

Numerical Analysis of Floristic Data
from
Vegetation Recording Sites
Happy Valley, Western Australia

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1.0 INTRODUCTION

1.1 Purpose of this report

The current report is to provide an objective framework for the assessment of the different types of plant communities in the Happy Valley area. The framework is based on numerical classification techniques of site based species composition observations (quadrats). Reference quadrats are drawn from two sources. From the preliminary results of a study by Bronwen Keighery are 70 quadrats. From the published data from the Swan Coastal Plain study (SCP) (Gibson et al, 1994) and S6 Update come 33 quadrats. The latter quadrats have with them the assignment of Floristic Community type (FCT) defined by Gibson et al (1994).

1.2 Location of Happy Valley Quadrats

The Happy Valley and Bronwen Keighery's quadrats were straddling the northern end of the Whicher Scarp. Happy Valley is in the Quindinup area, east of Busselton. An open cut mine is proposed in the 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 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 quadrats. 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 quadrats.
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 Whicher Scarp Study

An study of the variation in plant communities is nearing completion (B Keighery pers com). This is attempting to elucidate definitions of communities which can be used for conservation assessment.

The raw data from this has been provided along with a preliminary classification.

1.5 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 quadrats 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 Happy Valley quadrats were observed in Spring 2005 on the occasion of a single visit each. They were revisited in 2007. Bronwen Keighery's quadrats have been visited twice. The SCP quadrats are the result of at least two visits in different seasons. All surveys were from quadrats that were 100 square metres.

1.6 Comparison of Data Quality

A measure of differences between the quality of data sets is the average number of species recorded at a quadrat in each survey. However, simple averages can be misleading for they will be comparing data from different ranges of plant communities. It is important, therefore, that only comparable data be used. This is not often possible as surveys may not contain quadrats comparable communities.

Table 1 suggests that there are differences. While there are quadrats from the same classification group for the different studies, this only suggests that they are similar but they may not be directly comparable.

Table 1 Av # species per site in site classification groups

gp10	HV	DEC
1	43	55
2	48	55
3	47	53
4	26	40
5		51
6		33
7	45	53
8	33	43
9		14
10		5

Likewise, on the face of the selected plant families listed in Table 2, there is a suggestion that there is an under representation of some families. While these are mostly families that are at times overlooked by single observations, their lower numbers do not necessarily indicate lower sampling effort. It also includes some families which are not likely to be overlooked. This might mean a slightly different inherent richness in the Happy Valley area. This requires confirmation at the quadrat level.

Table 2 Av # species per site for selected plant families

FCODE	HV	DEC
031	0.79	1.44
032	1.92	3.45
054C	2.79	4.11
054F	1.30	2.87
066	2.98	2.94
163	1.52	2.27
165	3.82	5.08
273	4.23	4.73
281	2.05	2.61
341	0.95	1.82

Therefore, there is evidence that the data is different enough to need to require amendment.

2.0 METHODS

2.1 Data Preparation

The data from the Happy Valley (HV) and Bronwen Keighery's (BK) quadrats were provided in spreadsheets. These were incorporated into a standard MS Access 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 other surveys was undertaken. This was done separately for HV with the BK data and both with SCP data. That for the latter was more difficult because of the greater time between the surveys.

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.

These data plus interpretations are provided in Happy Valley.mdb and HVoutput.xls files (Appendix 3).

2.2 Comparability of datasets

It was initially concluded that the quadrat datasets were probably reasonably compatible in nomenclature.

However, a preliminary analysis provided strong evidence that there were significant survey differences. In the process of review, a number of genera were identified as having differences either in nomenclature or frequency of recording. Based on the similarities in other taxa, these differences appeared unlikely. A second review was undertaken and a number of genera were omitted for the data sets to be analysed.

The reconciliations employed in the final analysis is provided in Appendix 1. The potential of differences due to effort mentioned above is not clear.

2.3 Comparisons made

Two separate datasets were compiled and analysed separately. One had all the species as defined after the reconciliation process and the other had annuals and

geophytes also removed. It was hoped that at least with the latter that the apparent survey differences would be reduced.

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 quadrats (as presence/absence) in the data sets. Likewise, with the transposed data matrices, the techniques were based on the similarity of species distribution patterns.

The analyses performed were largely the same for all four sets (two of quadrats and two of species).

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 to ensure consistency of analysis with that study. These are largely the default values of the respective modules.

The PATN modules used were ASO (calculation of similarity matrix), FUSE (classification based on the results of ASO), DEND (representation of classification), GDEF (group definition), SSH (semi-strong hybrid scaling ordination) and NNB (determination of quadrats most similar to each other quadrat, ie nearest neighbours).

The group definitions chosen for each data set was to a degree arbitrary and should be used as an indication of the relationships of floristic groups. No attempt has been made to refine the classification to define “real” communities or to create a rank of groups equivalent to Gibson et al (1994) FCTs.

The results of the analyses were imported into a database (Happy Valley 2007.mdb) so that quadrat characteristics and previous classifications (eg., Gibson et al, 1994 FCTs) could be associated and various analyses and summaries based on these data could be performed.

2.4.2 Determination of possible FCTs

The assignment of FCTs from the DEC Whicher study to the Happy Valley quadrats was made by summarising the results of two different methods:

- the classification, and
- the nearest neighbours.

Experience demonstrates that the results of these alternate methods are likely to vary, but that from nearest neighbours is likely to make more sense for it is not directly influenced by the number of quadrats in a group. On the other hand the nearest neighbour analysis often is ambiguous as it provides several options.

To the classification dendrogram of the dataset, the FCT assigned by the DEC survey was associated with the DEC survey quadrats. The apparent FCTs were assigned to

the new quadrats by interpreting the position of these quadrats in the dendrogram (particularly by the way they joined to the SCP quadrats).

The quadrats in the data set that were most similar to each of HV quadrats were obtained from the nearest neighbour method (NNB). By associating those nearest neighbours from the DEC survey, the most likely FCTs from this method for each of the new quadrats were determined. This does not mean that they would belong to that FCT, for they might better be determined to be a new FCT if they are not very similar to the DEC quadrats.

It is common for there to appear to be inconsistencies in the affinities indicated by these methods. Classification can be strongly influenced by the membership of groups which can “draw” a site “away” from another that it appears similar to. An attempt was then made to reconcile these different assignments of a Floristic Community Type. The relevant portion of the site by species matrix was examined to seek clarity in some cases.

2.4.3 Data Summaries

The principle outputs were tabulations of the classification with some of the interpretation, eg FCTs to enable an examination of the likely veracity of putative quadrat clusters. This can only be confirmed by the addition of field knowledge. These summaries are provided in the database and the spreadsheet.

Some scatter plots of classification of the quadrats were generated using the geographic location as X and Y axes. This provided an indication of the geographic distribution of classification groups.

3.0 LIMITATIONS

It has been found in earlier projects that the addition of new quadrats 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 quadrats using this method.

Secondly, it is common for new data to group with their cohorts. The more quadrats in the added batch, the tighter they draw together. These results can be a product of local nodes of similar species composition. However, in some cases this has proven to result from common deficiencies in the data, ie. whole groups of species missing. This absence tends to draw the new quadrats together.

The analyses were conducted without personal knowledge of the quadrats.

4.0 RESULTS

A number of analyses and interpretations were generated. Only some of these are provided in this report. The remainder of these is provided in the Happy Valley 2007.mdb and Happy Valley 2007.xls files (see Appendix 2). These include ones that are important to the report but are of a size that is difficult to present in any printed format or particularly in a Word document. The classification dendrograms and the cross tabulation of the species and quadrat data ordered by the classification order are especially large. In this report reference will occasionally be made to a query in the .mdb file or a sheet in the .xls file.

4.1 Comparison between quadrat classification of data sets

The classifications of the two data sets (with and without annuals etc) produced slightly different relationships. The individual classifications are provided in Appendices 3 and 4 respectively. Table 3 is an attempt to represent the differences at the 20 group level. This shows general accord with some reorganisation.

Table 3 Comparison of classifications (All – rows, no annuals – columns)

gp10	gp20	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	1	3											1								
1	2											5									
1	3									1	5		11								
1	4													1							
2	5									29											
3	6																4				
3	7																1				
4	8			1																	
4	9							2													
4	10				1	1															
5	11															1					
6	12																				
6	13											2									
7	14		4	3						1											
7	15									2								7		5	
7	16																	7			
8	17																		21	2	
8	18																			4	1
9	19																				1
10	20																				1

4.2 Project differences

There appeared to still be significant project differences in both classifications. This made it difficult to devise a classification that embraced the analysis of the Whicher study as there appeared “artificial” differences. This is mostly inferred by the relatively tight clustering of sites from the same projects. Tables 4 and 5 are summaries at the 40 group level for both data sets which indicate a modest project influence.

Table 4 Group 40 All Species by Projects

gp10	gp20	gp40	DEC	EEB
1	1	1		3
1	1	2		1
1	2	3	5	
1	3	4	5	
1	3	5	2	10
1	4	6	1	
2	5	7		1
2	5	8		1
2	5	9	2	5
2	5	10	4	16
3	6	11	5	
3	6	12	9	
3	6	13	3	
3	6	14	2	
3	6	15	4	
3	6	16	3	
3	6	17	3	
3	6	18	3	
3	6	19	2	2
3	6	20	2	
3	7	21	1	
4	8	22		1
4	9	23	2	
4	10	24	1	
4	10	25		1
5	11	26	1	
6	12	27	2	
6	13	28	2	
7	14	29		3
7	14	30	1	4
7	15	31	7	1
7	15	32		6
7	16	33	7	
8	17	34	6	2
8	17	35	2	
8	17	36	13	
8	18	37	1	
8	18	38		4
9	19	39	1	
10	20	40	1	

Table 5 Group 40 No annuals and geophytes by Projects

gp10	gp20	gp40	DEC	EEB
1	1	1		3
1	2	2		4
1	3	3		1
1	3	4	1	2
2	4	5	1	
2	5	6		1
3	6	7	1	
3	6	8	1	
3	7	9	2	
3	8	10	2	
4	9	11		2
4	9	12	3	16
4	9	13	1	2
4	9	14		2
4	9	15	3	4
5	10	16	11	
5	10	17	6	
5	10	18	7	
5	10	19	4	
5	10	20	3	2
5	10	21	2	
5	10	22	4	
5	11	23	5	
5	12	24	2	10
6	13	25	1	
6	14	26	1	
7	15	27	6	
7	15	28	4	
7	15	29	3	
7	15	30	2	1
7	15	31	3	
8	16	32	16	
8	16	33	3	
8	16	34	2	
8	17	35		3
8	17	36		5
8	17	37		3
9	18	38	1	
10	19	39	1	
10	20	40	1	

4.2 Determination of most likely floristic community types

The main focus was to relate the HV quadrats to the Whicher study. Table 6 is a list of the draft communities defined by the Whicher study. Note that there is a hierarchy defined by alpha and numeric components. In many cases it seemed clear what sub group to assign, in others only the group and others there was no clarity.

Table 6 Draft Whicher Scarp Communities

Group A: Whicher Scarp woodlands of grey/white sands

- A1: Central Whicher Scarp Mountain Marri woodland (7 quadrats)**
- A2: North Whicher Scarp Jarrah and Woody Pear woodland (5 quadrats)
- A3: North Whicher Scarp Banksia and Woody Pear woodland (4 quadrats)
- A4: Whicher Scarp Banksia grandis, Jarrah and Marri woodland (1 quadrat)
- A5: Central/North Whicher Scarp Mountain Marri woodland (6 quadrats)

Group B: Swan Coastal Plain centred woodlands of grey/white sands

- B1: Swan Coastal Plain/North Whicher Scarp Banksia attenuata woodlands (21 quadrats)
- B2: West Whicher Scarp Banksia attenuata woodland (1 quadrat)

Group C: Whicher Scarp woodlands of coloured sands and laterites

- C1: Central Whicher Scarp Jarrah woodlands (10 quadrats)**
- C2: Whicher Scarp Jarrah woodlands of deep coloured sands (8 quadrats)
- C3: Whicher Scarp Jarrah and Mountain Marri woodland on laterites (11 quadrats)
- C4: Whicher Scarp/Blackwood Plateau Jarrah and Marri woodland (17 quadrats)
- C5: Dardanup Jarrah and Mountain Marri woodland on laterite (2 quadrats)**
- C6 SWA Foothills Jarrah woodland on laterite (1 quadrat) (not in HV area)

Group D: (not in HV area)

Group E: Jarrah and Marri woodland wetland type 1

Group F: Jarrah and Marri woodland wetland type 2

- F1 Sabina River Jarrah and Marri woodland (2 quadrats)
- F2: Miscellaneous Wetlands (2 quadrats)

Group G: West Whicher Scarp wetlands NOTE These are based on vegetation mapping data as well

- G1: Creekline Blackbutt (Eucalyptus patens) and Marri forest (1 quadrat)**
- G2: Shrublands of near permanent wetlands in creeklines**

Group H: (not in HV area)

Notes on groups

- Letter groups are most robust, subgroups vary
- **Bold** groups are relatively robust and restricted to/in the Whicher Scarp
- Underlined group approaches above

The SCP floristic Community type was not assigned to the HV study for several reasons, principally because of the low number of quadrats which had FCTs available to make such comparisons. However, for a perspective, Table 7 is a comparison of the FCTs and Whicher units. This demonstrates that the FCTs are neither comprehensive nor detailed enough for the purposes of this study.

Table 7 Whicher Classification compared to SCP FCTs

Whicher		<>	FCT		
			01a	01b	21b
A	1	7			
A	2	3		1	1
A	3	4			
A	4		1		
A	5	5	1		
B	1	4			17
B	2	1			
C	1	7	3		
C	2	4	4		
C	3	9	2		
C	4	17			
C	5		2		
C	6		1		
E	1	3			
F	1	2			
F	2	2			
G	1	1			
G	2	1			

Appendix 5 is the results in a series of interpretations from both data sets (with and without annuals and geophytes) and two methods (from classification and nearest neighbour analysis). This shows modest variation in the apparent community to which each site might be most related. This recognises both the variation in the reference DEC communities and the relative importance which annuals etc might play in the characterisation.

It should be noted that for some sites the putative communities types are tentative. About a quarter of the sites had an association score with representative sites of the DEC reference set of greater than 0.5 to the “most likely” community. Notably, it did not generally matter which data set was used, most of these sites were significantly different.

Some of the sites may better be determined to be something different from what has been defined by the Whicher study. Those most likely to be different are sites 2007-05 and HV25, however, those sites where the association score is >0.5 might also be different. These sites are highlighted in Appendix 5. It may be of interest that most of the sites with the “2007” prefix were in this group. These tend to cluster together in the classification (Appendices 3 and 4). This raises the question, is this the result of survey effort or a suite of sites which are actually different from distinct communities? These analyses are not able to clarify this. However, an inspection of the species by site matrix may.

4.3 Comparison with classification

The classifications of the two datasets contributed to the determination of the community types. However, it is illustrative to compare the classifications with the community types interpreted. Tables 8 and 9 are the comparison with each of the classifications respectively. At the broad sense (communities A to F), there is good accord. The classifications at finer levels are not so well matched. This in part is related to the variation in the nomenclature used in the classifications.

Table 8 Interpreted community types by classification (all natives)
(shaded columns HV sites others DEC)

gp10	gp20	gp40	A1	A2	A3	A4	A5	A5	A	A/B	B/A	B1	B1	B2	A/C5	A/C	C/A3	C/A	C	C1	C2	C2	C3	C3	C4	C4	C5	C6	A/E	E1	E/F	F1	F2	G1	G2		
1	1	1													1											2											
1	1	2														1																					
1	2	3																					1		4												
1	3	4																					4				1										
1	3	5													1						1	2	8														
1	4	6																									1										
2	5	7													1																						
2	5	8																				1															
2	5	9																			1	2	1	3													
2	5	10				1										1					3	15															
3	6	11																		3					2												
3	6	12																		6	1		2														
3	6	13																			3																
3	6	14																							2												
3	6	15																		1					3												
3	6	16		1					2																												
3	6	17							3																												
3	6	18																					1		2												
3	6	19																							2												
3	6	20																		2					2												
3	7	21				1																															
4	8	22																																		1	
4	9	23																																		2	
4	10	24																																		1	
4	10	25																																		1	
5	11	26																										1									
6	12	27																																		2	
6	13	28																																		2	
7	14	29														2										1											
7	14	30							1	1	1	1					1																				
7	15	31		4	3						1																										
7	15	32								1				2																							
7	16	33	7																																		
8	17	34											6	2																							
8	17	35											2																								
8	17	36											13																								
8	18	37																																			
8	18	38												4																							
9	19	39																																		1	
10	20	40																																		1	

Table 9 Interpreted community types by classification (no annuals and geophytes)
(shaded columns HV sites others DEC)

gp10	gp20	gp40	A1dec	A2dec	A3dec	A4dec	A5dec	A5hv	Ahv	A/Bhv	B/Ahv	B1dec	B1hv	B2dec	A/C5hv	A/Chv	C/A3hv	C/Ahv	Chv	C1dec	C2dec	C2hv	C3dec	C3hv	C4dec	C4hv	C5dec	C6dec	A/Ehv	E1dec	E/Fhv	F1dec	F2dec	G1dec	G2dec	
1	1	1													1											2										
1	2	2													2	1										1										
1	3	3																													1					
1	3	4					1	1	1																											
2	4	5																												1						
2	5	6																											1							
3	6	7																												1						
3	6	8																											1							
3	7	9																																2		
3	8	10																															2			
4	9	11													1								1													
4	9	12																			3	16														
4	9	13																					1	2												
4	9	14								1														1												
4	9	15			2					1						1					1	2														
5	10	16																		8	1		2													
5	10	17																		1			4				1									
5	10	18																		1	3				3											
5	10	19																							4											
5	10	20																	2				1		2											
5	10	21																							2											
5	10	22					2																		2											
5	11	23																					1	4												
5	12	24														2							2	8												
6	13	25																									1									
6	14	26																									1									
7	15	27	6																																	
7	15	28		2	2																															
7	15	29		2		1																														
7	15	30					2				1																									
7	15	31	1	1			1																													
8	16	32										16																								
8	16	33										3																								
8	16	34										2																								
8	17	35											3																							
8	17	36						1			2		2																							
8	17	37											3																							
9	18	38												1																						
10	19	39																																	1	

4.4 Distribution of FCTs

The Happy Valley area is located on the eastern portion of the Whicher Scarp. In Figure 1 a red circle indicates its rough location. The other symbols are the DEC quadrats with the relevant Whicher communities with different symbols.

This figure shows quite clearly that the Happy Valley area is straddled by the three most common Whicher units (A, B and C).

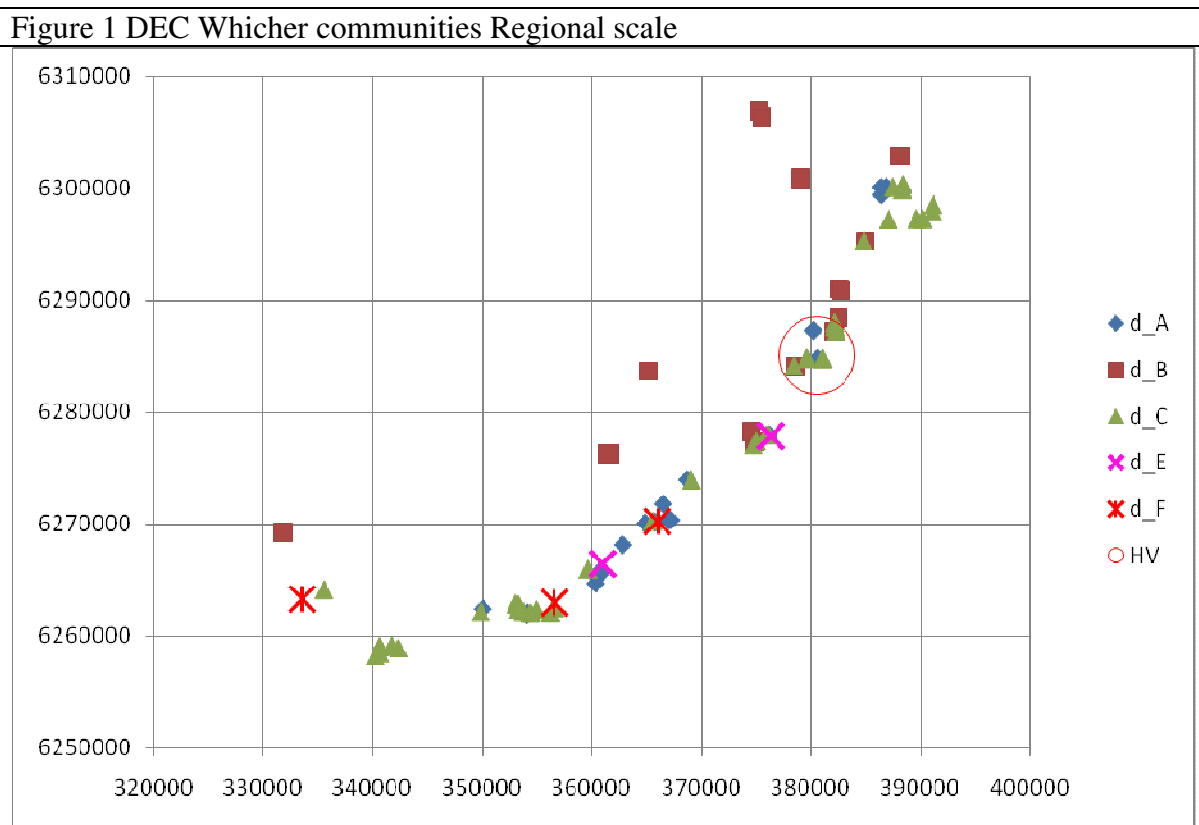
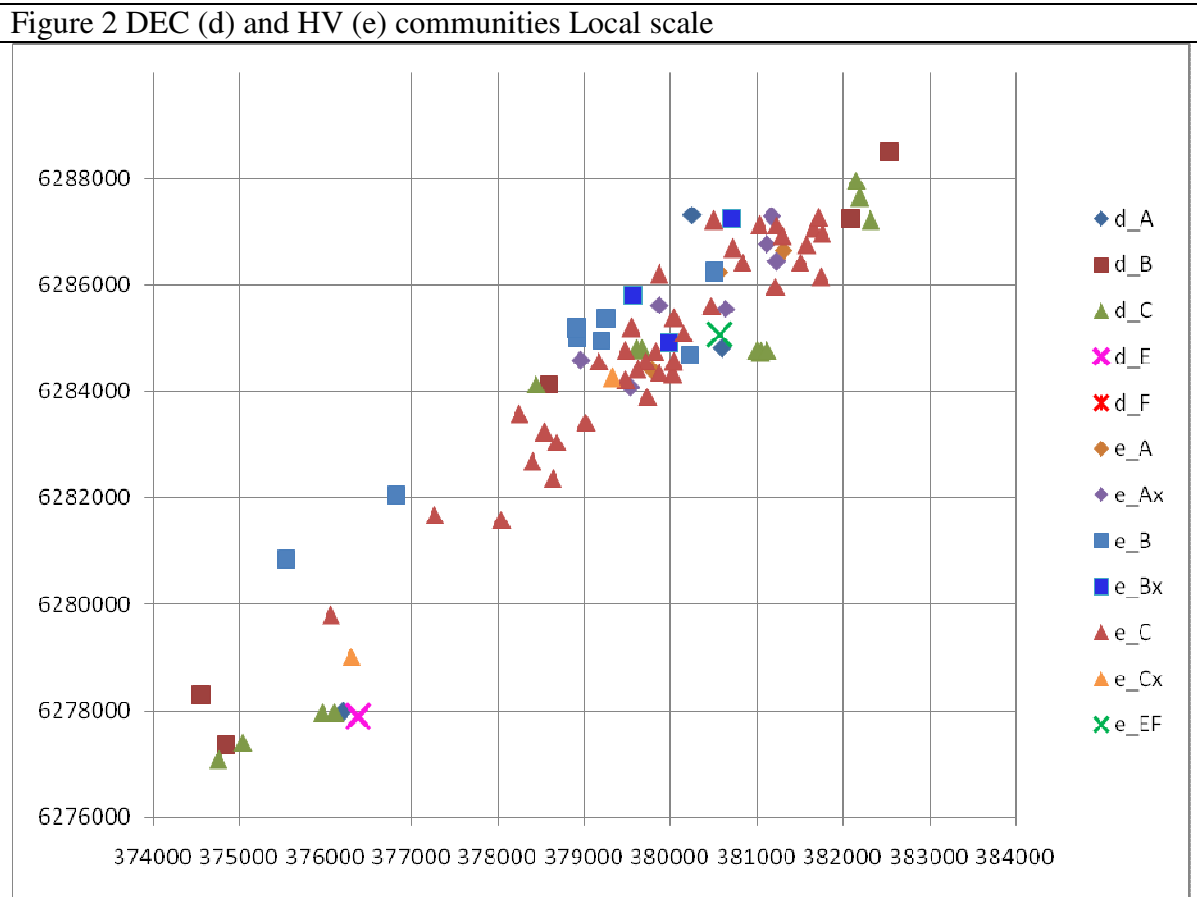


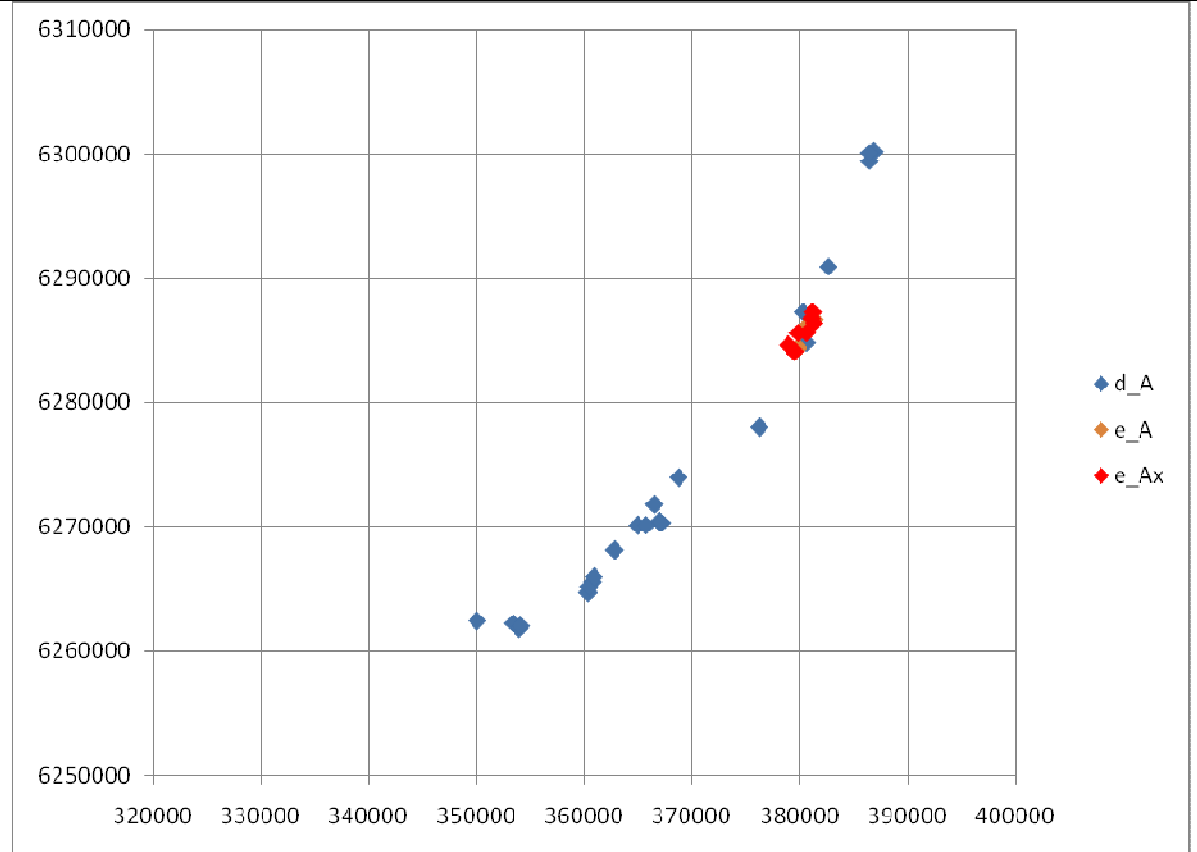
Figure 2 shows the distribution of all sites in the Happy Valley area. The same communities from the different data sets are indicated by the same symbol shapes. This tends to show a consistent geographic distribution with community B at the base of the scarp and community C and A further up.



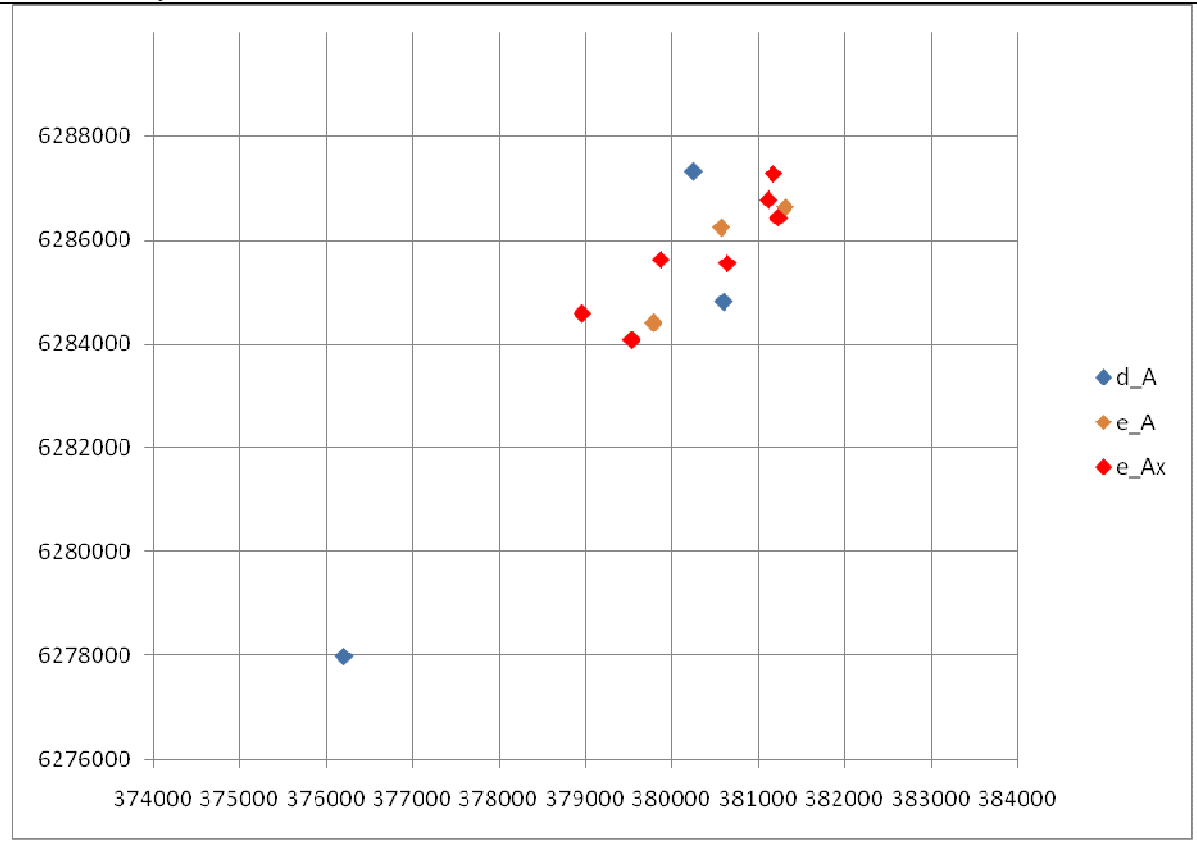
A series of Figures (Figure 3) shows the apparent distribution of the respective communities at regional and local scales. These show the sites from each data set in a different colour. Those with an x as a suffix are sites that do not match the DEC community well.

The geographic patterns tend to be consistent across data sets.

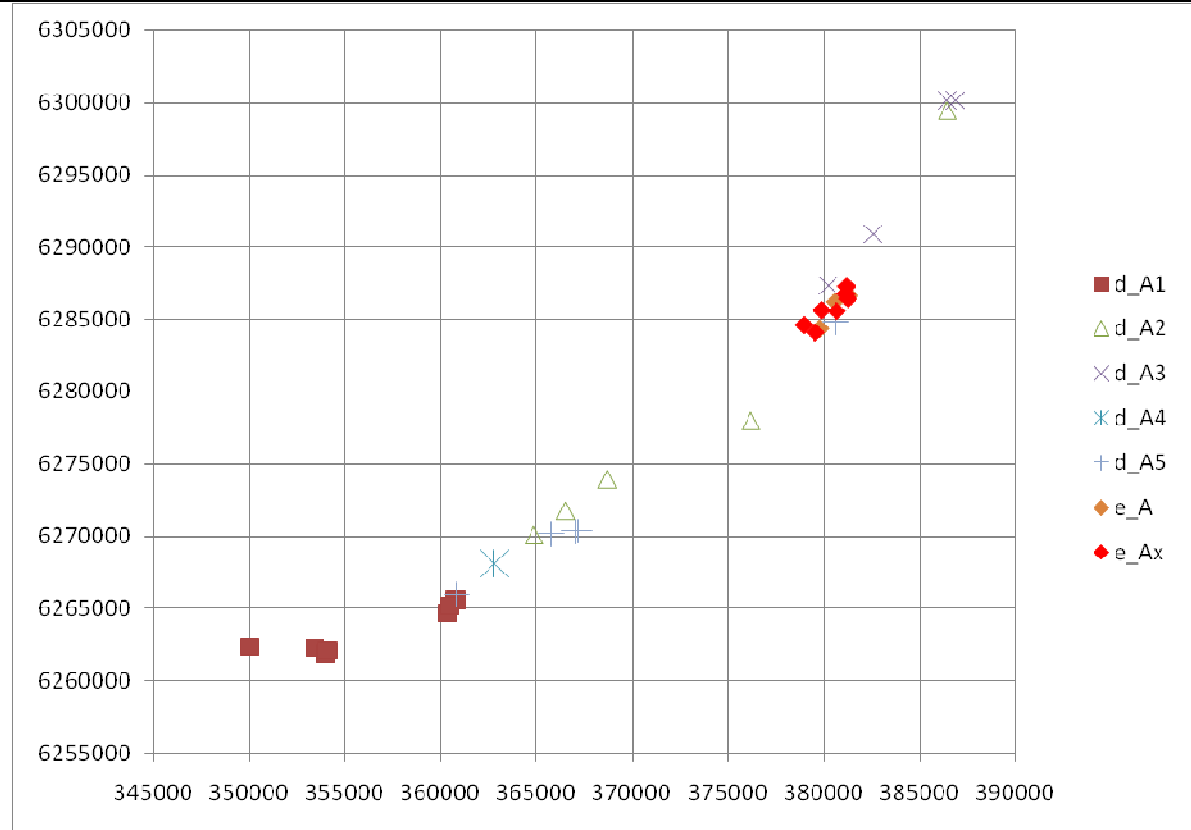
Figure 4 Community A Regional scale



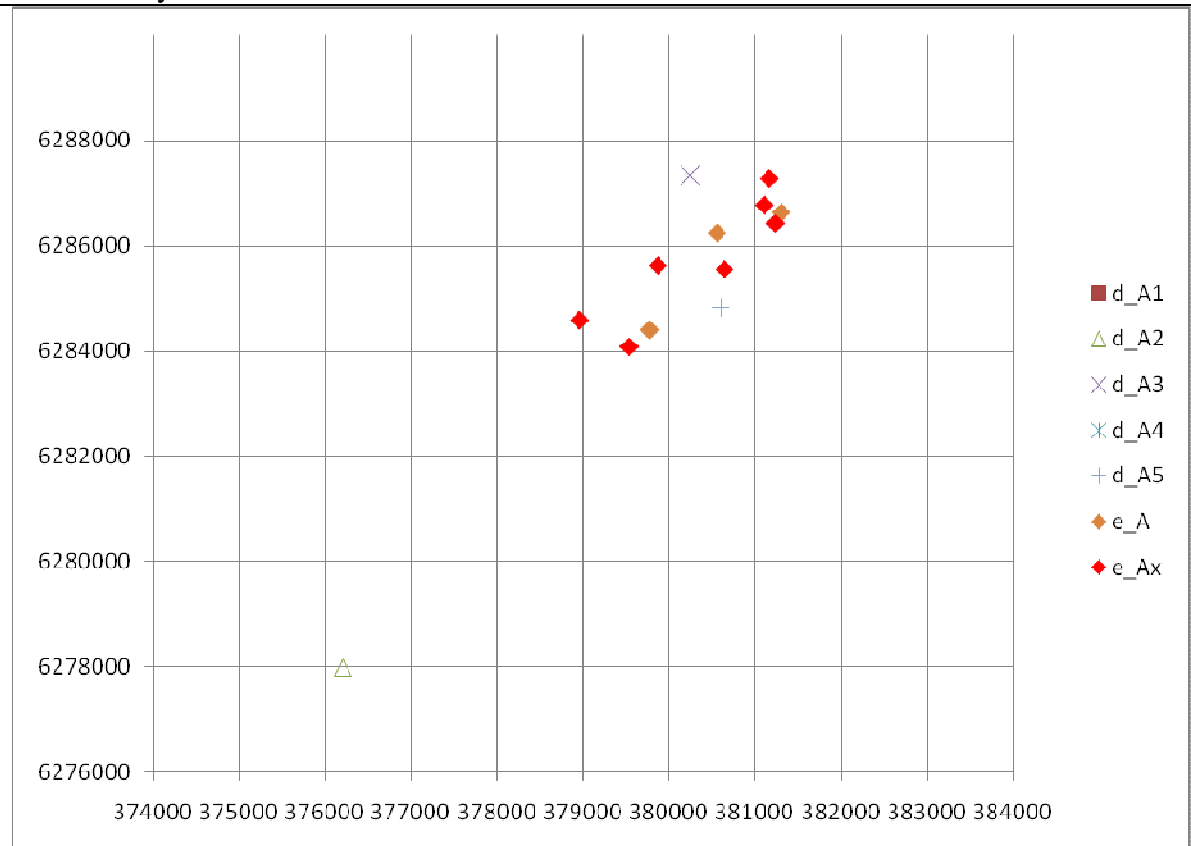
Community A Local



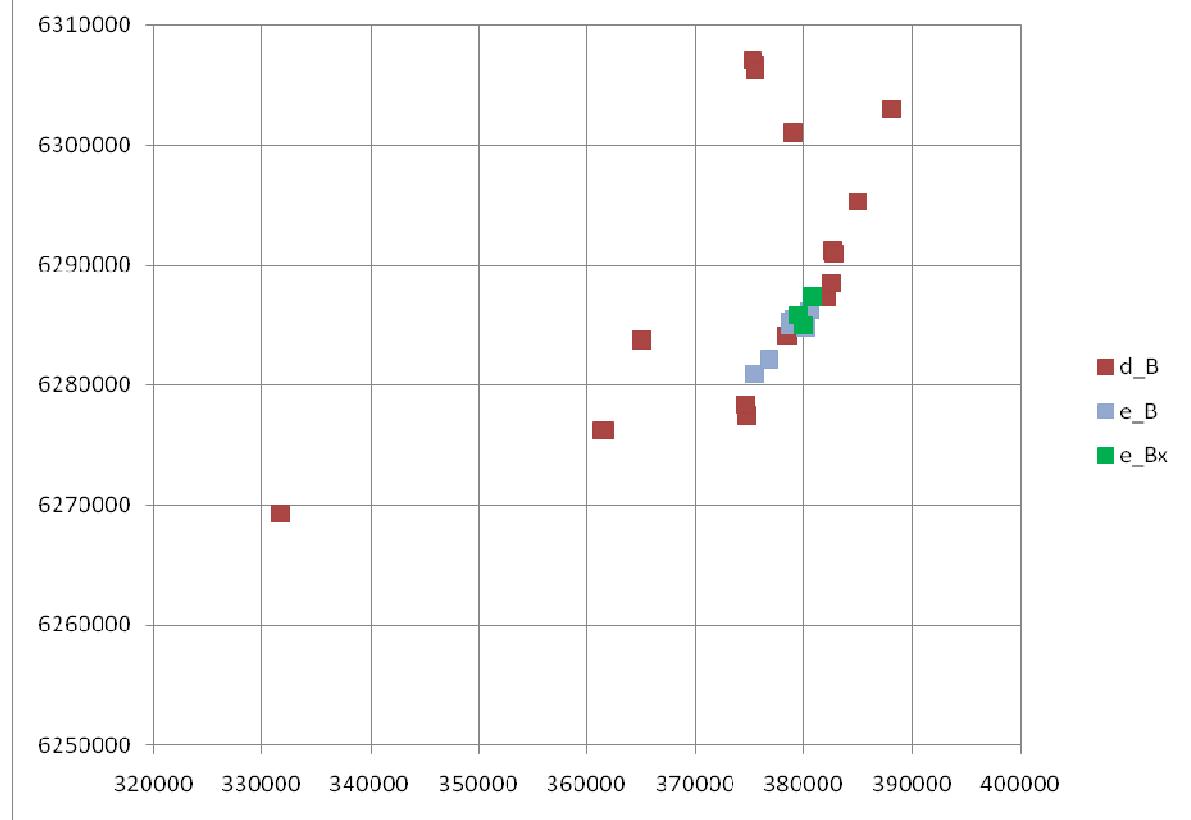
Communitiy A subdivided, regional



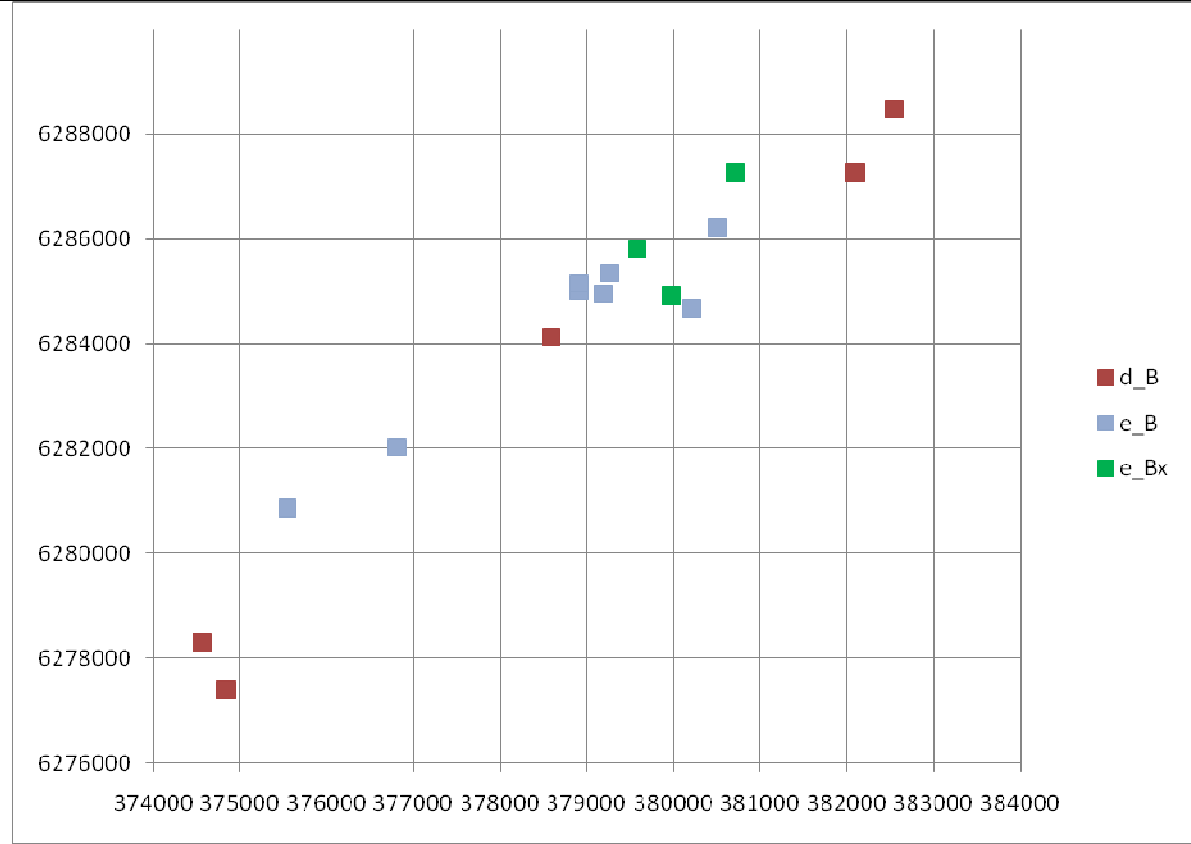
Communitiy A subdivided Local



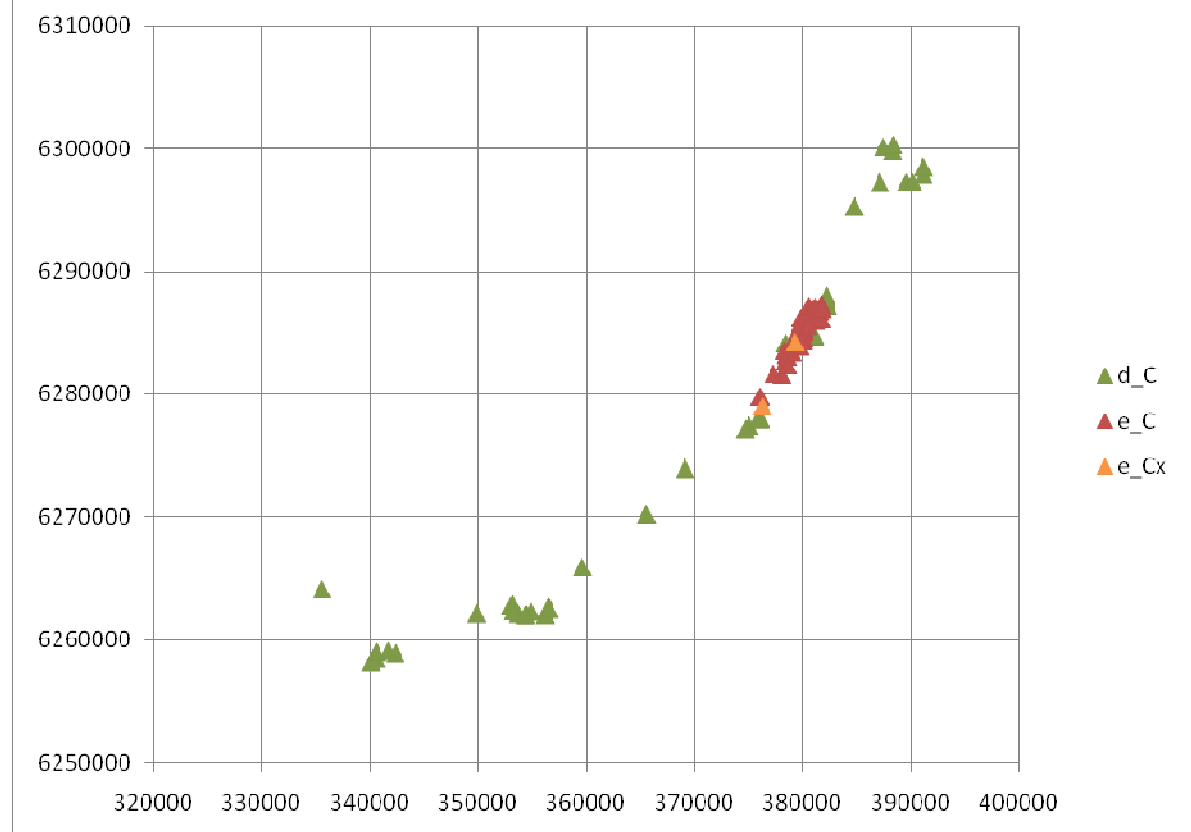
Community B regional



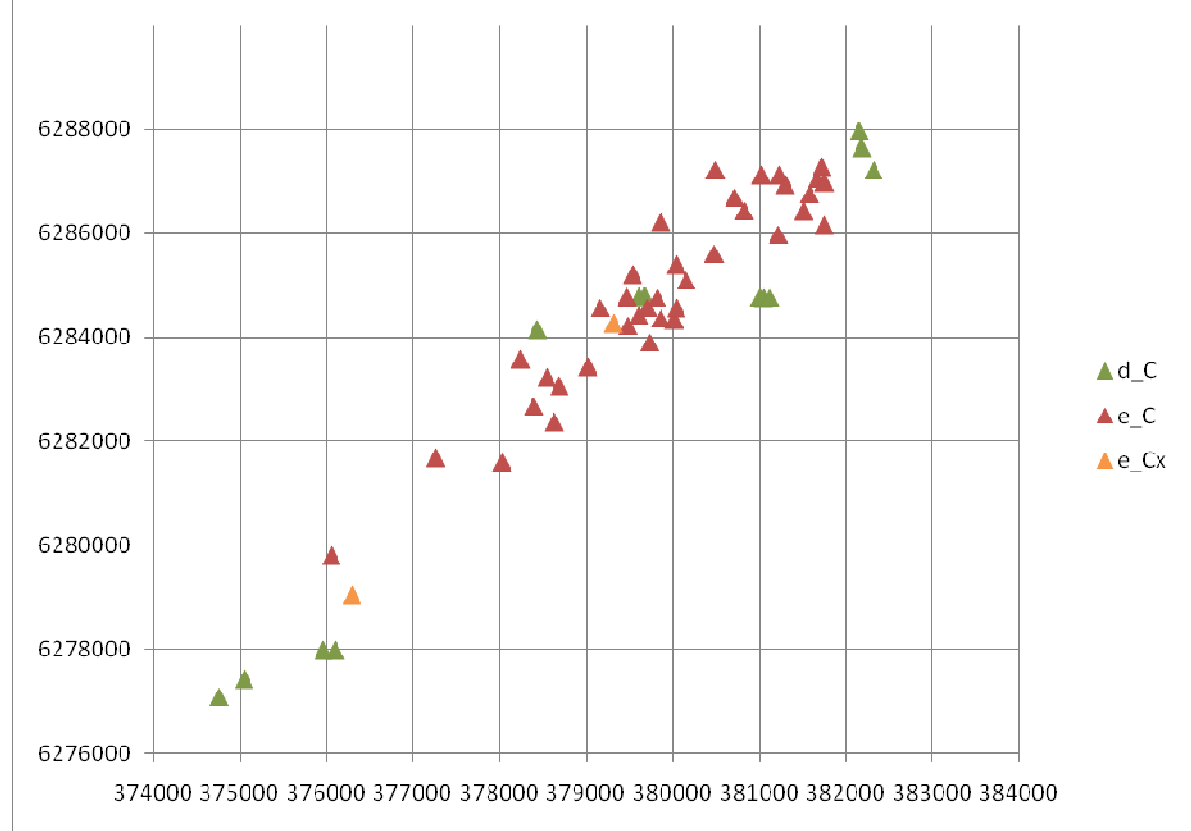
Community B local



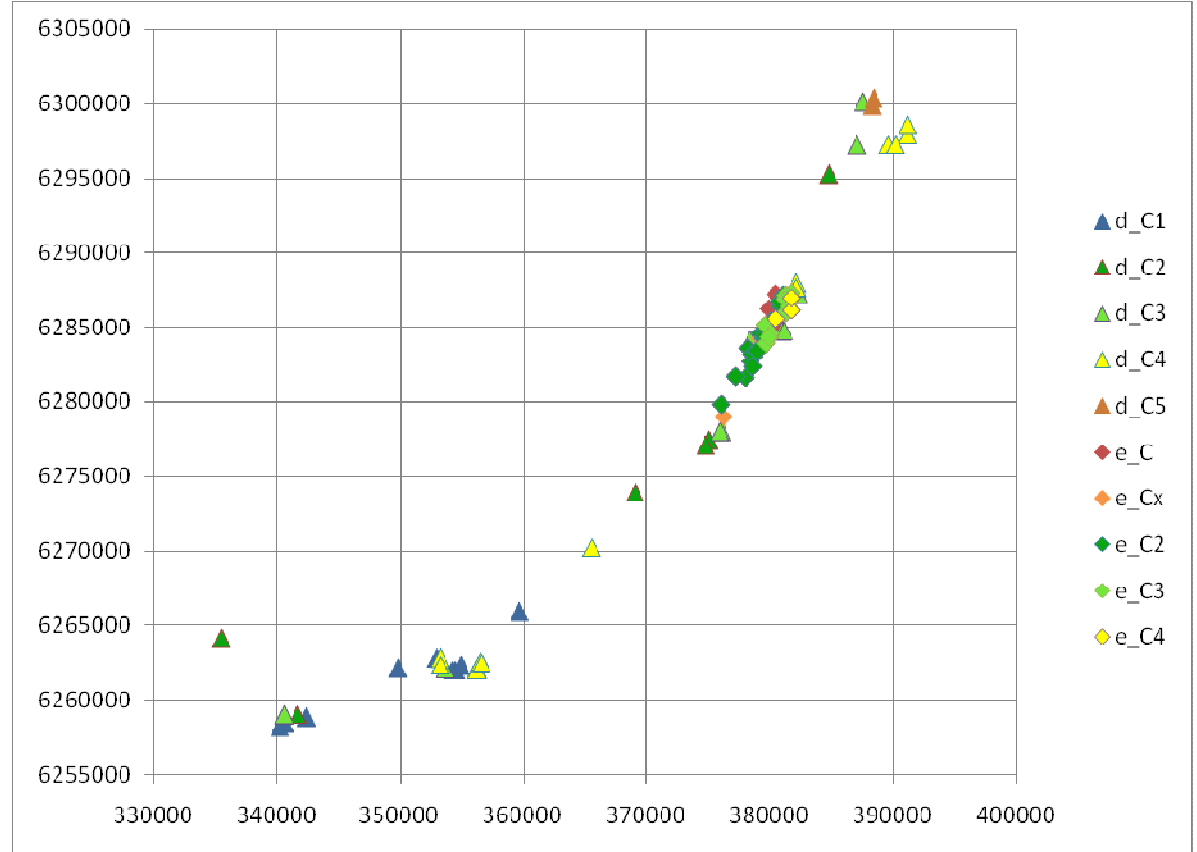
Communitiy C regional



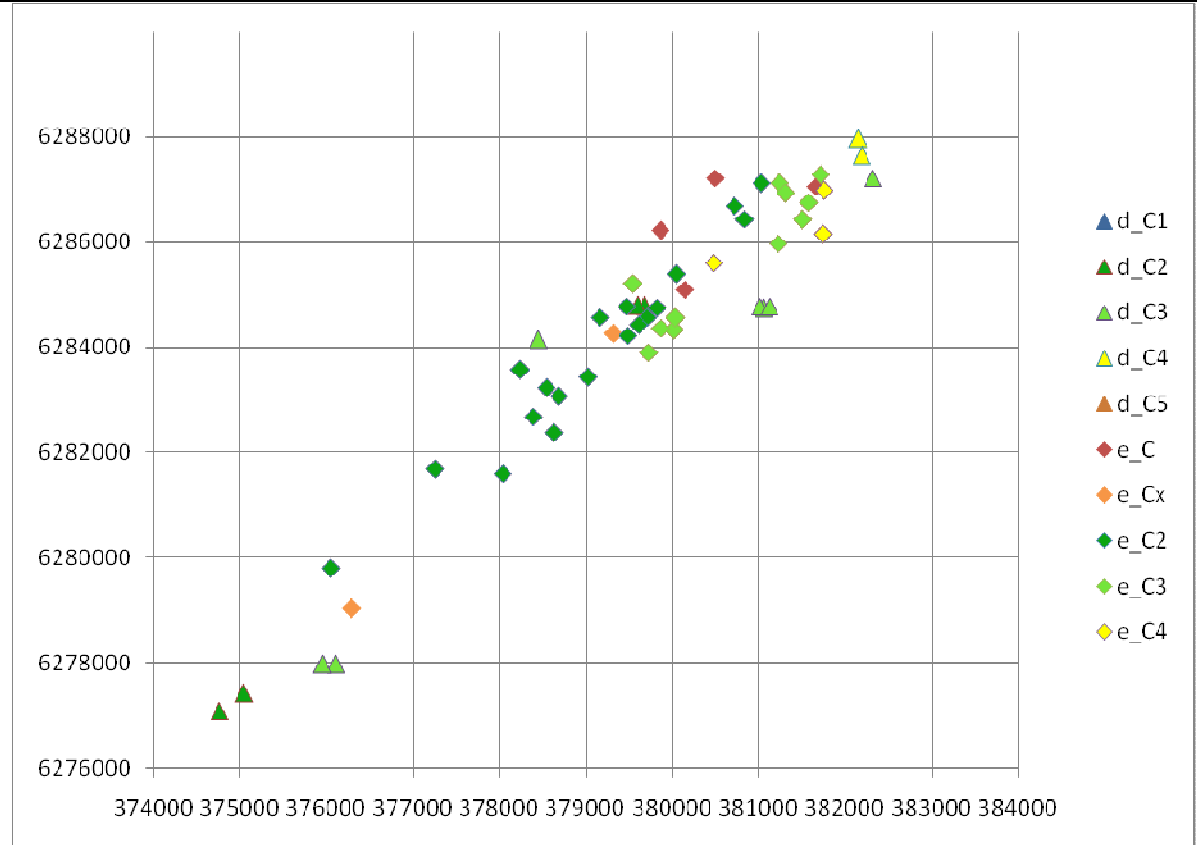
Communitiy C Local



Communitiy C subdivided regional



Communitiy C subdivided local



5.0 REFERENCES

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Gibson, N.G., Keighery, B.J., Keighery, G.J., Burbidge, A.H. and Lyons, M (1994). *A Floristic Survey of the Southern Swan Coastal Plain*. Unpublished report by the Department of Conservation and Land Management and the Conservation Council of Western Australia to the Australian Heritage Commission.

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6.0 APPENDICIES

APPENDIX 1 Names combined for reconciliation of Happy Valley and DEC data

FCODE	NAME	Lookup
	paniculata	omitted
031	Aira cupaniana	Aira caryophyllea
031	Amphipogon laguroides	Amphipogon amphipogonoides
031	Amphipogon turbinatus	Amphipogon amphipogonoides
031	Austrostipa campylachne	Austrostipa semibarbata/campylachne
031	Austrostipa compressa	omitted
031	Austrostipa trichophylla	Austrostipa semibarbata/campylachne
031	Lolium multiflorum	Lolium rigidum
031	Microlaena stipoides	omitted
031	Vulpia bromoides	Vulpia myuros
031	Vulpia myuros var. myuros	Vulpia myuros
032	Cyathochaeta avenacea	omitted
032	Cyathochaeta equitans	omitted
032	Cyathochaeta sp. Carburnup (G.J. Keighery 14123)	omitted
032	Cyathochaeta stipoides	omitted
032	Cyathochaeta teretifolia	omitted
032	Isolepis cernua	omitted
032	Isolepis marginata	omitted
032	Lepidosperma ?scabrum	Lepidosperma scabrum
032	Lepidosperma aphyllum	omitted
032	Lepidosperma gracile	Lepidosperma tenue
032	Lepidosperma leptostachyum	Lepidosperma scabrum
032	Lepidosperma squamatum	omitted
032	Schoenus aff. sublaxus	omitted
032	Schoenus bifidus	omitted
032	Schoenus breviculmis	omitted
032	Schoenus clandestinus	omitted
032	Schoenus discifer	omitted
032	Schoenus efoliatus	omitted
032	Schoenus nanus	omitted
032	Schoenus obtusifolius	omitted
032	Schoenus pennisetis	omitted
032	Schoenus plumosus	omitted
032	Schoenus sp. Whicher (G.J. Keighery and B.J. Keighery 901)	omitted
032	Schoenus subbarbatus	omitted
032	Schoenus subbulbosus	omitted
032	Schoenus subflavus subsp. subflavus	omitted
032	Schoenus sublateralis	omitted
032	Schoenus unispiculatus	omitted
039	Lyginia imberbis	Lyginia barbata
040	Centrolepis aristata	omitted
040	Centrolepis drummondiana	omitted
040	Centrolepis mutica	omitted
054C	Calectasia narragara	omitted
054C	Lomandra brittanii	omitted
054C	Lomandra integra	omitted
054C	Lomandra nigricans	omitted
054C	Lomandra preissii	omitted
054C	Lomandra purpurea	omitted

FCODE	NAME	Lookup
054C	<i>Lomandra</i> sp. nov.	<i>Lomandra</i> sp. Dardanup (G.J. Keighery15065)
054D	<i>Xanthorrhoea brunonis</i> subsp. <i>brunonis</i>	<i>Xanthorrhoea brunonis</i>
054D	<i>Xanthorrhoea</i> sp. nov.	<i>Xanthorrhoea acanthostachya</i>
054F	<i>Agrostocrinum hirsutum</i>	omitted
054F	<i>Agrostocrinum hirsutum</i>	omitted
054F	<i>Agrostocrinum scabrum</i>	omitted
054F	<i>Caesia occidentalis</i>	omitted
054F	<i>Chamaescilla corymbosa</i>	<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>
054F	<i>Johnsonia acaulis</i>	omitted
054F	<i>Laxmannia jamesii</i>	omitted
054F	<i>Laxmannia ramosa</i> subsp. <i>ramosa</i>	omitted
054F	<i>Laxmannia sessiliflora</i>	omitted
054F	<i>Laxmannia sessiliflora</i> subsp. <i>australis</i>	omitted
054F	<i>Thysanotus arbuscula</i>	omitted
054F	<i>Thysanotus arenarius</i>	omitted
054F	<i>Thysanotus formosus</i>	omitted
054F	<i>Thysanotus gracilis</i>	omitted
054F	<i>Thysanotus manglesianus</i>	omitted
054F	<i>Thysanotus multiflorus</i>	omitted
054F	<i>Thysanotus patersonii</i>	omitted
054F	<i>Thysanotus pauciflorus</i>	omitted
054F	<i>Thysanotus pseudojunceus</i>	omitted
054F	<i>Thysanotus scaber</i>	omitted
054F	<i>Thysanotus sparteus</i>	omitted
054F	<i>Thysanotus tenellus</i>	omitted
054F	<i>Thysanotus thyrsoideus</i>	omitted
054F	<i>Thysanotus triandrus</i>	omitted
054F	<i>Tricoryne humilis</i>	<i>Tricoryne elatior</i>
054F	<i>Tricoryne tenella</i>	<i>Tricoryne elatior</i>
054J	<i>Burchardia congesta</i>	<i>Burchardia umbellata/congesta</i>
054J	<i>Burchardia multiflora</i>	<i>Burchardia umbellata/congesta</i>
054J	<i>Burchardia umbellata</i>	<i>Burchardia umbellata/congesta</i>
055	<i>Anigozanthos manglesii</i> subsp. <i>manglesii</i>	<i>Anigozanthos manglesii</i>
055	<i>Conostylis aculeata</i> subsp. <i>aculeata</i>	<i>Conostylis aculeata</i>
055	<i>Conostylis serrulata</i>	omitted
060	<i>Patersonia babianooides</i>	omitted
060	<i>Patersonia umbrosa</i> var. <i>umbrosa</i>	<i>Patersonia umbrosa</i>
060	<i>Patersonia umbrosa</i> var. <i>xanthina</i>	<i>Patersonia umbrosa</i>
066	<i>Caladenia attingens</i> subsp. <i>atingens</i>	omitted
066	<i>Caladenia brownii</i>	omitted
066	<i>Caladenia deformis</i>	omitted
066	<i>Caladenia flava</i> subsp. <i>flava</i>	<i>Caladenia flava</i>
066	<i>Caladenia flava</i> subsp. <i>sylvestris</i>	<i>Caladenia flava</i>
066	<i>Caladenia georgei</i>	omitted
066	<i>Caladenia latifolia</i>	omitted
066	<i>Caladenia longicauda</i>	omitted
066	<i>Caladenia longicauda</i> subsp. <i>eminens</i>	omitted
066	<i>Caladenia longicauda</i> subsp. <i>longicauda</i>	omitted
066	<i>Caladenia macrostylis</i>	omitted
066	<i>Caladenia nana</i> subsp. <i>unita</i>	omitted
066	<i>Caladenia reptans</i>	omitted
066	<i>Caladenia reptans</i> subsp. <i>reptans</i>	omitted
066	<i>Caladenia</i> sp.	omitted
066	<i>Cyrtostylis</i> sp.	omitted
066	<i>Elythranthera brunonis</i>	omitted
066	<i>Elythranthera emarginata</i>	omitted

FCODE	NAME	Lookup
066	<i>Eriochilus dilatatus</i>	omitted
066	<i>Eriochilus dilatatus</i> subsp. <i>dilatatus</i> MS	omitted
066	<i>Eriochilus dilatatus</i> subsp. <i>multiflorus</i> MS	omitted
066	<i>Eriochilus scaber</i> subsp. <i>scaber</i> MS	omitted
066	<i>Leporella fimbriata</i>	omitted
066	<i>Lyperanthus serratus</i>	omitted
066	<i>Microtis media</i>	omitted
066	<i>Microtis</i> sp.	omitted
066	<i>Pheladenia deformis</i>	omitted
066	<i>Prasophyllum</i> sp.	omitted
066	<i>Pterostylis</i> aff. <i>nana</i>	<i>Pterostylis nana</i>
066	<i>Pterostylis</i> aff. <i>nana</i>	<i>Pterostylis nana</i>
066	<i>Pterostylis</i> affin. <i>nana</i>	<i>Pterostylis nana</i>
066	<i>Pterostylis barbata</i>	omitted
066	<i>Pterostylis pyramidalis</i>	<i>Pterostylis nana</i>
066	<i>Pterostylis recurva</i>	omitted
066	<i>Pterostylis</i> sp.	omitted
066	<i>Pyrorchis forrestii</i>	omitted
066	<i>Pyrorchis nigricans</i>	omitted
066	<i>Thelymitra antennifera</i>	omitted
066	<i>Thelymitra campanulata</i>	omitted
066	<i>Thelymitra canaliculata</i>	omitted
066	<i>Thelymitra cornicina</i>	omitted
066	<i>Thelymitra crinita</i>	omitted
066	<i>Thelymitra flexuosa</i>	omitted
066	<i>Thelymitra graminea</i>	omitted
066	<i>Thelymitra macrophylla</i>	omitted
066	<i>Thelymitra pauciflora</i>	omitted
066	<i>Thelymitra</i> sp.	omitted
066	<i>Thelymitra vulgaris</i>	omitted
090	<i>Adenanthos barbiger</i> subsp. <i>barbiger</i> MS	<i>Adenanthos barbiger</i>
090	<i>Adenanthos barbiger</i> subsp. <i>intermedius</i> MS	<i>Adenanthos barbiger</i>
090	<i>Conospermum caeruleum</i> subsp. <i>spathulatum</i>	omitted
090	<i>Conospermum capitatum</i>	omitted
090	<i>Conospermum capitatum</i> subsp. <i>capitatum</i>	omitted
090	<i>Conospermum capitatum</i> subsp. <i>glabratum</i>	omitted
090	<i>Conospermum flexuosum</i> subsp. <i>laevigatum</i>	omitted
090	<i>Conospermum paniculatum</i>	omitted
090	<i>Dryandra armata</i>	<i>Dryandra armata</i> var. <i>armata</i>
090	<i>Dryandra bipinnatifida</i>	<i>Dryandra bipinnatifida</i> subsp. <i>multifida</i>
090	<i>Dryandra lindleyana</i>	<i>Dryandra lindleyana</i> var. <i>lindleyana</i>
090	<i>Dryandra sessilis</i>	<i>Dryandra sessilis</i> var. <i>sessilis</i>
090	<i>Grevillea pulchella</i>	<i>Grevillea pulchella</i> subsp. <i>ascendens</i>
090	<i>Isopogon formosus</i>	<i>Isopogon formosus</i> subsp. <i>dasylepsis</i>
090	<i>Persoonia saccata</i>	omitted
090	<i>Synaphea petiolaris</i> subsp. <i>petiolaris</i>	<i>Synaphea petiolaris</i>
090	<i>Synaphea petiolaris</i> subsp. <i>simplex</i>	<i>Synaphea petiolaris</i>
090	<i>Synaphea petiolaris</i> subsp. <i>triloba</i>	<i>Synaphea petiolaris</i>
090	<i>Synaphea whicherensis</i>	<i>Synaphea petiolaris</i>
095	<i>Olax phyllanthi</i>	<i>Olax benthamiana</i>
131	<i>Cassytha flava</i>	<i>Cassytha racemosa</i> forma <i>racemosa</i>
131	<i>Cassytha glabella</i>	<i>Cassytha racemosa</i> forma <i>racemosa</i>
131	<i>Cassytha micrantha</i>	<i>Cassytha racemosa</i> forma <i>racemosa</i>
131	<i>Cassytha pomiformis</i>	<i>Cassytha racemosa</i> forma <i>racemosa</i>
131	<i>Cassytha racemosa</i>	<i>Cassytha racemosa</i> forma <i>racemosa</i>
143	<i>Drosera barbiger</i>	omitted
143	<i>Drosera bulbosa</i>	omitted

FCODE	NAME	Lookup
143	<i>Drosera erythrorhiza</i>	<i>Drosera erythrorhiza</i> subsp. <i>erythrorhiza</i>
143	<i>Drosera macrantha</i>	<i>Drosera macrantha</i> subsp. <i>macrantha</i>
143	<i>Drosera marchantii</i> subsp. <i>marchantii</i>	omitted
143	<i>Drosera menziesii</i> subsp. <i>penicillaris</i>	<i>Drosera menziesii</i> subsp. <i>menziesii</i>
143	<i>Drosera platystigma</i>	omitted
143	<i>Drosera preissii</i>	omitted
143	<i>Drosera pulchella</i>	omitted
143	<i>Drosera stelliflora</i>	<i>Drosera platystigma</i>
143	<i>Drosera stolonifera</i>	omitted
143	<i>Drosera stolonifera</i> subsp. <i>porrecta</i>	omitted
143	<i>Drosera stolonifera</i> subsp. <i>stolonifera</i>	omitted
149	<i>Crassula colorata</i> var. <i>colorata</i>	<i>Crassula colorata</i>
152	<i>Marianthus tenuis</i>	omitted
163	<i>Acacia pulchella</i> var. <i>glaberrima</i>	<i>Acacia pulchella</i>
163	<i>Acacia pulchella</i> var. <i>pulchella</i>	<i>Acacia pulchella</i>
163	<i>Acacia stenoptera</i>	omitted
165	<i>Bossiaea ornata</i>	omitted
165	<i>Bossiaea</i> sp. Waroona (B.J. Keighery & N. Gibson 229) PN	<i>Bossiaea rufa</i>
165	<i>Daviesia angulata</i>	<i>Daviesia incrassata</i> subsp. <i>incrassata</i>
165	<i>Daviesia divaricata</i>	<i>Daviesia divaricata</i> subsp. <i>divaricata</i> MS
165	<i>Daviesia incrassata</i>	<i>Daviesia incrassata</i> subsp. <i>incrassata</i>
165	<i>Daviesia nudiflora</i>	<i>Daviesia nudiflora</i> subsp. <i>nudiflora</i>
165	<i>Daviesia physodes</i>	<i>Daviesia inflata</i>
165	<i>Daviesia preissii</i>	<i>Daviesia incrassata</i> subsp. <i>incrassata</i>
165	<i>Gompholobium capitatum</i>	omitted
165	<i>Gompholobium ovatum</i>	omitted
165	<i>Gompholobium scabrum</i>	<i>Gompholobium confertum</i>
165	<i>Hovea chorizemifolia</i>	omitted
165	<i>Hovea elliptica</i>	omitted
165	<i>Hovea stricta</i>	omitted
165	<i>Hovea trisperma</i>	omitted
165	<i>Hovea trisperma</i> var. <i>grandiflora</i>	omitted
165	<i>Hovea trisperma</i> var. <i>trisperma</i>	omitted
165	<i>Jacksonia sparsa</i> MS	<i>Jacksonia horrida</i>
165	<i>Lotus angustissimus</i>	<i>Lotus</i> sp.
165	<i>Lotus suaveolens</i>	<i>Lotus</i> sp.
165	<i>Lotus subbiflorus</i>	<i>Lotus</i> sp.
165	<i>Medicago</i> sp.	omitted
165	<i>Pultenaea ericifolia</i>	omitted
165	<i>Sphaerolobium drummondii</i>	omitted
165	<i>Sphaerolobium grandiflorum</i>	omitted
165	<i>Sphaerolobium macranthum</i>	omitted
165	<i>Sphaerolobium medium</i>	omitted
165	<i>Sphaerolobium scabriusculum</i>	omitted
165	<i>Sphaerolobium</i> sp.	omitted
165	<i>Sphaerolobium vimineum</i>	omitted
165	<i>Trifolium</i> sp.	omitted
175	<i>Boronia crenulata</i>	omitted
175	<i>Boronia crenulata</i> subsp. <i>pubescens</i>	omitted
175	<i>Boronia crenulata</i> var. <i>crenulata</i>	omitted
175	<i>Boronia dichotoma</i>	omitted
175	<i>Boronia spathulata</i>	omitted
175	<i>Boronia tenuis</i>	<i>Boronia defoliata</i>
182	<i>Platytheca galioides</i>	<i>Platytheca</i> sp. Argyle (G.J. & B.J. Keighery 281) PN

FCODE	NAME	Lookup
182	Platytheca sp. Argyle	Platytheca sp. Argyle (G.J. & B.J. Keighery 281) PN
182	Tetratheca hirsuta	Tetratheca hispidissima
183	Comesperma calymega	omitted
183	Comesperma ciliatum	omitted
183	Comesperma confertum	omitted
183	Comesperma virgatum	omitted
183	Comesperma volubile	omitted
185	Amperea simulans	Amperea ericoides
185	Poranthera huegelii	omitted
185	Ricinocarpos aff. cyanescens	Ricinocarpos cyanescens
226	Hibbertia aff. aurea	Hibbertia aurea
226	Hibbertia cunninghamii	Hibbertia amplexicaulis
226	Hibbertia glomerata	Hibbertia glomerata subsp. glomerata
226	Hibbertia quadricolor	omitted
263	Pimelea angustifolia	omitted
263	Pimelea brevifolia	omitted
263	Pimelea preissii	omitted
263	Pimelea rosea	omitted
263	Pimelea rosea subsp. rosea	omitted
263	Pimelea spectabilis	omitted
263	Pimelea suaveolens	omitted
263	Pimelea suaveolens subsp. suaveolens	omitted
263	Pimelea sulphurea	omitted
263	Pimelea sylvestris	omitted
273	Agonis flexuosa	Agonis flexuosa var. flexuosa
273	Astartea sp.	omitted
273	Calytrix angulata	Calytrix flavescens
273	Corymbia calophylla	Corymbia haematoxylon
273	Darwinia citriodora	omitted
273	Darwinia oederoides	omitted
273	Darwinia vestita	omitted
273	Eremaea pauciflora	Eremaea pauciflora var. pauciflora
273	Eucalyptus calophylla	Corymbia calophylla
273	Eucalyptus haematoxylon	Corymbia haematoxylon
273	Eucalyptus haematoxylon x calophylla	Corymbia haematoxylon
273	Eucalyptus marginata subsp. elegantella	Eucalyptus marginata
273	Eucalyptus marginata subsp. marginata	Eucalyptus marginata
273	Kunzea rostrata	Kunzea recurva
273	Verticordia densiflora var. cespitosa	Verticordia densiflora
276	Gonocarpus benthamii	Gonocarpus paniculatus
281	Hydrocotyle callicarpa	Hydrocotyle pilifera
281	Hydrocotyle pilifera var. glabrata	Hydrocotyle pilifera
281	Hydrocotyle pilifera var. pilifera	Hydrocotyle pilifera
281	Pentapeltis silvatica	Pentapeltis peltigera
281	Xanthosia candida	omitted
281	Xanthosia ciliata	omitted
281	Xanthosia huegelii	omitted
281	Xanthosia huegelii subsp. huegelii MS	omitted
281	Xanthosia pusilla	omitted
281	Xanthosia singuliflora	omitted
281	Xanthosia tasmanica	omitted
288	Andersonia ferricola	omitted
288	Leucopogon aff. polymorphus south (Gibson et al. 1994)	Leucopogon polymorphus
288	Leucopogon australis	Leucopogon australis subsp. australis
288	Leucopogon pulchellus 'southern form'	Leucopogon pulchellus

Fcode	NAME	Lookup
288	<i>Leucopogon racemulosus</i>	<i>Leucopogon nutans</i>
288	<i>Leucopogon</i> sp. Margaret River	omitted
288	<i>Leucopogon</i> sp. Margaret River (J. Scott 207) PN	omitted
302	<i>Logania connii</i>	<i>Logania wendyae</i> MS
302	<i>Logania serpyllifolia</i> subsp. <i>angustifolia</i>	<i>Logania spermacocea</i>
302	<i>Logania wendyae</i>	<i>Logania wendyae</i> MS
302	<i>Phyllangium divergens</i>	omitted
302	<i>Phyllangium paradoxum</i>	omitted
340	<i>Lobelia heterophylla</i>	<i>Lobelia rhytidosperma</i>
340	<i>Lobelia rhytidosperma</i>	<i>Lobelia tenuior</i>
341	<i>Goodenia coerulea</i>	omitted
341	<i>Goodenia eatoniana</i>	omitted
341	<i>Goodenia incana</i>	omitted
341	<i>Goodenia pulchella</i>	omitted
343	<i>Levenhookia dubia</i>	<i>Levenhookia pusilla</i>
343	<i>Levenhookia stipitata</i>	omitted
343	<i>Stylidium amoenum</i>	<i>Stylidium amoenum</i> var. <i>amoenum</i>
343	<i>Stylidium brunonianum</i>	<i>Stylidium brunonianum</i> subsp. <i>brunonianum</i>
343	<i>Stylidium calcaratum</i>	omitted
343	<i>Stylidium ciliatum</i>	<i>Stylidium piliferum</i> subsp. <i>piliferum</i>
343	<i>Stylidium junceum</i> subsp. <i>brevius</i>	<i>Stylidium junceum</i>
343	<i>Stylidium junceum</i> subsp. <i>junceum</i>	<i>Stylidium junceum</i>
343	<i>Stylidium neurophyllum</i> MS	omitted
343	<i>Stylidium piliferum</i>	<i>Stylidium piliferum</i> subsp. <i>piliferum</i>
343	<i>Stylidium schoenoides</i>	omitted
345	<i>Amblyperma spathulatum</i>	<i>Trichocline spathulata</i>
345	<i>Lagenophora huegelii</i>	omitted
345	<i>Millotia tenuifolia</i>	<i>Millotia tenuifolia</i> var. <i>tenuifolia</i>
345	<i>Pithocarpa pulchella</i>	<i>Pithocarpa pulchella</i> var. <i>pulchella</i>
345	<i>Quinetia urvillei</i>	omitted
345	<i>Rhodanthe citrina</i>	omitted
345	<i>Siloxerus filifolius</i>	omitted
345	<i>Siloxerus humifusus</i>	omitted

APPENDIX 2 Contents of Hvoutput.xls file

sheet:Fam_by_Project

Average number of species per site by family and by Data source

sheet:Proj_all_spp

Number of sites by data set for each of 10, 20 and 40 group levels from "All native species" classification

sheet:Proj_no_anns

Number of sites by data set for each of 10, 20 and 40 group levels from "no annual or geophytes" classification

sheet:Distn

distribution of community types from interpretation (Appendix 5).

sheet: spp_site_no_anns

species by site from "no annual or geophytes" classification

APPENDIX 3 Dendrogram all native species

Highlighted sites have low similarity with the sites from the DEC data to which they are most similar.

Project	Site	no spp	gp10	gp20	gp40	SCP FCT	Whicher	Inferred Whicher														
									01/10/08 14:39:43.39 dend EMB Happy Valley with DEC Jan 2008 all													
									0.2460	0.3876	0.5291	0.6707	0.8122	0.9538	1.0953	1.2369	1.3784	1.5200				
EEB	2007-01	59	1	1	1			A5/C4														
EEB	2007-02	43	1	1	1			C4														
EEB	HV27	34	1	1	1			C4														
EEB	HV35	39	1	1	2			C														
DEC	DARP01	51	1	2	3		C4															
DEC	DARP04	54	1	2	3		C4															
DEC	DARP05	53	1	2	3		C4															
DEC	DARP03	61	1	2	3		C4															
DEC	GAV02	49	1	2	3		C3															
DEC	boyan 02	58	1	3	4	01a	C3															
DEC	kelly01	61	1	3	4	01a	C3															
DEC	dard03	53	1	3	4	01a	C5															
DEC	GOOD03	58	1	3	4		C3															
DEC	GOOD04	59	1	3	4		C3															
DEC	DAVE04	51	1	3	5		C3															
DEC	DAVE05	60	1	3	5		C3															
EEB	HV14	37	1	3	5			C3														
EEB	HV29	40	1	3	5			C3														
EEB	HV33	48	1	3	5			C3														
EEB	HV13	41	1	3	5			C3														
EEB	HV32	51	1	3	5			C3														
EEB	HV37	58	1	3	5			C3														
EEB	HV09	41	1	3	5			C														
EEB	HV30	46	1	3	5			C2														
EEB	HV31	42	1	3	5			C3														
EEB	HV21	42	1	3	5			C3														
DEC	dard01	63	1	4	6	01a	C5															
EEB	2007-06	59	2	5	7			A5/C														
EEB	41	44	2	5	8			C2														
DEC	DARP08	50	2	5	9		C3															
EEB	HV26	40	2	5	9			C3														
EEB	HV05	42	2	5	9			C3														
EEB	HV19	41	2	5	9			C2														
DEC	gibson02	47	2	5	9	01a	C2															
EEB	HV15	33	2	5	9			C2														
EEB	HV06	42	2	5	9			C3														
DEC	DAVE01	62	2	5	10		C2															
EEB	HV17	44	2	5	10			C2														
EEB	HV01	57	2	5	10			C2														
EEB	HV24	49	2	5	10			C2														
EEB	HV18	44	2	5	10			C2														
EEB	HV08	49	2	5	10			C2														
DEC	DAVE02	53	2	5	10		C2															
EEB	HV12	46	2	5	10			C2														
EEB	EXTRA01	45	2	5	10			C2														
EEB	EXTRA03	52	2	5	10			C2														
EEB	EXTRA02	47	2	5	10			C2														
EEB	EXTRA07	52	2	5	10			C2														
EEB	EXTRA06	53	2	5	10			C2														
EEB	EXTRA08	55	2	5	10			C2														
EEB	EXTRA04	49	2	5	10			C2														
DEC	HAPP01	62	2	5	10		C2															
DEC	GAV01	59	2	5	10		A3															
EEB	HV39	52	2	5	10			C2														
EEB	EXTRA05	50	2	5	10			C3/A														
EEB	EXTRA09	56	2	5	10			C2														

Project	Site	no spp	gp10	gp20	gp40	SCP FCT	Whicher	Inferred Whicher	
DEC	ACTN02	43	3	6	11		C1		
DEC	smith03	47	3	6	11	01a	C1		
DEC	wicher01	42	3	6	11	01a	C1		
DEC	CHAM01	46	3	6	11		C4		
DEC	CHAM02	38	3	6	11		C4		
DEC	BOYA01	58	3	6	12		C2		
DEC	kemp01	49	3	6	12	01a	C1		
DEC	GOUL01	56	3	6	12		C1		
DEC	TREE01	46	3	6	12		C3		
DEC	TREE03	57	3	6	12		C1		
DEC	TREE04	57	3	6	12		C1		
DEC	SABI10	61	3	6	12		C1		
DEC	SABI11	58	3	6	12		C1		
DEC	WH05	63	3	6	12		C3		
DEC	ACTON-1	45	3	6	13	01a	C2		
DEC	smith02	57	3	6	13	01a	C2		
DEC	WONN-1	54	3	6	13	01a	C2		
DEC	GIBB02	41	3	6	14		C4		
DEC	GIBB06	43	3	6	14		C4		
DEC	GOUL02	61	3	6	15		C4		
DEC	TREE02	57	3	6	15		C1		
DEC	SABI02	57	3	6	15		C4		
DEC	SABI06	67	3	6	15		C4		
DEC	DAVE03	58	3	6	16		A5		
DEC	UCL03	59	3	6	16		A5		
DEC	WONN-2	61	3	6	16	01b	A2		
DEC	UCL02	64	3	6	17		A5		
DEC	will04	59	3	6	17	01a	A5		
DEC	WH02	69	3	6	17		A5		
DEC	DAVE06	56	3	6	18		C3		
DEC	UCL05	55	3	6	18		C4		
DEC	WH03	64	3	6	18		C4		
DEC	GAV03	54	3	6	19		C4		
DEC	GAV04	54	3	6	19		C4		
EEB	HV28	49	3	6	19			C4/3	
EEB	HV36	51	3	6	19			C	
DEC	SABI01	68	3	6	20		C4		
DEC	SABI04	48	3	6	20		C4		
DEC	will02	60	3	7	21	01a	A4		
EEB	2007-05	29	4	8	22			E/F	
DEC	davies04	46	4	9	23		E1		
DEC	WH01	56	4	9	23		E1		
DEC	GOOD01	41	4	10	24		E1		
EEB	HV25	28	4	10	25			A/E	
DEC	Norm02	53	5	11	26	01a	C6		
DEC	SABI03	32	6	12	27		F1		
DEC	SABI05	34	6	12	27		F1		
DEC	TAYL01	37	6	13	28		F2		
DEC	UCL04	36	6	13	28		F2		
EEB	2007-03	61	7	14	29			A5/C1	
EEB	2007-04	53	7	14	29			C4	
EEB	2007-09	47	7	14	29			A5	
EEB	2007-07	38	7	14	30			A5	
EEB	HV38	49	7	14	30			A	
DEC	UCL01	50	7	14	30		A5		
EEB	2007-08	47	7	14	30			C/A	
EEB	HV20	45	7	14	30			A/B1	
DEC	DARP02	49	7	15	31		A2		
EEB	HV23	45	7	15	31			A/B1	
DEC	GOOD02	61	7	15	31		A2		
DEC	DARP06	51	7	15	31		A3		
DEC	DARP07	56	7	15	31		A3		
DEC	GWINDR01	48	7	15	31		A3		

Project	Site	no spp	gp10	gp20	gp40	SCP FCT	Whicher	Inferred Whicher												
DEC	OATES-1	64	7	15	31	21b	A2													
DEC	UCL06	81	7	15	31		A2													
EEB	HV02	58	7	15	32			B1												
EEB	HV11	54	7	15	32			B1												
EEB	HV07	42	7	15	32			B1/A												
EEB	HV34	48	7	15	32			B1/A												
EEB	HV10	58	7	15	32			B1/A												
EEB	HV22	36	7	15	32			A												
DEC	ACTN01	34	7	16	33			A1												
DEC	SABIO7	49	7	16	33			A1												
DEC	SABIO8	54	7	16	33			A1												
DEC	SABIO12	64	7	16	33			A1												
DEC	WH06	59	7	16	33			A1												
DEC	WH04	59	7	16	33			A1												
DEC	SABIO9	46	7	16	33			A1												
DEC	boyan 01	60	8	17	34	21b		B1												
DEC	buffer01	40	8	17	34	21b		B1												
DEC	dard02	64	8	17	34	21b		B1												
DEC	GAV05	44	8	17	34			B1												
DEC	GWINDR02	68	8	17	34			B1												
DEC	GWINDR03	54	8	17	34			B1												
EEB	EXTRA10	44	8	17	34			B1												
EEB	EXTRA11	39	8	17	34			B1												
DEC	CARB-3	42	8	17	35	21b		B1												
DEC	HAPP02	38	8	17	35			B1												
DEC	CAPEL-1	42	8	17	36	21b		B1												
DEC	R116702	52	8	17	36	21b		B1												
DEC	Plant03	46	8	17	36	21b		B1												
DEC	Chid01	39	8	17	36	21b		B1												
DEC	Chid02	46	8	17	36	21b		B1												
DEC	gibson01	45	8	17	36	21b		B1												
DEC	kelly02	45	8	17	36	21b		B1												
DEC	CAPEL-2	41	8	17	36	21b		B1												
DEC	RUAB-2	36	8	17	36	21b		B1												
DEC	RUAB-1	41	8	17	36	21b		B1												
DEC	MANEA-3	47	8	17	36	21b		B1												
DEC	MGK03	42	8	17	36	21b		B1												
DEC	MGK04	43	8	17	36	21b		B1												
DEC	CHAM03	29	8	18	37			B2												
EEB	HV03	36	8	18	38			B1												
EEB	HV16	35	8	18	38			B1												
EEB	HV40	33	8	18	38			B1												
EEB	HV04	31	8	18	38			B1												
DEC	GIBB01	20	9	19	39			G1												
DEC	GIBB03	6	10	20	40			G2												
									0.2460	0.3876	0.5291	0.6707	0.8122	0.9538	1.0953	1.2369	1.3784	1.5200		

Project	Site	no spp	gp10	gp20	gp40	SCP FCT	Whicher	Inferred Whicher	
DEC	DARP07	56	7	15	28		A3		
DEC	OATES-1	64	7	15	29	21b	A2		
DEC	UCL06	81	7	15	29		A2		
DEC	will02	60	7	15	29	01a	A4		
DEC	DAVE03	58	7	15	30		A5		
DEC	UCL03	59	7	15	30		A5		
EEB	HV10	58	7	15	30			B1/A	
DEC	SABI09	46	7	15	31		A1		
DEC	WH02	69	7	15	31		A5		
DEC	WONN-2	61	7	15	31	01b	A2		
DEC	boyan_01	60	8	16	32	21b	B1		
DEC	kelly02	45	8	16	32	21b	B1		
DEC	buffer01	40	8	16	32	21b	B1		
DEC	dard02	64	8	16	32	21b	B1		
DEC	GAV05	44	8	16	32		B1		
DEC	GWINDR02	68	8	16	32		B1		
DEC	GWINDR03	54	8	16	32		B1		
DEC	CAPEL-1	42	8	16	32	21b	B1		
DEC	Plant03	46	8	16	32	21b	B1		
DEC	gibson01	45	8	16	32	21b	B1		
DEC	Chid01	39	8	16	32	21b	B1		
DEC	Chid02	46	8	16	32	21b	B1		
DEC	R116702	52	8	16	32	21b	B1		
DEC	CAPEL-2	41	8	16	32	21b	B1		
DEC	RUAB-1	41	8	16	32	21b	B1		
DEC	RUAB-2	36	8	16	32	21b	B1		
DEC	MANEA-3	47	8	16	33	21b	B1		
DEC	MGK03	42	8	16	33	21b	B1		
DEC	MGK04	43	8	16	33	21b	B1		
DEC	CARB-3	42	8	16	34	21b	B1		
DEC	HAPP02	38	8	16	34		B1		
EEB	EXTRA10	44	8	17	35			B1	
EEB	EXTRA11	39	8	17	35			B1	
EEB	HV40	33	8	17	35			B1	
EEB	HV02	58	8	17	36			B1	
EEB	HV11	54	8	17	36			B1	
EEB	HV07	42	8	17	36			B1/A	
EEB	HV34	48	8	17	36			B1/A	
EEB	HV22	36	8	17	36			A	
EEB	HV03	36	8	17	37			B1	
EEB	HV16	35	8	17	37			B1	
EEB	HV04	31	8	17	37			B1	
DEC	CHAM03	29	9	18	38			B2	
DEC	GIBB01	20	10	19	39			G1	
DEC	GIBB03	6	10	20	40			G2	
									0.2280
									0.3749
									0.5218
									0.6687
									0.8156
									0.9624
									1.1093
									1.2562
									1.4031
									1.5500

APPENDIX 5 Summary of Determination of Whicher Community Types

HV Sites only

A – All species. B – no annuals etc v – association similarity value (values > 0.5 are not very similar)

“Interpretation” is the nearest but not necessarily the appropriate community as the value of the association score needs to be considered).

site	From Classification		From Nearest Neighbour				Interpretation
	A	B	nA	vA	nB	vB	
2007-01	C	A	A5/C4	0.51	C4/A5	0.53	A5/C4
2007-02	C	A	C4	0.55	C4	0.53	C
2007-03	A	A	A5/1	0.52	C1	0.53	A5/C1
2007-04	A	A	C4/A	0.54	C4	0.51	C4
2007-05	E1	A	E/F	0.7	E/F	0.68	E/F
2007-06	C	C2	A5	0.51	A5	0.51	A5/C
2007-07	A5	A	A5	0.56	A5	0.52	A5
2007-08	A5	A	C1/A	0.52	C1/A	0.49	C/A
2007-09	A	A	A5/C4	0.5	A5	0.49	A5
41	C	C2	C2	0.47	C2	0.46	C2
EXTRA01	C2	C2	C2	0.44	C2	0.45	C2
EXTRA02	C2	C2	C2	0.48	C2	0.47	C2
EXTRA03	C2	C2	C2	0.42	C2	0.42	C2
EXTRA04	C2	C2	C2	0.38	C2	0.39	C2
EXTRA05	C2	A3	C3	0.5	A3/C2	0.5	C3/A
EXTRA06	C2	C2	C2	0.37	C2	0.35	C2
EXTRA07	C2	C2	C2	0.4	C2	0.33	C2
EXTRA08	C2	C2	C2	0.39	C2	0.38	C2
EXTRA09	C2	C2	C2	0.41	C2	0.35	C2
EXTRA10	B1	B1	B1	0.43	B1	0.41	B1
EXTRA11	B1	B1	B1	0.49	B1	0.48	B1
HV01	C2	C2	C2	0.3	C2	0.36	C2
HV02	A	B1	B1/A2	0.46	B1	0.47	B1
HV03	B	B1	B1	0.44	B1	0.46	B1
HV04	B	B1	B1	0.54	B1	0.52	B1
HV05	C3	C3	C3	0.49	C	0.45	C3
HV06	C2	C3	C3/2	0.48	C3	0.46	C3
HV07	A	B1	B1/A	0.5	B1	0.49	B1/A
HV08	C2	C2	C2	0.38	C2	0.36	C2
HV09	C3	C3	C3/2	0.44	C3/2	0.39	C3/2
HV10	A5	A5	A/B1	0.51	B1/A	0.46	B1/A
HV11	A	B1	B1	0.47	B1	0.47	B1
HV12	C2	C2	C2	0.33	C2	0.27	C2
HV13	C3	C3	C3	0.44	C3	0.4	C3
HV14	C3	C3	C3	0.4	C3	0.36	C3
HV15	C2	C2	C2	0.45	C2	0.38	C2
HV16	B	B1	B1	0.5	B1	0.5	B1
HV17	C2	C2	C2	0.26	C2	0.34	C2
HV18	C2	C2	C2	0.36	C2	0.34	C2
HV19	C3	C2	C2	0.41	C2	0.34	C2
HV20	A5	C3	A/B	0.55	B/A	0.54	A/B
HV21	C3	C3	C3	0.48	C3	0.46	C3
HV22	A	B1	A	0.59	A/B1	0.54	A
HV23	A2	C2	A2/3	0.43	B1/A	0.47	A/B
HV24	C2	C2	C2	0.33	C2	0.32	C2
HV25	E1	E1	A/E	0.66	A/E	0.64	A/E
HV26	C3	C3	C3	0.43	C3	0.36	C3
HV27	C	A	C4	0.58	C4/C3	0.54	C4
HV28	C4	C4	C4/3	0.47	C3/4	0.47	C4/3
HV29	C3	C3	C3/4	0.44	C3	0.38	C3
HV30	C3	C3	C2/3	0.4	C2	0.36	C2
HV31	C3	C3	C3	0.46	C3	0.45	C3
HV32	C3	C3	C3	0.44	C3	0.36	C3

site	From Classification		From Nearest Neighbour				Interpretation
	A	B	nA	vA	nB	vB	
HV33	C3	C3	C3	0.4	C3	0.32	C3
HV34	A	B1	A/B1	0.48	B1/A2	0.46	B1/A
HV35	C	C3	C3/4	0.52	C	0.5	C
HV36	C4	C4	A5/C4	0.46	C4/A5	0.45	C4/A5
HV37	C3	C3	C3/4	0.44	C3	0.42	C3
HV38	A5	A	A/B	0.54	A2/5	0.56	A
HV39	C2	C2	A3/C2	0.42	C2	0.4	C3
HV40	B	B1	B1	0.48	B1	0.47	B1