulosum, Olearia axillaris Open Heath over *Lepidosperma gladiatum* Very Open Sedgeland over **Bromus diandrus, *Anagallis arvensis* grassland.

Lepidosperma gladiatum
Spyridium globulosum
Olearia axillaris
Rhagodia baccata subsp baccata
*Bromus arenarius
*Ehrharta longiflora
*Anagallis arvensis
Melaleuca huegelii

APPENDIX D

Condition Scale and Structure Classes

Vegetation Structure Classes
and
Condition Scale
Tables

Vegetation Structure Classes (Layers)

These vegetation structure classes are the ones defined and used in Bush Forever (2000, Volume 2, Table 11 and p. 493) to describe vegetation in Bush Forever sites, (except that [1] a bracketed name refers to a dominant that has fewer plants and provides significantly less cover than others, and that [2] 'scattered' refers to trees, low trees, tall shrubs and low shrubs that have <2% cover).
'Sedges' are in Table 11 but not on p. 493.

Life Form/ Height Class	**Canopy Cover (percentage)**			
	100% - 70%	**70% - 30%**	**30% - 10%**	**10% - 2%**
Trees 10-30m Trees < 10m	Closed Forest Low Closed Forest	Open Forest Low Open Forest	Woodland Low Woodland	Open Woodland Low Open Woodland
Shrub Mallee	Closed Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub Mallee
Shrubs > 2m Shrubs 1-2m Shrubs <1m	Closed Tall Scrub Closed Heath Closed Low Heath	Tall Open Scrub Open Heath Open Low Heath	Tall Shrubland Shrubland Low Shrubland	Tall Open Shrubland Open Shrubland Low Open Shrubland
Grasses	Closed Grassland	Grassland	Open Grassland	Very Open Grassland
Herbs	Closed Herbland	Herbland	Open Herbland	Very Open Herbland
Sedges	Closed Sedgeland	Sedgeland	Open Sedgeland	Very Open Sedgeland

Vegetation Condition Scale

This condition scale is the one used in *Bush Forever* (2000, Volume 2, Table 12 and p. 494) to describe condition of vegetation in Bush Forever sites.
Assessment of condition is at least as much of understorey strata as of overstorey.

P	Pristine	No obvious signs of disturbance
E	Excellent	Vegetation structure intact, disturbance affecting individual species [plants?]; weeds are non-aggressive species
V	Very Good	Vegetation structure altered; obvious signs of disturbance
G	Good	Vegetation structure significantly altered by very obvious signs of multiple disturbance; basic vegetation structure or ability to regenerate it is retained
D	Degraded	Basic vegetation structure severely impacted by disturbance; scope for regeneration but not to a state approaching good (sic) condition without intensive management
C	Completely Degraded	Vegetation structure not intact; the area completely or almost completely without native species ('parkland cleared').