**SUPPLEMENTARY MATERIAL**

Conole, L. E. (2013). Habitat-of-origin predicts degree of adaptation in urban tolerant birds. *PeerJ PrePrints*. doi:10.7287/peerj.preprints.156v2

*Study area*

The study area is metropolitan Melbourne; capital city of the State of Victoria in coastal south-eastern Australia, within a 50 km radius of its Central Business District (37°49'S 144°58'E). The study area excludes the sea, but includes areas not yet urbanised. The total area of metropolitan Melbourne is approximately 880,000 ha, with a population in 2007 of approximately 3.8 million people (DPCD, 2008). Suburbs, with detached single dwellings in gardens dominated by plant species exotic to Melbourne, cover most of the above area. Semi-natural remnants of native vegetation are scattered within the bounds of the urban area, which also contains many parks and gardens planted with exotic plant species. Trees are planted in most streets; these tend to be native to Australia, but not to the Melbourne region (Frank, Waters, Beer, & May, 2006). The original vegetation of Melbourne and the native vegetation that survives on its margins is highly varied, this variation being related to soils, which range from highly fertile black, cracking clays to highly infertile deep leached sands, and annual rainfall, which ranges from 540 to 1,000 mm from the west to the east.

*Atlas data*

Approximately 220,000 records of 292 species of birds from 11,434 surveys were extracted from the Birds Australia 'New Atlas of Australian Birds' project database (hereafter 'the Atlas') (Barrett, Silcocks, Barry, Cunningham, & Poulter, 2003). The Atlas database contains four types of record: 2-ha search for 20 minutes; small area search (within 500 m of a central point); large area search (within 5 km of a central point); and, incidental observations of individual species from a single point (Barrett et al., 2003). Each survey represents a list of species for a defined area and time (ranging from 20 minutes to one month), with geographic co-ordinates. All data were collected between 1998 and 2002. Data initially extracted for this study included 4,221 2-ha searches, 4,993 small area searches, 793 large area searches, and 1,427 incidental observations, and were compiled in a matrix as species and their relative abundance (number of surveys in which a species was recorded in a cell divided by the total number of surveys conducted in the cell) by site.

Using ArcMap GIS, a 1 x 1 km grid based on that developed by the Australian Research Centre for Urban Ecology (ARCUE) (Hahs & McDonnell, 2006) was intersected with Atlas records to produce a matrix of grid cells by species presence/absence. All surveys were assigned to the grid cell in which the central geographic coordinates fell, regardless of survey spatial or temporal scale. It was assumed that most large area searches (6.9% of the surveys in the unfiltered data set) referred to areas of between 500 – 2,000 m diameter, and therefore could reasonably be assigned to 1 x 1 km grid cells within which the central coordinates fell.

*Estimated sampling completeness*

As there is a likelihood that less abundant species may be missed where sampling effort is lower, leading to uneven representation of species (Watson, 2003), a measure of estimated sampling completeness was calculated for each of the grid cells. This enabled an assessment of the evenness of sampling, and for unrepresentative samples to be removed from the data to be analysed.

First, the predicted number of species ($S_{Chao2}$) was calculated for each cell in a 66 km x 65 km grid, using the $Chao_2$ formula (Chao, 1987) (Formula 1), where Sobs equals the number of species observed, $Q_1$ the number of unique records (species observed once at a site during surveys), and $Q_2$ the number of doubletons (species observed twice). $S_{Chao2}$ is the estimated total number of species present at survey sites, including those not found during surveys.

$$S_{Chao2} = S_{Obs} + \frac{Q_1^2}{2Q_2}$$

**Formula 1: Chao2**

From these calculations a standardized measure of sampling completeness (%Completeness) was also calculated for each grid cell, with observed species richness ($S_{obs}$) as a proportion of predicted species richness ($S_{Chao2}$) (Peterson & Slade, 1998).

*Data organisation*

Several assumptions were made about species to be excluded from analyses, and species were not included in grid cell totals and were eliminated from further analyses if any of the following exclusion criteria were met: (i) constituted fewer than five records in the total dataset; (ii) was an irregular or vagrant species to the area or feral species not yet naturalised, determined from the literature (Barrett et al., 2003); or, (iii) were seabird, waterbird, and nocturnal species, except the Tawny Frogmouth *Podargus strigoides*, from the orders or families: Anseriformes, Podicipediformes, Strigiformes, Eurostopodidae, Aeogothelidae, Procellariformes, Spenisciformes, Phalacrocaraciformes, Ciconiiformes, Gruiformes, Charadriiformes (sensu Christidis & Boles, 2008). A final list of 141 species (hereafter ‘the filtered species list’) was retained for further analysis.

Grid cells were eliminated from further analyses if any of the following exclusion criteria were met: (i) ≤ 1 surveys in the cell; (ii) %Completeness < 50%; (iii) land area < 25% of the cell; or (iv) a high proportion of singleton records (>50%) and/or no doubleton records (indicating skewed data collection, e.g. single-species or other narrowly targeted surveys). A final list of 390 grid cells was retained for further analysis.

Bird species were classified into foraging guilds using a modified scheme for southern Victorian species (Mac Nally, 1994). Mac Nally's (1994) 'Hawker' and 'Sweeper' categories were combined to make 'Hawker/Sweeper', 'Wood Searcher' and 'Bark Prober' combined to make 'Wood Searcher/Bark Prober', and the categories of 'Raptor' and 'Frugivore' were added. Species not classified by Mac Nally (1994) were classified according to data contained in the 'Handbook of Australian, New Zealand and Antarctic Birds' (HANZAB) (Higgins, 1999; Higgins & Davies, 1996; Higgins & Peter, 2002; Higgins, Peter, & Cowling, 2006; Higgins, Peter, & Steele, 2001; Marchant & Higgins, 1993). Nest substrate and dispersal groupings were also assigned from data contained in HANZAB. Data on bird size was tabulated as maximum mass (in grams) from HANZAB. Systematics and nomenclature of birds follow Christidis and Boles (2008).

Spatial data on the degree of urbanisation of the study area employed in this study were developed at ARCUE and are discussed in detail by Hahs and McDonnell (2006); a brief summary follows. People per square kilometre (People $km^{-2}$) is the total number of people in census collection districts (Australian Bureau of Statistics, 2003). Dwellings per square kilometre (Dwellings $km^{-2}$) is the total number of dwellings in census collection districts (Australian Bureau of Statistics, 2003). Frequency Greenspace is the reciprocal of the average amount of impervious surface calculated at the sub-pixel level from the impervious surface fraction image created during the spectral mixture analysis of the 2000 Landsat ETM + image (2006). Combined index ($Index_{combined}$) is the average value of $Index_{image}$ and $Index_{census}$; where $Index_{image}$ is calculated from fraction images produced by the spectral mixture analysis of the 2000 Landsat ETM+ image, and $Index_{census}$ = the total number of people multiplied by the proportion of males employed in non-agricultural work, as enumerated in the 2001 census (2006). Combined index was found to be a useful measure for determining the level of urbanisation represented by a combination of demographic and spatial data (2006).

Metrics were calculated for all cells in the 65 x 66 km ARCUE grid (2006) (Amy Hahs pers. comm, 25 May 2007).

*Data analysis*

All statistical analyses were performed in R (R Core Team, 2013), using core functions and procedures from the community ecology package ‘vegan’ (Oksanen et al., 2013). Figures were drawn using R core functions, and the ‘PBSmapping’ (Schnute et al., 2013) and ‘sp’ (Bivand, Pebesma, & Gómez-Rubio, 2013) packages.

The data for cluster analysis consisted of a standard ‘r x c’ array, with sites as rows, species as columns, and relative abundance (% incidence in surveys conducted in each cell) data for species occurring in each grid cell. A Bray-Curtis distance matrix was prepared, and groups of species were formed by hierarchical agglomerative clustering using Ward’s algorithm performed on the distance matrix, as a function of their similarity in distribution and relative abundance. Following González Oreja et al. (2007), an assemblage is a cluster of species separated from all other such clusters by an ecological distance greater than the greatest distance between the two most disparate members of the clade. Where significant sub-structuring in the dendrogram coincided with diagnosable trends in the environmental and demographic data, sub-assemblages were recognized. Assemblages were named using Blair’s (1996) standard nomenclature, in keeping with its wide use in the urban bird ecology literature (Chace & Walsh, 2006).

The species and grid cells were ordinated by global non-metric multidimensional scaling (NMDS) methods, using the ‘vegan’ package. A two-dimensional solution using the Wisconsin square-root transformation and Bray-Curtis coefficients as a measure of dissimilarity in species composition between the sample plots was chosen. Vectors for seven variables were fitted to both the species and grid cell two-dimensional ordination space using the procedure, ‘envfit’, in ‘vegan’, and the species ordination space was plotted in an ordination graphic.

Each grid cell was attributed to the bird cluster that had the highest proportion of its total number of species within it, except for 13 cells out of 390 (3.3%), which had equal numbers of cluster 2a and 2b species present.

A Kruskal-Wallis test was used to test whether these five groups of grid cells differed in a simple measure of urbanisation intensity, People $km^{-2}$. A Kruskal-Wallis test was also used to test whether these five groups of grid cells differed in longitude (indicating their position on a west to east environmental gradient in Melbourne), and to test whether bird mass differed significantly between the five groups. The Mann-Whitney U-test was used to determine which means were significantly different from others. As we were principally interested in the ‘comparisonwise error rate’ rather than the ‘experimentise error rate’, an $\alpha$ correction (such as Bonferroni) for multiple comparison testing was judged to be unnecessary (Bender & Lange, 2001).

The assemblage members were then allocated to the categories of urban exploiter, suburban adapter, or urban avoider (Blair, 1996) on the basis of their membership of the clusters associated with different levels of urbanisation intensity. This objective classification process (Conole & Kirkpatrick, 2011) differs from the method employed in some other studies, in which the urban bird classes were commonly aligned a priori with predetermined classes of urbanisation intensity (Croci, Butet, & Clergeau, 2008; White, Antos, Fitzsimons, & Palmer, 2005).

For most analyses and discussion, the exploiter and adapter groups are pooled as urban tolerant. A Pearson's Chi-square test was used to determine whether particular functional and size classes deviated from expected distributions between urban tolerant and urban avoider birds.

Proportions of urban tolerant or urban avoider species occurring in foraging, nest substrate dispersal and size classes were converted to simple probabilities. Joint probabilities of all extant foraging and nest substrate combinations were obtained by multiplying simple probability pairings. Odds Ratios were also calculated for all these combinations. The Odds Ratio is a measure of effect size, and is a way of comparing whether the probability of a certain event is the same for two groups (Rita & Komonen, 2008). An odds ratio of 1 implies that the event is equally likely in both groups, an odds ratio greater than one implies that the event is more likely in the first (focal) group, or an odds ratio less than one (indicated by negative index -1) implies that the event is less likely in the first (focal) group. Where the focal proportion is p, and the reference proportion r, the Odds Ratio is calculated by dividing the odds of an event happening (p) by the odds of it not happening (r). The Odds Ratio is suitable for measuring both the size and direction of the difference between proportions in ecology (Rita & Komonen, 2008).

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# Script for non-metric multidimensional scaling (NMDS) analysis of urban adapter bird data

This is an R Mardkown file which contains a 'vegan' script for a non-metric multidimensional scaling ordination for the urban adapter bird assemblage that I ran in:

Conole, L. E. (2013). Habitat-of-origin predicts degree of adaptation in urban tolerant birds. *PeerJ PrePrints*. doi:10.7287/peerj.preprints.156v2. https://peerj.com/preprints/156v2

```
library(vegan)
```

```
## Loading required package: permute
## Loading required package: lattice
## This is vegan 2.0-10
```

```
clade2a <- read.table("clade2a.RA.txt", header = T)
clade2a
```

```
##      Australian.Raven Bell.Miner Blackfaced.CuckooShrike Brown.Thornbill
## AA45           0.0000     0.0000                  0.0000          0.0000
## AC44           0.0290     0.0000                  0.0010          0.0000
## AD36           0.0000     0.0000                  0.0238          0.0000
## AD46           0.0435     0.0000                  0.0000          0.0000
## AE45           0.0000     0.0000                  0.0000          0.0000
## AF34           0.0000     0.0000                  0.0000          0.0000
## AF37           0.0000     0.0000                  0.0000          0.0000
## AF39           0.0000     0.0000                  0.0085          0.0000
## AF40           0.0000     0.0000                  0.0000          0.0000
## AG33           0.0000     0.0000                  0.0114          0.0000
## AG36           0.0000     0.0000                  0.0000          0.0000
## AG43           0.0000     0.0000                  0.0000          0.0000
## AH33           0.0000     0.0000                  0.0000          0.0000
## AH37           0.0000     0.0000                  0.0088          0.0000
## AH38           0.0000     0.0000                  0.0313          0.0000
## AH41           0.0000     0.0000                  0.0000          0.0000
## AI37           0.0000     0.0000                  0.0000          0.0000
## AJ27           0.0000     0.0000                  0.0000          0.0000
## AJ37           0.0741     0.0000                  0.0000          0.0000
## AJ39           0.0000     0.0000                  0.0000          0.0000
## AJ40           0.0222     0.0000                  0.0111          0.0000
## AK39           0.0000     0.0000                  0.0215          0.0000
## AK40           0.0769     0.0000                  0.0000          0.0000
## AK41           0.0000     0.0000                  0.0000          0.0000
## AK43           0.0400     0.0000                  0.0000          0.0000
## AK44           0.0000     0.0000                  0.0000          0.0000
## AL34           0.0000     0.0000                  0.0050          0.0000
## AL36           0.0317     0.0000                  0.0000          0.0000
## AM36           0.0187     0.0000                  0.0187          0.0467
```

```
## AM37              0.0000    0.0000                   0.0000        0.0000
## AM46              0.0011    0.0000                   0.0223        0.0685
## AN30              0.0000    0.0000                   0.0000        0.0000
## AN36              0.0000    0.0000                   0.0408        0.0000
## AN39              0.0000    0.0055                   0.0164        0.0055
## AN40              0.0120    0.0040                   0.0200        0.0040
## AN50              0.0000    0.0000                   0.0000        0.0000
## AO37              0.0000    0.0000                   0.0231        0.0000
## AO41              0.0012    0.0162                   0.0416        0.0393
## AO43              0.0000    0.0012                   0.0012        0.0012
## AP43              0.0000    0.0366                   0.0167        0.0312
## AQ30              0.0000    0.0000                   0.0070        0.0000
## AQ37              0.0000    0.0136                   0.0068        0.0272
## AQ43              0.0000    0.0000                   0.0375        0.0500
## AQ44              0.0000    0.0000                   0.0000        0.0000
## AR30              0.0000    0.0144                   0.0086        0.0029
## AR38              0.0091    0.0273                   0.0182        0.0455
## AR43              0.0000    0.0000                   0.0102        0.0102
## AR45              0.0000    0.0000                   0.0000        0.0400
## AS30              0.0000    0.0244                   0.0081        0.0244
## AS39              0.0000    0.0000                   0.0060        0.0482
## AS40              0.0000    0.0000                   0.0000        0.0588
## AS46              0.0000    0.0000                   0.0000        0.0476
## AS48              0.0000    0.0000                   0.0217        0.0000
## AT30              0.0135    0.0135                   0.0135        0.0541
## AT32              0.0000    0.0000                   0.0000        0.0000
## AT36              0.0000    0.0650                   0.0108        0.0407
## AT37              0.0000    0.0508                   0.0169        0.0508
## AT41              0.0000    0.0000                   0.0000        0.0000
## AT46              0.0645    0.0000                   0.0645        0.0000
## AT48              0.0274    0.0000                   0.0137        0.0411
## AU29              0.0000    0.0000                   0.0000        0.0000
## AU30              0.0000    0.0286                   0.0000        0.0143
## AU44              0.0000    0.0000                   0.0000        0.0000
## AU47              0.0000    0.0000                   0.0172        0.0172
## AU50              0.0000    0.0000                   0.0034        0.0215
## AV27              0.0000    0.0357                   0.0179        0.0000
## AV40              0.0000    0.0000                   0.0000        0.0882
## AV41              0.0455    0.0000                   0.0000        0.0455
## AV49              0.0000    0.0000                   0.0000        0.0000
## AW30              0.0020    0.0176                   0.0020        0.0342
## AW42              0.0000    0.0000                   0.0000        0.0400
## AW43              0.0068    0.0000                   0.0000        0.0068
## AW44              0.0000    0.0000                   0.0084        0.0000
## AW47              0.0206    0.0000                   0.0103        0.0412
## AW50              0.0000    0.0000                   0.0075        0.0008
## AX39              0.0000    0.0000                   0.0000        0.0606
## AX42              0.0000    0.0000                   0.0313        0.0000
## AX43              0.0000    0.0000                   0.0069        0.0165
```

```
## AX50              0.0000    0.0000              0.0054       0.0385
## AY29              0.0431    0.0259              0.0000       0.0259
## AY45              0.0000    0.0000              0.0000       0.0000
## AY49              0.0000    0.0046              0.0153       0.0581
## BA25              0.0339    0.0508              0.0000       0.0169
## BA26              0.0042    0.0254              0.0169       0.0169
## BA29              0.0000    0.0023              0.0023       0.0000
## BA30              0.0000    0.0286              0.0095       0.0333
## BA40              0.0000    0.0000              0.0000       0.0000
## BA42              0.0000    0.0000              0.0000       0.0400
## BA44              0.0714    0.0000              0.0000       0.0000
## BA47              0.0000    0.0000              0.0000       0.0000
## BA48              0.0009    0.0034              0.0017       0.0273
## BA50              0.0000    0.0000              0.0000       0.0000
## BB28              0.0000    0.0126              0.0126       0.0084
## BB31              0.0049    0.0196              0.0049       0.0098
## BB32              0.0000    0.0417              0.0000       0.0278
## BB37              0.0000    0.0000              0.0000       0.0000
## BB42              0.0000    0.0054              0.0095       0.0692
## BB45              0.0105    0.0000              0.0042       0.0000
## BC34              0.0385    0.0577              0.0192       0.0385
## BC40              0.0185    0.0370              0.0185       0.0370
## BC43              0.0000    0.0000              0.0000       0.0000
## BC44              0.0000    0.0000              0.0000       0.0000
## BC45              0.0000    0.0000              0.0000       0.0000
## BD49              0.0952    0.0000              0.0000       0.0476
## BD50              0.0000    0.0426              0.0043       0.0043
## BE33              0.0000    0.0588              0.0000       0.0000
## BE38              0.0058    0.0250              0.0231       0.0443
## BE39              0.0000    0.0491              0.0000       0.0429
## BE40              0.0000    0.0000              0.0035       0.0035
## BE44              0.0000    0.0074              0.0012       0.0593
## BE45              0.0000    0.0233              0.0000       0.0465
## BE47              0.0000    0.0000              0.0132       0.0066
## BF41              0.0208    0.0104              0.0104       0.0208
## BF42              0.0000    0.0000              0.0025       0.0215
## BF44              0.0000    0.0161              0.0000       0.0968
## BG37              0.0000    0.0000              0.0039       0.0000
## BG41              0.0000    0.0000              0.0093       0.0093
## BG42              0.0000    0.0000              0.0000       0.0000
## BG49              0.0812    0.0000              0.0016       0.0211
## BH31              0.0039    0.0329              0.0174       0.0213
## BH32              0.0000    0.0152              0.0152       0.0303
## BH39              0.0000    0.0526              0.0000       0.0175
## BH40              0.0000    0.0385              0.0385       0.0000
## BH42              0.0000    0.0089              0.0000       0.0000
## BH46              0.0000    0.0000              0.0000       0.1333
## BH49              0.0602    0.0000              0.0120       0.0000
## BI43              0.0000    0.0000              0.0000       0.0000
```

```
## BJ37              0.0036     0.0108                      0.0000          0.0430
## BJ41              0.0294     0.0000                      0.0000          0.0588
## BJ42              0.0000     0.0000                      0.0000          0.0800
## BJ43              0.0000     0.0044                      0.0175          0.0482
## BJ46              0.0000     0.0167                      0.0000          0.0000
## BJ47              0.0140     0.0026                      0.0070          0.0009
## BJ48              0.0000     0.0009                      0.0051          0.0153
## BK36              0.0333     0.0000                      0.0000          0.0000
## BK43              0.0098     0.0000                      0.0196          0.0490
## BL39              0.0174     0.0000                      0.0043          0.0000
## BL43              0.0000     0.0357                      0.0119          0.0000
## BM45              0.0000     0.1250                      0.0000          0.0000
## BM46              0.0168     0.0000                      0.0000          0.0000
## BM49              0.0526     0.0000                      0.0000          0.0000
## BN39              0.0046     0.0000                      0.0046          0.0548
## BN40              0.0588     0.0000                      0.0000          0.0000
## BZ29              0.0000     0.0250                      0.0250          0.0250
## BZ30              0.0009     0.0296                      0.0141          0.0292
## BZ37              0.0000     0.0000                      0.0000          0.0000
## BZ42              0.0333     0.0000                      0.0000          0.0333
## BZ46              0.0000     0.0000                      0.0000          0.0667
## BZ48              0.0033     0.0393                      0.0131          0.0525
## BZ49              0.0007     0.0274                      0.0137          0.0280
## C28               0.0526     0.0000                      0.0000          0.0000
## N15               0.0526     0.0000                      0.0000          0.0000
## U48               0.0000     0.0000                      0.0000          0.0000
## x3351             0.0000     0.0000                      0.0000          0.0000
## x3479             0.0000     0.0000                      0.0031          0.0126
## x3546             0.0000     0.0000                      0.0012          0.0012
## x3679             0.0000     0.0000                      0.0000          0.0000
## x3682             0.0000     0.0000                      0.0000          0.0000
## x3761             0.0000     0.0000                      0.0000          0.0537
## x3869             0.0006     0.0000                      0.0126          0.0348
## x3872             0.0000     0.0000                      0.0000          0.0000
## x3940             0.0036     0.0000                      0.0018          0.0000
## x3950             0.0000     0.0500                      0.0000          0.0000
## x3953             0.0000     0.0029                      0.0000          0.0029
## x4000             0.0000     0.0000                      0.0000          0.0000
## x4001             0.0280     0.0000                      0.0093          0.0000
## x4006             0.0000     0.0000                      0.0000          0.0000
## x4066             0.0000     0.0000                      0.0127          0.0000
## x4134             0.0000     0.0000                      0.0000          0.0000
## x4135             0.0000     0.0000                      0.0000          0.0000
## x4139             0.0000     0.0000                      0.0000          0.0000
## x4146             0.0000     0.0045                      0.0000          0.0045
## x4149             0.0013     0.0379                      0.0013          0.0327
## x4208             0.0000     0.0000                      0.0000          0.0000
## x4231             0.0000     0.0000                      0.0000          0.0000
## x4264             0.0000     0.0000                      0.0357          0.0000
```

```
## x4269           0.0000     0.0000                    0.0000            0.0000
## x4275           0.0000     0.0000                    0.0095            0.0006
## x4276           0.0058     0.0000                    0.0106            0.0290
##        Common.Bronzewing Crimson.Rosella Eastern.Rosella Eastern.Spinebill
## AA45              0.0000          0.0000          0.0000            0.0000
## AC44              0.0000          0.0000          0.0000            0.0000
## AD36              0.0000          0.0000          0.0000            0.0000
## AD46              0.0000          0.0000          0.0000            0.0000
## AE45              0.0000          0.0000          0.0000            0.0000
## AF34              0.0000          0.0000          0.0000            0.0000
## AF37              0.0000          0.0000          0.0076            0.0000
## AF39              0.0000          0.0000          0.0000            0.0000
## AF40              0.0000          0.0000          0.0000            0.0000
## AG33              0.0000          0.0000          0.0341            0.0000
## AG36              0.0000          0.0000          0.0000            0.0000
## AG43              0.0000          0.0000          0.0000            0.0000
## AH33              0.0000          0.0000          0.0000            0.0000
## AH37              0.0000          0.0000          0.0000            0.0000
## AH38              0.0000          0.0000          0.0313            0.0000
## AH41              0.0000          0.0000          0.0000            0.0000
## AI37              0.0000          0.0000          0.0000            0.0333
## AJ27              0.0000          0.0000          0.0000            0.0000
## AJ37              0.0000          0.0000          0.0000            0.0000
## AJ39              0.0000          0.0161          0.0323            0.0000
## AJ40              0.0000          0.0000          0.0222            0.0000
## AK39              0.0000          0.0000          0.0108            0.0000
## AK40              0.0000          0.0000          0.0000            0.0000
## AK41              0.0000          0.0000          0.0000            0.0000
## AK43              0.0000          0.0000          0.0000            0.0000
## AK44              0.0000          0.0000          0.0000            0.0000
## AL34              0.0000          0.0000          0.0000            0.0000
## AL36              0.0000          0.0000          0.0000            0.0000
## AM36              0.0000          0.0187          0.0187            0.0000
## AM37              0.0000          0.0000          0.0000            0.0000
## AM46              0.0000          0.0006          0.0111            0.0139
## AN30              0.0000          0.0000          0.0328            0.0164
## AN36              0.0000          0.0000          0.0816            0.0000
## AN39              0.0000          0.0000          0.0109            0.0000
## AN40              0.0000          0.0000          0.0080            0.0040
## AN50              0.0000          0.0000          0.0357            0.0000
## AO37              0.0000          0.0000          0.0463            0.0000
## AO41              0.0000          0.0058          0.0301            0.0139
## AO43              0.0000          0.0000          0.0000            0.0000
## AP43              0.0000          0.0005          0.0258            0.0264
## AQ30              0.0140          0.0000          0.0420            0.0000
## AQ37              0.0068          0.0204          0.0272            0.0272
## AQ43              0.0000          0.0000          0.0125            0.0375
## AQ44              0.0000          0.0000          0.0323            0.0000
## AR30              0.0057          0.0000          0.0345            0.0000
```

```
## AR38            0.0000         0.0091         0.0545           0.0000
## AR43            0.0000         0.0000         0.0000           0.0102
## AR45            0.0000         0.0000         0.0200           0.0200
## AS30            0.0000         0.0081         0.0407           0.0163
## AS39            0.0000         0.0000         0.0422           0.0000
## AS40            0.0000         0.0000         0.0588           0.0588
## AS46            0.0000         0.0000         0.0476           0.0000
## AS48            0.0000         0.0000         0.0217           0.0000
## AT30            0.0000         0.0405         0.0541           0.0405
## AT32            0.0000         0.0000         0.0769           0.0000
## AT36            0.0190         0.0257         0.0203           0.0407
## AT37            0.0169         0.0000         0.0508           0.0169
## AT41            0.0000         0.0000         0.0732           0.0244
## AT46            0.0000         0.0000         0.0323           0.0000
## AT48            0.0000         0.0000         0.0548           0.0000
## AU29            0.0000         0.0165         0.0744           0.0000
## AU30            0.0000         0.0429         0.0714           0.0000
## AU44            0.0000         0.0455         0.0909           0.0000
## AU47            0.0000         0.0000         0.0000           0.0000
## AU50            0.0000         0.0000         0.0328           0.0015
## AV27            0.0000         0.0000         0.1071           0.0000
## AV40            0.0000         0.0000         0.0000           0.1176
## AV41            0.0000         0.0000         0.0455           0.0455
## AV49            0.0000         0.0000         0.0769           0.0000
## AW30            0.0020         0.0020         0.0616           0.0000
## AW42            0.0000         0.0000         0.1200           0.0400
## AW43            0.0000         0.0204         0.0544           0.0068
## AW44            0.0000         0.0168         0.0672           0.0000
## AW47            0.0000         0.0000         0.0206           0.0000
## AW50            0.0017         0.0059         0.0343           0.0017
## AX39            0.0000         0.0000         0.0152           0.0000
## AX42            0.0000         0.0000         0.0313           0.0000
## AX43            0.0000         0.0007         0.0468           0.0021
## AX50            0.0000         0.0009         0.0081           0.0081
## AY29            0.0172         0.0345         0.0517           0.0259
## AY45            0.0000         0.0000         0.0000           0.0000
## AY49            0.0000         0.0046         0.0382           0.0153
## BA25            0.0000         0.0000         0.0508           0.0000
## BA26            0.0085         0.0127         0.0297           0.0127
## BA29            0.0599         0.0507         0.0622           0.0415
## BA30            0.0333         0.0000         0.0238           0.0000
## BA40            0.0000         0.0000         0.0526           0.0000
## BA42            0.0000         0.0000         0.0800           0.0000
## BA44            0.0000         0.0000         0.0429           0.0000
## BA47            0.0000         0.0118         0.0353           0.0235
## BA48            0.0000         0.0247         0.0512           0.0205
## BA50            0.0000         0.0000         0.0073           0.0000
## BB28            0.0251         0.0042         0.0418           0.0000
## BB31            0.0343         0.0245         0.0490           0.0196
```

```
## BB32              0.0278        0.0000        0.0417         0.0000
## BB37              0.0000        0.0000        0.1226         0.0000
## BB42              0.0000        0.0081        0.0326         0.0176
## BB45              0.0000        0.0000        0.0126         0.0168
## BC34              0.0192        0.0000        0.0385         0.0000
## BC40              0.0185        0.0185        0.0370         0.0000
## BC43              0.0000        0.0000        0.0000         0.0000
## BC44              0.0000        0.0000        0.0000         0.0000
## BC45              0.0000        0.0000        0.0215         0.0323
## BD49              0.0000        0.0000        0.0000         0.0000
## BD50              0.0021        0.0340        0.0426         0.0255
## BE33              0.0000        0.0294        0.0294         0.0294
## BE38              0.0193        0.0289        0.0250         0.0212
## BE39              0.0000        0.0245        0.0123         0.0307
## BE40              0.0000        0.0035        0.0283         0.0035
## BE44              0.0185        0.0457        0.0346         0.0407
## BE45              0.0000        0.0698        0.0465         0.0233
## BE47              0.0000        0.0000        0.0298         0.0000
## BF41              0.0208        0.0104        0.0417         0.0521
## BF42              0.0013        0.0279        0.0659         0.0177
## BF44              0.0161        0.0806        0.0161         0.0323
## BG37              0.0039        0.0157        0.0472         0.0512
## BG41              0.0000        0.0185        0.0370         0.0278
## BG42              0.0714        0.0000        0.0000         0.0000
## BG49              0.0000        0.0032        0.0016         0.0000
## BH31              0.0116        0.0291        0.0155         0.0174
## BH32              0.0303        0.0455        0.0000         0.0152
## BH39              0.0000        0.0175        0.0000         0.0351
## BH40              0.0000        0.0000        0.0000         0.0000
## BH42              0.0022        0.0045        0.0401         0.0557
## BH46              0.0000        0.0222        0.0000         0.0000
## BH49              0.0000        0.0602        0.0120         0.0000
## BI43              0.0000        0.0714        0.0000         0.0000
## BJ37              0.0000        0.0430        0.0394         0.0430
## BJ41              0.0000        0.0588        0.0294         0.0588
## BJ42              0.0000        0.0400        0.0400         0.0000
## BJ43              0.0000        0.0439        0.0263         0.0395
## BJ46              0.0000        0.0500        0.1167         0.0000
## BJ47              0.0000        0.0472        0.0437         0.0079
## BJ48              0.0000        0.0323        0.0400         0.0060
## BK36              0.0000        0.0667        0.0667         0.0000
## BK43              0.0000        0.0588        0.0000         0.0490
## BL39              0.0000        0.0826        0.0217         0.0522
## BL43              0.0000        0.0119        0.0476         0.0000
## BM45              0.0000        0.0625        0.0000         0.0000
## BM46              0.0000        0.0672        0.0000         0.0336
## BM49              0.0000        0.0263        0.0000         0.0000
## BN39              0.0000        0.0776        0.0251         0.0776
## BN40              0.0000        0.0588        0.0294         0.0294
```

```
## BZ29              0.0250          0.0000          0.0250               0.0000
## BZ30              0.0301          0.0032          0.0360               0.0005
## BZ37              0.0000          0.0000          0.0645               0.0000
## BZ42              0.0333          0.0000          0.0667               0.0000
## BZ46              0.0000          0.0667          0.0000               0.0000
## BZ48              0.0000          0.0164          0.0459               0.0295
## BZ49              0.0000          0.0233          0.0342               0.0274
## C28               0.0000          0.0000          0.0789               0.0263
## N15               0.0000          0.0263          0.0526               0.0000
## U48               0.0000          0.0175          0.0000               0.0000
## x3351             0.0000          0.0000          0.0110               0.0000
## x3479             0.0031          0.0000          0.0047               0.0000
## x3546             0.0000          0.0000          0.0407               0.0000
## x3679             0.0000          0.0000          0.0000               0.0000
## x3682             0.0000          0.0000          0.1136               0.0000
## x3761             0.0000          0.0041          0.0000               0.0000
## x3869             0.0270          0.0071          0.0338               0.0211
## x3872             0.0000          0.0000          0.0400               0.0000
## x3940             0.0018          0.0000          0.0163               0.0000
## x3950             0.0000          0.0000          0.0000               0.0000
## x3953             0.0000          0.0000          0.0372               0.0000
## x4000             0.0000          0.0000          0.0000               0.0000
## x4001             0.0000          0.0000          0.0748               0.0000
## x4006             0.0000          0.0000          0.0000               0.0000
## x4066             0.0000          0.0000          0.0609               0.0000
## x4134             0.0000          0.0000          0.0294               0.0000
## x4135             0.0000          0.0000          0.0000               0.0000
## x4139             0.0126          0.0126          0.0818               0.0000
## x4146             0.0000          0.0000          0.0316               0.0023
## x4149             0.0000          0.0000          0.0078               0.0000
## x4208             0.0000          0.0000          0.0000               0.0200
## x4231             0.0000          0.0000          0.0000               0.0385
## x4264             0.0000          0.0000          0.0000               0.0000
## x4269             0.0000          0.0000          0.0000               0.0000
## x4275             0.0000          0.0000          0.0196               0.0000
## x4276             0.0000          0.0097          0.0348               0.0155
##       Grey.Butcherbird Grey.Currawong Grey.Fantail Laughing.Kookaburra
## AA45            0.0000         0.0000       0.0000              0.0000
## AC44            0.0000         0.0000       0.0290              0.0000
## AD36            0.0000         0.0000       0.0000              0.0000
## AD46            0.0000         0.0000       0.0000              0.0000
## AE45            0.0000         0.0000       0.0278              0.0000
## AF34            0.0000         0.0000       0.0000              0.0000
## AF37            0.0000         0.0000       0.0000              0.0000
## AF39            0.0000         0.0000       0.0085              0.0000
## AF40            0.0000         0.0000       0.0131              0.0000
## AG33            0.0000         0.0000       0.0000              0.0000
## AG36            0.0000         0.0000       0.0000              0.0000
## AG43            0.0000         0.0000       0.0000              0.0000
```

```
## AH33                0.0000         0.0000       0.0029                0.0000
## AH37                0.0177         0.0000       0.0088                0.0000
## AH38                0.0000         0.0000       0.0000                0.0000
## AH41                0.0000         0.0000       0.0000                0.0000
## AI37                0.0000         0.0000       0.0333                0.0000
## AJ27                0.0000         0.0000       0.0000                0.0000
## AJ37                0.0000         0.0000       0.0000                0.0000
## AJ39                0.0161         0.0000       0.0000                0.0000
## AJ40                0.0000         0.0000       0.0111                0.0000
## AK39                0.0000         0.0000       0.0323                0.0000
## AK40                0.0000         0.0000       0.0000                0.0000
## AK41                0.0000         0.0000       0.0000                0.0000
## AK43                0.0000         0.0000       0.0000                0.0000
## AK44                0.0000         0.0000       0.0025                0.0000
## AL34                0.0050         0.0000       0.0000                0.0000
## AL36                0.0000         0.0000       0.0000                0.0079
## AM36                0.0280         0.0000       0.0093                0.0000
## AM37                0.0000         0.0000       0.0000                0.0000
## AM46                0.0334         0.0000       0.0295                0.0000
## AN30                0.0492         0.0000       0.0000                0.0000
## AN36                0.0816         0.0000       0.0000                0.0000
## AN39                0.0055         0.0055       0.0000                0.0000
## AN40                0.0120         0.0000       0.0160                0.0200
## AN50                0.0000         0.0000       0.0000                0.0000
## AO37                0.0463         0.0000       0.0000                0.0000
## AO41                0.0139         0.0035       0.0543                0.0370
## AO43                0.0012         0.0000       0.0000                0.0012
## AP43                0.0237         0.0005       0.0022                0.0091
## AQ30                0.0350         0.0000       0.0070                0.0210
## AQ37                0.0204         0.0068       0.0272                0.0204
## AQ43                0.0500         0.0000       0.0125                0.0000
## AQ44                0.0000         0.0000       0.0000                0.0000
## AR30                0.0259         0.0000       0.0029                0.0172
## AR38                0.0273         0.0000       0.0364                0.0364
## AR43                0.0306         0.0000       0.0000                0.0000
## AR45                0.0400         0.0000       0.0000                0.0000
## AS30                0.0163         0.0163       0.0163                0.0163
## AS39                0.0422         0.0000       0.0000                0.0000
## AS40                0.0000         0.0000       0.0000                0.0000
## AS46                0.0952         0.0000       0.0476                0.0000
## AS48                0.0217         0.0000       0.0217                0.0000
## AT30                0.0405         0.0405       0.0405                0.0676
## AT32                0.0000         0.0000       0.0000                0.0000
## AT36                0.0610         0.0041       0.0420                0.0556
## AT37                0.0169         0.0000       0.0339                0.0169
## AT41                0.0488         0.0000       0.0000                0.0244
## AT46                0.0323         0.0000       0.0000                0.0000
## AT48                0.0411         0.0000       0.0000                0.0274
## AU29                0.0661         0.0000       0.0000                0.0496
```

```
## AU30            0.0143      0.0000     0.0143               0.0143
## AU44            0.0000      0.0000     0.0000               0.0000
## AU47            0.0345      0.0000     0.0345               0.0172
## AU50            0.0484      0.0010     0.0015               0.0000
## AV27            0.0714      0.0000     0.0000               0.0179
## AV40            0.0294      0.0000     0.0588               0.0000
## AV41            0.0455      0.0000     0.0000               0.0455
## AV49            0.0769      0.0000     0.0000               0.0000
## AW30            0.0323      0.0313     0.0010               0.0440
## AW42            0.0400      0.0000     0.0000               0.0000
## AW43            0.0340      0.0136     0.0204               0.0340
## AW44            0.0504      0.0084     0.0000               0.0252
## AW47            0.0412      0.0000     0.0000               0.0000
## AW50            0.0109      0.0059     0.0000               0.0000
## AX39            0.0152      0.0000     0.0000               0.0303
## AX42            0.0000      0.0000     0.0000               0.0000
## AX43            0.0337      0.0076     0.0000               0.0165
## AX50            0.0233      0.0054     0.0188               0.0081
## AY29            0.0345      0.0086     0.0086               0.0172
## AY45            0.0000      0.0000     0.0000               0.0000
## AY49            0.0092      0.0046     0.0076               0.0031
## BA25            0.0169      0.0000     0.0000               0.0000
## BA26            0.0297      0.0169     0.0042               0.0254
## BA29            0.0092      0.0000     0.0046               0.0161
## BA30            0.0333      0.0190     0.0000               0.0333
## BA40            0.0526      0.0000     0.0000               0.0000
## BA42            0.0400      0.0000     0.0000               0.0400
## BA44            0.0000      0.0000     0.0000               0.0000
## BA47            0.0353      0.0235     0.0000               0.0000
## BA48            0.0460      0.0298     0.0136               0.0392
## BA50            0.0000      0.0000     0.0000               0.0000
## BB28            0.0126      0.0084     0.0084               0.0084
## BB31            0.0343      0.0049     0.0000               0.0343
## BB32            0.0417      0.0278     0.0417               0.0278
## BB37            0.1194      0.0000     0.0000               0.0032
## BB42            0.0407      0.0027     0.0204               0.0244
## BB45            0.0504      0.0000     0.0000               0.0000
## BC34            0.0385      0.0000     0.0192               0.0577
## BC40            0.0370      0.0370     0.0370               0.0556
## BC43            0.0385      0.0000     0.0000               0.0385
## BC44            0.0000      0.0000     0.0000               0.0000
## BC45            0.0215      0.0215     0.0000               0.0000
## BD49            0.0000      0.0000     0.0000               0.0000
## BD50            0.0362      0.0021     0.0000               0.0149
## BE33            0.0588      0.0294     0.0000               0.0588
## BE38            0.0462      0.0250     0.0231               0.0289
## BE39            0.0429      0.0123     0.0061               0.0429
## BE40            0.0459      0.0106     0.0106               0.0247
## BE44            0.0593      0.0358     0.0247               0.0469
```

```
## BE45             0.0465      0.0465      0.0233              0.0465
## BE47             0.0099      0.0033      0.0000              0.0033
## BF41             0.0208      0.0208      0.0104              0.0313
## BF42             0.0634      0.0253      0.0013              0.0342
## BF44             0.0000      0.0000      0.0484              0.0000
## BG37             0.0157      0.0000      0.0000              0.0394
## BG41             0.0278      0.0093      0.0093              0.0093
## BG42             0.0000      0.0000      0.0000              0.0000
## BG49             0.0016      0.0000      0.0179              0.0000
## BH31             0.0271      0.0155      0.0291              0.0252
## BH32             0.0152      0.0000      0.0455              0.0152
## BH39             0.0175      0.0000      0.0000              0.0175
## BH40             0.0769      0.0000      0.0000              0.0385
## BH42             0.0156      0.0000      0.0045              0.0445
## BH46             0.1111      0.0222      0.0000              0.0000
## BH49             0.0241      0.0241      0.0120              0.0120
## BI43             0.0000      0.0000      0.0000              0.0000
## BJ37             0.0108      0.0143      0.0215              0.0358
## BJ41             0.0294      0.0294      0.0294              0.0588
## BJ42             0.0800      0.0400      0.0800              0.0000
## BJ43             0.0263      0.0132      0.0175              0.0044
## BJ46             0.0833      0.0000      0.0000              0.0000
## BJ47             0.0385      0.0105      0.0000              0.0149
## BJ48             0.0374      0.0009      0.0060              0.0102
## BK36             0.0000      0.0000      0.0000              0.0667
## BK43             0.0196      0.0392      0.0392              0.0294
## BL39             0.0391      0.0000      0.0261              0.0783
## BL43             0.0476      0.0119      0.0238              0.0119
## BM45             0.0000      0.0000      0.0000              0.0000
## BM46             0.0336      0.0000      0.0000              0.0336
## BM49             0.0000      0.0000      0.0000              0.0000
## BN39             0.0205      0.0023      0.0137              0.0091
## BN40             0.0294      0.0000      0.0000              0.0588
## BZ29             0.0500      0.0250      0.0000              0.0500
## BZ30             0.0387      0.0269      0.0023              0.0305
## BZ37             0.0323      0.0000      0.0000              0.0000
## BZ42             0.0667      0.0000      0.0000              0.0333
## BZ46             0.0333      0.0333      0.0333              0.0333
## BZ48             0.0525      0.0098      0.0262              0.0197
## BZ49             0.0308      0.0178      0.0185              0.0212
## C28              0.0000      0.0000      0.0000              0.0000
## N15              0.0000      0.0000      0.0000              0.0000
## U48              0.0000      0.0000      0.0000              0.0000
## x3351            0.0000      0.0000      0.0000              0.0000
## x3479            0.0189      0.0000      0.0063              0.0000
## x3546            0.0360      0.0000      0.0023              0.0000
## x3679            0.0208      0.0000      0.0000              0.0000
## x3682            0.1136      0.0000      0.0227              0.0000
## x3761            0.0041      0.0000      0.0455              0.0000
```

```
## x3869           0.0340         0.0000       0.0211              0.0066
## x3872           0.0400         0.0000       0.0000              0.0000
## x3940           0.0090         0.0000       0.0000              0.0000
## x3950           0.0000         0.0000       0.0250              0.0250
## x3953           0.0057         0.0000       0.0029              0.0057
## x4000           0.1053         0.0000       0.0000              0.0000
## x4001           0.0748         0.0000       0.0000              0.0000
## x4006           0.0000         0.0000       0.0000              0.0000
## x4066           0.0635         0.0000       0.0000              0.0051
## x4134           0.0294         0.0000       0.0000              0.0000
## x4135           0.0000         0.0000       0.0000              0.0000
## x4139           0.0503         0.0000       0.0000              0.0440
## x4146           0.0158         0.0000       0.0090              0.0000
## x4149           0.0000         0.0000       0.0209              0.0013
## x4208           0.0600         0.0000       0.0000              0.0000
## x4231           0.0000         0.0000       0.0000              0.0000
## x4264           0.0000         0.0000       0.0000              0.0000
## x4269           0.0000         0.0000       0.0000              0.0000
## x4275           0.0153         0.0000       0.0006              0.0006
## x4276           0.0348         0.0010       0.0048              0.0010
##        Noisy.Miner Pied.Currawong Rainbow.Lorikeet Silvereye
## AA45       0.0000         0.0000           0.0400    0.0000
## AC44       0.0000         0.0010           0.0050    0.0270
## AD36       0.0000         0.0000           0.0476    0.0000
## AD46       0.0000         0.0000           0.0000    0.0000
## AE45       0.0000         0.0000           0.0278    0.0000
## AF34       0.0000         0.0000           0.0769    0.0000
## AF37       0.0000         0.0000           0.0455    0.0000
## AF39       0.0000         0.0000           0.0085    0.0000
## AF40       0.0000         0.0000           0.0065    0.0131
## AG33       0.0341         0.0000           0.0341    0.0000
## AG36       0.0000         0.0000           0.0476    0.0476
## AG43       0.0000         0.0000           0.0556    0.0000
## AH33       0.0000         0.0000           0.0345    0.0287
## AH37       0.0000         0.0000           0.0531    0.0442
## AH38       0.0313         0.0000           0.0625    0.0000
## AH41       0.0000         0.0000           0.0149    0.0000
## AI37       0.0000         0.0000           0.0000    0.0000
## AJ27       0.0000         0.0000           0.0000    0.0909
## AJ37       0.0000         0.0000           0.0741    0.0000
## AJ39       0.0000         0.0000           0.0161    0.0000
## AJ40       0.0000         0.0000           0.0556    0.0000
## AK39       0.0108         0.0000           0.0538    0.0538
## AK40       0.0000         0.0000           0.0000    0.0000
## AK41       0.0000         0.0000           0.0625    0.0000
## AK43       0.0400         0.0400           0.0400    0.0000
## AK44       0.0124         0.0000           0.0471    0.0000
## AL34       0.0000         0.0000           0.0402    0.0000
## AL36       0.0000         0.0000           0.0000    0.0000
```

```
## AM36        0.0000        0.0000          0.0093    0.0187
## AM37        0.0000        0.0000          0.0556    0.0000
## AM46        0.0000        0.0000          0.0000    0.0000
## AN30        0.0000        0.0000          0.0000    0.0000
## AN36        0.0000        0.0000          0.0000    0.0000
## AN39        0.0000        0.0000          0.0437    0.0055
## AN40        0.0000        0.0000          0.0440    0.0240
## AN50        0.0714        0.0000          0.0357    0.0000
## AO37        0.0185        0.0000          0.0556    0.0046
## AO41        0.0035        0.0012          0.0127    0.0000
## AO43        0.0024        0.0356          0.0902    0.0047
## AP43        0.0269        0.0070          0.0371    0.0274
## AQ30        0.0979        0.0000          0.0140    0.0000
## AQ37        0.0068        0.0204          0.0340    0.0272
## AQ43        0.0000        0.0500          0.0500    0.0375
## AQ44        0.0645        0.0000          0.0323    0.0000
## AR30        0.0546        0.0029          0.0546    0.0086
## AR38        0.0545        0.0091          0.0273    0.0091
## AR43        0.0000        0.0102          0.0510    0.0000
## AR45        0.0200        0.0600          0.0400    0.0200
## AS30        0.0488        0.0163          0.0407    0.0244
## AS39        0.0542        0.0000          0.0542    0.0542
## AS40        0.0000        0.0000          0.0588    0.0000
## AS46        0.0000        0.0000          0.0000    0.0000
## AS48        0.0000        0.0000          0.0217    0.0000
## AT30        0.0000        0.0000          0.0135    0.0000
## AT32        0.0769        0.0000          0.0769    0.0000
## AT36        0.0027        0.0000          0.0054    0.0027
## AT37        0.0000        0.0000          0.0169    0.0169
## AT41        0.0000        0.0244          0.0000    0.0000
## AT46        0.0000        0.0000          0.0323    0.0323
## AT48        0.0000        0.0137          0.0000    0.0000
## AU29        0.0331        0.0413          0.0413    0.0248
## AU30        0.0286        0.0000          0.0286    0.0000
## AU44        0.0455        0.0000          0.0000    0.0000
## AU47        0.1034        0.0000          0.0690    0.0000
## AU50        0.0000        0.0005          0.0000    0.0000
## AV27        0.0000        0.0000          0.0179    0.0000
## AV40        0.0588        0.0000          0.0588    0.0000
## AV41        0.0000        0.0000          0.0455    0.0455
## AV49        0.0000        0.0000          0.0000    0.0000
## AW30        0.0733        0.0029          0.0743    0.0000
## AW42        0.0800        0.0800          0.0400    0.0000
## AW43        0.0544        0.0340          0.0612    0.0068
## AW44        0.0840        0.0168          0.0840    0.0000
## AW47        0.0309        0.0000          0.0619    0.0309
## AW50        0.0620        0.0008          0.0528    0.0000
## AX39        0.0000        0.0152          0.0000    0.0000
## AX42        0.1250        0.0000          0.0625    0.0000
```

```
## AX43        0.0544          0.0172            0.0475    0.0076
## AX50        0.0134          0.0000            0.0233    0.0125
## AY29        0.0345          0.0345            0.0603    0.0259
## AY45        1.0000          0.0000            0.0000    0.0000
## AY49        0.0000          0.0000            0.0000    0.0000
## BA25        0.0678          0.0000            0.0678    0.0000
## BA26        0.0297          0.0297            0.0297    0.0212
## BA29        0.0530          0.0553            0.0622    0.0184
## BA30        0.0333          0.0333            0.0333    0.0143
## BA40        0.1053          0.0000            0.0526    0.0000
## BA42        0.0800          0.0400            0.0800    0.0000
## BA44        0.0714          0.0000            0.0571    0.0000
## BA47        0.0706          0.0000            0.0706    0.0000
## BA48        0.0571          0.0017            0.0264    0.0017
## BA50        0.0218          0.0000            0.0036    0.0000
## BB28        0.0711          0.0167            0.0502    0.0042
## BB31        0.0392          0.0196            0.0539    0.0049
## BB32        0.0417          0.0139            0.0417    0.0139
## BB37        0.1226          0.0419            0.1161    0.0000
## BB42        0.0651          0.0122            0.0719    0.0000
## BB45        0.0042          0.0042            0.0756    0.0105
## BC34        0.0577          0.0385            0.0577    0.0192
## BC40        0.0000          0.0000            0.0556    0.0000
## BC43        0.0769          0.0000            0.0385    0.0000
## BC44        0.0385          0.0000            0.0769    0.0000
## BC45        0.0430          0.0215            0.0645    0.0000
## BD49        0.0000          0.0000            0.0000    0.0000
## BD50        0.0468          0.0234            0.0468    0.0000
## BE33        0.0588          0.0588            0.0588    0.0000
## BE38        0.0058          0.0250            0.0462    0.0250
## BE39        0.0245          0.0491            0.0736    0.0061
## BE40        0.0000          0.0389            0.0389    0.0353
## BE44        0.0148          0.0358            0.0543    0.0074
## BE45        0.0000          0.0233            0.0465    0.0233
## BE47        0.0033          0.0000            0.0265    0.0000
## BF41        0.0104          0.0208            0.0208    0.0208
## BF42        0.0697          0.0266            0.0697    0.0000
## BF44        0.0161          0.0000            0.0645    0.0323
## BG37        0.0276          0.0512            0.0551    0.0197
## BG41        0.0278          0.0556            0.0648    0.0000
## BG42        0.0000          0.0000            0.0714    0.0714
## BG49        0.0032          0.0000            0.0016    0.0065
## BH31        0.0039          0.0213            0.0291    0.0271
## BH32        0.0000          0.0000            0.0152    0.0303
## BH39        0.0000          0.0526            0.0351    0.0175
## BH40        0.0000          0.0385            0.0385    0.0000
## BH42        0.0000          0.0490            0.0490    0.0178
## BH46        0.0000          0.0000            0.1111    0.0222
## BH49        0.0120          0.0000            0.0120    0.0241
```

```
## BI43        0.0000        0.0714          0.0714    0.0000
## BJ37        0.0179        0.0287          0.0430    0.0430
## BJ41        0.0000        0.0588          0.0588    0.0000
## BJ42        0.0000        0.0400          0.0400    0.0400
## BJ43        0.0307        0.0439          0.0658    0.0395
## BJ46        0.1167        0.0000          0.0500    0.0000
## BJ47        0.0437        0.0087          0.0472    0.0009
## BJ48        0.0306        0.0094          0.0409    0.0000
## BK36        0.0333        0.0000          0.0667    0.0000
## BK43        0.0000        0.0490          0.0490    0.0392
## BL39        0.0000        0.0739          0.0043    0.0304
## BL43        0.0595        0.0119          0.0238    0.0119
## BM45        0.0000        0.0000          0.0000    0.0000
## BM46        0.0000        0.0252          0.0084    0.0168
## BM49        0.1053        0.0000          0.0789    0.0000
## BN39        0.0000        0.0479          0.0137    0.0708
## BN40        0.0000        0.0000          0.0588    0.0588
## BZ29        0.0500        0.0500          0.0500    0.0000
## BZ30        0.0392        0.0301          0.0392    0.0050
## BZ37        0.0323        0.0323          0.0645    0.0000
## BZ42        0.0667        0.0333          0.0667    0.0000
## BZ46        0.0667        0.0333          0.0667    0.0000
## BZ48        0.0557        0.0262          0.0361    0.0098
## BZ49        0.0308        0.0260          0.0294    0.0164
## C28         0.0000        0.0000          0.0000    0.0000
## N15         0.0000        0.0000          0.0263    0.0263
## U48         0.0000        0.0000          0.0000    0.0000
## x3351       0.0110        0.0000          0.0110    0.0000
## x3479       0.0220        0.0000          0.0315    0.0079
## x3546       0.0430        0.0000          0.0407    0.0395
## x3679       0.1042        0.0000          0.0625    0.0000
## x3682       0.0227        0.0000          0.0000    0.0000
## x3761       0.0000        0.0000          0.0041    0.0331
## x3869       0.0365        0.0006          0.0336    0.0118
## x3872       0.0800        0.0000          0.0400    0.0000
## x3940       0.0398        0.0000          0.0054    0.0000
## x3950       0.0500        0.0000          0.0000    0.0000
## x3953       0.0201        0.0029          0.0229    0.0029
## x4000       0.0526        0.0000          0.0000    0.0000
## x4001       0.0935        0.0000          0.0561    0.0000
## x4006       0.0426        0.0000          0.0284    0.0000
## x4066       0.0635        0.0025          0.0635    0.0000
## x4134       0.0000        0.0000          0.0588    0.0588
## x4135       0.0526        0.0000          0.0000    0.0000
## x4139       0.0818        0.0063          0.0818    0.0000
## x4146       0.0497        0.0000          0.0361    0.0045
## x4149       0.0105        0.0000          0.0065    0.0196
## x4208       0.0600        0.0000          0.0800    0.0200
## x4231       0.0000        0.0000          0.0385    0.0000
```

```
## x4264      0.0000        0.0000           0.0357    0.0000
## x4269      0.0000        0.0000           0.0000    0.0000
## x4275      0.0522        0.0000           0.0510    0.0009
## x4276      0.0348        0.0000           0.0358    0.0329
##       Spotted.Pardalote Sulphurcrested.Cockatoo Superb.Fairywren
## AA45             0.0000                  0.0000           0.0400
## AC44             0.0110                  0.0000           0.0390
## AD36             0.0000                  0.0238           0.0238
## AD46             0.0000                  0.0000           0.0000
## AE45             0.0000                  0.0000           0.0833
## AF34             0.0000                  0.0385           0.0000
## AF37             0.0000                  0.0152           0.0000
## AF39             0.0085                  0.0000           0.0085
## AF40             0.0000                  0.0000           0.0131
## AG33             0.0000                  0.0341           0.0000
## AG36             0.0000                  0.0476           0.0000
## AG43             0.0000                  0.0000           0.0000
## AH33             0.0057                  0.0000           0.0000
## AH37             0.0000                  0.0265           0.0000
## AH38             0.0000                  0.0000           0.0313
## AH41             0.0000                  0.0000           0.0299
## AI37             0.0000                  0.0000           0.0000
## AJ27             0.0000                  0.0000           0.0909
## AJ37             0.0000                  0.0000           0.0000
## AJ39             0.0000                  0.0000           0.0000
## AJ40             0.0000                  0.0000           0.0000
## AK39             0.0323                  0.0000           0.0538
## AK40             0.0000                  0.0000           0.0000
## AK41             0.0000                  0.0000           0.0000
## AK43             0.0000                  0.0000           0.0000
## AK44             0.0000                  0.0546           0.0000
## AL34             0.0000                  0.0000           0.0101
## AL36             0.0000                  0.0000           0.0079
## AM36             0.0000                  0.0000           0.0093
## AM37             0.0000                  0.0000           0.0000
## AM46             0.0000                  0.0000           0.0000
## AN30             0.0000                  0.0000           0.0000
## AN36             0.0000                  0.0000           0.0000
## AN39             0.0000                  0.0055           0.0055
## AN40             0.0000                  0.0160           0.0320
## AN50             0.0000                  0.0000           0.0000
## AO37             0.0000                  0.0000           0.0000
## AO41             0.0023                  0.0035           0.0012
## AO43             0.0297                  0.0095           0.0000
## AP43             0.0210                  0.0156           0.0247
## AQ30             0.0140                  0.0140           0.0000
## AQ37             0.0272                  0.0204           0.0272
## AQ43             0.0500                  0.0000           0.0000
## AQ44             0.0000                  0.0000           0.0000
```

```
## AR30              0.0086                0.0517          0.0172
## AR38              0.0000                0.0182          0.0455
## AR43              0.0000                0.0000          0.0000
## AR45              0.0000                0.0200          0.0000
## AS30              0.0325                0.0163          0.0163
## AS39              0.0181                0.0361          0.0000
## AS40              0.0000                0.0000          0.0000
## AS46              0.0000                0.0000          0.0000
## AS48              0.0000                0.0000          0.0000
## AT30              0.0000                0.0000          0.0135
## AT32              0.0000                0.0000          0.0000
## AT36              0.0014                0.0027          0.0054
## AT37              0.0169                0.0000          0.0169
## AT41              0.0000                0.0000          0.0000
## AT46              0.0323                0.0000          0.0323
## AT48              0.0000                0.0000          0.0137
## AU29              0.0000                0.0083          0.0083
## AU30              0.0000                0.0286          0.0143
## AU44              0.0455                0.0000          0.0000
## AU47              0.0000                0.0517          0.0000
## AU50              0.0005                0.0005          0.0000
## AV27              0.0000                0.0000          0.0000
## AV40              0.0000                0.0000          0.0000
## AV41              0.0000                0.0000          0.0000
## AV49              0.0000                0.0000          0.0000
## AW30              0.0010                0.0127          0.0127
## AW42              0.0000                0.0000          0.0000
## AW43              0.0000                0.0000          0.0000
## AW44              0.0168                0.0000          0.0000
## AW47              0.0000                0.0000          0.0000
## AW50              0.0000                0.0000          0.0000
## AX39              0.0000                0.0000          0.0303
## AX42              0.0000                0.0000          0.0000
## AX43              0.0110                0.0021          0.0000
## AX50              0.0107                0.0000          0.0466
## AY29              0.0172                0.0517          0.0000
## AY45              0.0000                0.0000          0.0000
## AY49              0.0000                0.0000          0.0000
## BA25              0.0000                0.0508          0.0000
## BA26              0.0297                0.0212          0.0169
## BA29              0.0138                0.0138          0.0000
## BA30              0.0095                0.0286          0.0000
## BA40              0.0000                0.0000          0.0000
## BA42              0.0400                0.0000          0.0000
## BA44              0.0000                0.0000          0.0000
## BA47              0.0118                0.0000          0.0000
## BA48              0.0153                0.0000          0.0000
## BA50              0.0000                0.0000          0.0618
## BB28              0.0000                0.0209          0.0042
```

```
## BB31          0.0196          0.0245     0.0392
## BB32          0.0139          0.0417     0.0417
## BB37          0.0000          0.0032     0.0000
## BB42          0.0543          0.0027     0.0068
## BB45          0.0000          0.0000     0.0000
## BC34          0.0000          0.0192     0.0192
## BC40          0.0370          0.0000     0.0556
## BC43          0.0000          0.0000     0.0000
## BC44          0.0000          0.0000     0.0000
## BC45          0.0000          0.0000     0.0000
## BD49          0.0000          0.0000     0.0476
## BD50          0.0021          0.0404     0.0000
## BE33          0.0000          0.0588     0.0000
## BE38          0.0405          0.0405     0.0212
## BE39          0.0245          0.0061     0.0245
## BE40          0.0035          0.0318     0.0035
## BE44          0.0321          0.0099     0.0000
## BE45          0.0233          0.0000     0.0000
## BE47          0.0066          0.0265     0.0596
## BF41          0.0104          0.0000     0.0208
## BF42          0.0076          0.0000     0.0000
## BF44          0.0000          0.0161     0.0161
## BG37          0.0000          0.0591     0.0000
## BG41          0.0093          0.0556     0.0093
## BG42          0.0000          0.0000     0.1429
## BG49          0.0000          0.0016     0.0649
## BH31          0.0213          0.0271     0.0291
## BH32          0.0303          0.0000     0.0303
## BH39          0.0000          0.0702     0.0000
## BH40          0.0000          0.0000     0.0000
## BH42          0.0000          0.0690     0.0000
## BH46          0.0000          0.0000     0.0000
## BH49          0.0120          0.0000     0.0000
## BI43          0.0000          0.0000     0.0000
## BJ37          0.0072          0.0394     0.0000
## BJ41          0.0000          0.0000     0.0000
## BJ42          0.0400          0.0000     0.0000
## BJ43          0.0307          0.0088     0.0000
## BJ46          0.0000          0.0000     0.0000
## BJ47          0.0000          0.0280     0.0000
## BJ48          0.0094          0.0204     0.0213
## BK36          0.0000          0.0667     0.0000
## BK43          0.0490          0.0196     0.0000
## BL39          0.0043          0.0043     0.0000
## BL43          0.0000          0.0000     0.0238
## BM45          0.0000          0.0000     0.0625
## BM46          0.0000          0.0756     0.0084
## BM49          0.0000          0.0263     0.0000
## BN39          0.0023          0.0183     0.0000
```

```
## BN40          0.0000                  0.0294          0.0000
## BZ29          0.0250                  0.0250          0.0000
## BZ30          0.0087                  0.0305          0.0000
## BZ37          0.0000                  0.0000          0.0000
## BZ42          0.0333                  0.0000          0.0333
## BZ46          0.0333                  0.0000          0.0000
## BZ48          0.0426                  0.0000          0.0098
## BZ49          0.0274                  0.0041          0.0123
## C28           0.0000                  0.0000          0.0263
## N15           0.0000                  0.0526          0.0263
## U48           0.0000                  0.0000          0.0000
## x3351         0.0000                  0.0220          0.0220
## x3479         0.0000                  0.0094          0.0472
## x3546         0.0012                  0.0407          0.0314
## x3679         0.0417                  0.0417          0.0000
## x3682         0.0000                  0.0000          0.0000
## x3761         0.0083                  0.0041          0.0413
## x3869         0.0301                  0.0019          0.0216
## x3872         0.0000                  0.0000          0.0000
## x3940         0.0000                  0.0018          0.0506
## x3950         0.0250                  0.0500          0.0500
## x3953         0.0057                  0.0172          0.0029
## x4000         0.0000                  0.0000          0.0000
## x4001         0.0000                  0.0000          0.0000
## x4006         0.0000                  0.0000          0.0426
## x4066         0.0051                  0.0102          0.0000
## x4134         0.0294                  0.0000          0.0000
## x4135         0.0000                  0.0000          0.0000
## x4139         0.0000                  0.0818          0.0000
## x4146         0.0023                  0.0068          0.0045
## x4149         0.0118                  0.0105          0.0575
## x4208         0.0000                  0.0000          0.0000
## x4231         0.0000                  0.0000          0.0000
## x4264         0.0000                  0.0357          0.0000
## x4269         0.0000                  0.0000          0.0000
## x4275         0.0003                  0.0014          0.0040
## x4276         0.0222                  0.0077          0.0300
##       Tawny.Frogmouth Whitebrowed.Scrubwren Yellowtailed.BlackCockatoo
## AA45           0.0000                0.0000                     0.0000
## AC44           0.0000                0.0000                     0.0000
## AD36           0.0000                0.0238                     0.0000
## AD46           0.0000                0.0000                     0.0000
## AE45           0.0000                0.0000                     0.0000
## AF34           0.0000                0.0000                     0.0000
## AF37           0.0000                0.0000                     0.0000
## AF39           0.0000                0.0000                     0.0000
## AF40           0.0000                0.0000                     0.0000
## AG33           0.0000                0.0000                     0.0000
## AG36           0.0000                0.0000                     0.0000
```

```
## AG43          0.0000          0.0000          0.0000
## AH33          0.0000          0.0000          0.0000
## AH37          0.0000          0.0088          0.0000
## AH38          0.0000          0.0000          0.0000
## AH41          0.0000          0.0000          0.0000
## AI37          0.0000          0.0000          0.0000
## AJ27          0.0000          0.0000          0.0000
## AJ37          0.0000          0.0000          0.0000
## AJ39          0.0000          0.0000          0.0000
## AJ40          0.0000          0.0000          0.0000
## AK39          0.0108          0.0000          0.0000
## AK40          0.0000          0.0000          0.0000
## AK41          0.0000          0.0000          0.0000
## AK43          0.0000          0.0000          0.0000
## AK44          0.0000          0.0000          0.0000
## AL34          0.0000          0.0000          0.0000
## AL36          0.0000          0.0000          0.0000
## AM36          0.0000          0.0000          0.0000
## AM37          0.0000          0.0000          0.0000
## AM46          0.0000          0.0000          0.0000
## AN30          0.0000          0.0000          0.0000
## AN36          0.0000          0.0000          0.0000
## AN39          0.0000          0.0328          0.0000
## AN40          0.0080          0.0440          0.0040
## AN50          0.0000          0.0000          0.0000
## AO37          0.0000          0.0000          0.0000
## AO41          0.0012          0.0023          0.0012
## AO43          0.0107          0.0807          0.0024
## AP43          0.0048          0.0344          0.0000
## AQ30          0.0000          0.0000          0.0000
## AQ37          0.0068          0.0204          0.0068
## AQ43          0.0125          0.0000          0.0000
## AQ44          0.0000          0.0000          0.0000
## AR30          0.0029          0.0115          0.0000
## AR38          0.0000          0.0000          0.0091
## AR43          0.0000          0.0000          0.0000
## AR45          0.0400          0.0000          0.0000
## AS30          0.0000          0.0163          0.0000
## AS39          0.0000          0.0000          0.0000
## AS40          0.0000          0.0000          0.0000
## AS46          0.0000          0.0000          0.0476
## AS48          0.0000          0.0000          0.0000
## AT30          0.0000          0.0000          0.0000
## AT32          0.0000          0.0000          0.0769
## AT36          0.0000          0.0014          0.0014
## AT37          0.0000          0.0169          0.0000
## AT41          0.0000          0.0000          0.0000
## AT46          0.0000          0.0323          0.0000
## AT48          0.0000          0.0000          0.0000
```

```
## AU29          0.0000          0.0083          0.0000
## AU30          0.0000          0.0143          0.0143
## AU44          0.0455          0.0000          0.0000
## AU47          0.0000          0.0000          0.0000
## AU50          0.0000          0.0005          0.0000
## AV27          0.0000          0.0000          0.0000
## AV40          0.0000          0.0294          0.0000
## AV41          0.0000          0.0000          0.0000
## AV49          0.0000          0.0000          0.0000
## AW30          0.0029          0.0020          0.0020
## AW42          0.0000          0.0000          0.0000
## AW43          0.0000          0.0136          0.0000
## AW44          0.0000          0.0084          0.0000
## AW47          0.0000          0.0000          0.0000
## AW50          0.0000          0.0000          0.0000
## AX39          0.0000          0.0000          0.0000
## AX42          0.0000          0.0000          0.0000
## AX43          0.0034          0.0048          0.0000
## AX50          0.0000          0.0412          0.0000
## AY29          0.0172          0.0000          0.0172
## AY45          0.0000          0.0000          0.0000
## AY49          0.0000          0.0000          0.0000
## BA25          0.0000          0.0169          0.0000
## BA26          0.0000          0.0169          0.0127
## BA29          0.0207          0.0323          0.0046
## BA30          0.0095          0.0333          0.0333
## BA40          0.0000          0.0000          0.0000
## BA42          0.0000          0.0400          0.0000
## BA44          0.0000          0.0000          0.0000
## BA47          0.0000          0.0000          0.0000
## BA48          0.0145          0.0034          0.0009
## BA50          0.0000          0.0000          0.0000
## BB28          0.0084          0.0418          0.0042
## BB31          0.0000          0.0196          0.0147
## BB32          0.0000          0.0139          0.0139
## BB37          0.0129          0.0000          0.0000
## BB42          0.0027          0.0407          0.0014
## BB45          0.0000          0.0000          0.0000
## BC34          0.0000          0.0192          0.0000
## BC40          0.0000          0.0185          0.0000
## BC43          0.0000          0.0385          0.0000
## BC44          0.0000          0.0000          0.0000
## BC45          0.0000          0.0000          0.0000
## BD49          0.0000          0.0000          0.0000
## BD50          0.0085          0.0000          0.0000
## BE33          0.0000          0.0294          0.0000
## BE38          0.0000          0.0000          0.0077
## BE39          0.0000          0.0245          0.0123
## BE40          0.0106          0.0035          0.0035
```

```
## BE44          0.0000        0.0160        0.0025
## BE45          0.0000        0.0233        0.0000
## BE47          0.0000        0.0000        0.0000
## BF41          0.0000        0.0208        0.0000
## BF42          0.0089        0.0013        0.0025
## BF44          0.0000        0.0484        0.0000
## BG37          0.0197        0.0276        0.0354
## BG41          0.0093        0.0278        0.0278
## BG42          0.0000        0.0000        0.0714
## BG49          0.0000        0.0097        0.0000
## BH31          0.0019        0.0174        0.0078
## BH32          0.0000        0.0303        0.0000
## BH39          0.0000        0.0000        0.0351
## BH40          0.0000        0.0000        0.0000
## BH42          0.0000        0.0000        0.0089
## BH46          0.0000        0.0000        0.0000
## BH49          0.0000        0.0000        0.0000
## BI43          0.0000        0.0000        0.0000
## BJ37          0.0036        0.0394        0.0358
## BJ41          0.0000        0.0000        0.0294
## BJ42          0.0000        0.0400        0.0000
## BJ43          0.0000        0.0132        0.0044
## BJ46          0.0167        0.0000        0.0000
## BJ47          0.0131        0.0035        0.0000
## BJ48          0.0034        0.0187        0.0009
## BK36          0.0000        0.0000        0.0000
## BK43          0.0000        0.0000        0.0098
## BL39          0.0000        0.0261        0.0087
## BL43          0.0000        0.0119        0.0119
## BM45          0.0000        0.0000        0.0000
## BM46          0.0000        0.0084        0.0000
## BM49          0.0000        0.0000        0.0000
## BN39          0.0000        0.0365        0.0183
## BN40          0.0000        0.0588        0.0294
## BZ29          0.0000        0.0250        0.0250
## BZ30          0.0109        0.0342        0.0173
## BZ37          0.0000        0.0000        0.0000
## BZ42          0.0333        0.0000        0.0000
## BZ46          0.0000        0.0667        0.0000
## BZ48          0.0328        0.0426        0.0000
## BZ49          0.0239        0.0260        0.0000
## C28           0.0000        0.0000        0.0000
## N15           0.0000        0.0000        0.0000
## U48           0.0000        0.0000        0.0000
## x3351         0.0000        0.0000        0.0000
## x3479         0.0000        0.0126        0.0000
## x3546         0.0000        0.0000        0.0000
## x3679         0.0000        0.0000        0.0000
## x3682         0.0000        0.0000        0.0000
```

```
## x3761          0.0000                  0.0289                     0.0000
## x3869          0.0004                  0.0303                     0.0000
## x3872          0.0000                  0.0000                     0.0000
## x3940          0.0000                  0.0000                     0.0000
## x3950          0.0000                  0.0500                     0.0000
## x3953          0.0000                  0.0029                     0.0000
## x4000          0.0000                  0.0000                     0.0000
## x4001          0.0000                  0.0000                     0.0000
## x4006          0.0000                  0.0000                     0.0000
## x4066          0.0000                  0.0000                     0.0000
## x4134          0.0000                  0.0000                     0.0000
## x4135          0.0000                  0.0000                     0.0000
## x4139          0.0000                  0.0000                     0.0000
## x4146          0.0000                  0.0023                     0.0000
## x4149          0.0000                  0.0405                     0.0000
## x4208          0.0000                  0.0200                     0.0000
## x4231          0.0000                  0.0000                     0.0000
## x4264          0.0000                  0.0000                     0.0000
## x4269          0.0000                  0.0000                     0.0000
## x4275          0.0000                  0.0000                     0.0000
## x4276          0.0019                  0.0019                     0.0000
##       Ganggang.Cockatoo
## AA45             0.0000
## AC44             0.0000
## AD36             0.0000
## AD46             0.0000
## AE45             0.0000
## AF34             0.0000
## AF37             0.0000
## AF39             0.0000
## AF40             0.0000
## AG33             0.0000
## AG36             0.0000
## AG43             0.0000
## AH33             0.0000
## AH37             0.0000
## AH38             0.0000
## AH41             0.0000
## AI37             0.0000
## AJ27             0.0000
## AJ37             0.0000
## AJ39             0.0000
## AJ40             0.0000
## AK39             0.0000
## AK40             0.0000
## AK41             0.0000
## AK43             0.0000
## AK44             0.0000
## AL34             0.0000
```

```
## AL36              0.0000
## AM36              0.0000
## AM37              0.0000
## AM46              0.0000
## AN30              0.0000
## AN36              0.0000
## AN39              0.0000
## AN40              0.0040
## AN50              0.0000
## AO37              0.0000
## AO41              0.0023
## AO43              0.0000
## AP43              0.0005
## AQ30              0.0000
## AQ37              0.0000
## AQ43              0.0000
## AQ44              0.0000
## AR30              0.0000
## AR38              0.0000
## AR43              0.0000
## AR45              0.0000
## AS30              0.0000
## AS39              0.0000
## AS40              0.1176
## AS46              0.0000
## AS48              0.0000
## AT30              0.0135
## AT32              0.0000
## AT36              0.0054
## AT37              0.0000
## AT41              0.0000
## AT46              0.0000
## AT48              0.0000
## AU29              0.0165
## AU30              0.0286
## AU44              0.0000
## AU47              0.0000
## AU50              0.0005
## AV27              0.0000
## AV40              0.0000
## AV41              0.0000
## AV49              0.0000
## AW30              0.0156
## AW42              0.0400
## AW43              0.0272
## AW44              0.0000
## AW47              0.0000
## AW50              0.0000
## AX39              0.0000
```

```
## AX42                0.0625
## AX43                0.0028
## AX50                0.0000
## AY29                0.0345
## AY45                0.0000
## AY49                0.0000
## BA25                0.0339
## BA26                0.0212
## BA29                0.0023
## BA30                0.0333
## BA40                0.0000
## BA42                0.0000
## BA44                0.0000
## BA47                0.0000
## BA48                0.0051
## BA50                0.0000
## BB28                0.0084
## BB31                0.0049
## BB32                0.0139
## BB37                0.0097
## BB42                0.0027
## BB45                0.0021
## BC34                0.0000
## BC40                0.0000
## BC43                0.0000
## BC44                0.0000
## BC45                0.0000
## BD49                0.0000
## BD50                0.0085
## BE33                0.0000
## BE38                0.0000
## BE39                0.0123
## BE40                0.0071
## BE44                0.0025
## BE45                0.0000
## BE47                0.0000
## BF41                0.0208
## BF42                0.0266
## BF44                0.0000
## BG37                0.0000
## BG41                0.0093
## BG42                0.0000
## BG49                0.0000
## BH31                0.0000
## BH32                0.0000
## BH39                0.0175
## BH40                0.0000
## BH42                0.0022
## BH46                0.0000
```

```
## BH49                0.0000
## BI43                0.0000
## BJ37                0.0000
## BJ41                0.0000
## BJ42                0.0000
## BJ43                0.0088
## BJ46                0.0000
## BJ47                0.0000
## BJ48                0.0000
## BK36                0.0000
## BK43                0.0000
## BL39                0.0000
## BL43                0.0000
## BM45                0.0000
## BM46                0.0000
## BM49                0.0000
## BN39                0.0114
## BN40                0.0000
## BZ29                0.0000
## BZ30                0.0246
## BZ37                0.0323
## BZ42                0.0333
## BZ46                0.0000
## BZ48                0.0000
## BZ49                0.0082
## C28                 0.0000
## N15                 0.0000
## U48                 0.0000
## x3351               0.0000
## x3479               0.0000
## x3546               0.0000
## x3679               0.0000
## x3682               0.0000
## x3761               0.0041
## x3869               0.0000
## x3872               0.0000
## x3940               0.0000
## x3950               0.0000
## x3953               0.0000
## x4000               0.0000
## x4001               0.0000
## x4006               0.0000
## x4066               0.0127
## x4134               0.0000
## x4135               0.0000
## x4139               0.0063
## x4146               0.0023
## x4149               0.0013
## x4208               0.0000
```

```
## x4231             0.0000
## x4264             0.0000
## x4269             0.1111
## x4275             0.0000
## x4276             0.0010
```

In the data frame 'clade2a', columns are species and rows are sites. The values in this 'r x c' frame are relative abundance of each species at each site.

This script runs a three dimensional NMDS ordination.

```
# run NMDS 3D
clade2a.mds <- metaMDS(clade2a, distance = "bray", k = 3, zerodist = "add",
    autotransform = TRUE, noshare = 0.1, wascores = TRUE, expand = TRUE, trace = 1,
    plot = FALSE)
```

```
## Zero dissimilarities changed into  0.02519
## Run 0 stress 0.1585
## Run 1 stress 0.1659
## Run 2 stress 0.1575
## ... New best solution
## ... procrustes: rmse 0.0128  max resid 0.1209
## Run 3 stress 0.1659
## Run 4 stress 0.1574
## ... New best solution
## ... procrustes: rmse 0.01384  max resid 0.1776
## Run 5 stress 0.1575
## ... procrustes: rmse 0.002112  max resid 0.02299
## Run 6 stress 0.1587
## Run 7 stress 0.1588
## Run 8 stress 0.1574
## ... New best solution
## ... procrustes: rmse 0.01385  max resid 0.1782
## Run 9 stress 0.1575
## ... procrustes: rmse 0.001742  max resid 0.01367
## Run 10 stress 0.1574
## ... procrustes: rmse 0.01428  max resid 0.1843
## Run 11 stress 0.1664
## Run 12 stress 0.1575
## ... procrustes: rmse 0.002286  max resid 0.02566
## Run 13 stress 0.1587
## Run 14 stress 0.1575
## ... procrustes: rmse 0.01359  max resid 0.1743
## Run 15 stress 0.1603
## Run 16 stress 0.1574
## ... New best solution
## ... procrustes: rmse 0.007351  max resid 0.06834
## Run 17 stress 0.1588
## Run 18 stress 0.16
```

```
## Run 19 stress 0.1599
## Run 20 stress 0.1574
## ... procrustes: rmse 0.01436  max resid 0.186
```

Plotting the first two axes.

```
# plot 2D NMDS - first 2 axes
ordiplot(clade2a.mds, type = "none", main = "Urban adapter birds - assemblage 2a")
points(clade2a.mds, "sites", pch = 21, col = "black", bg = "black")
text(clade2a.mds, "species", col = "blue", cex = 0.5)
```

A suite of environmental factors were fitted to the ordination. Columns in 'envar.clade2a' represent parameter names and rows represent sites. The values represented by column names are as follows:

- X = longitude in decimal degrees
- Y = latitude in decimal degrees (negative values indicate southern hemisphere)
- IndComb = the combined index, an index of urbanisation intensity
- Peop = density of people (per square kilometre)
- Dwell - density of dwellings (per square kilometre)
- Fr_Green = frequency greenspace (reciprocal of density impervious surfaces)
- LC_Rich = land cover richness
- LC_Dom = land cover dominance
- PC_URB = percent (%) urban
- Sobs = observed bird species richness (all assemblages)
- Sobs.2a - observed species richness of urban adapter birds
- Sobs.2b - observed species richness of urban exploiter birds
- Arbor = an index of 'arborisation', indicating woodiness of former native vegetation prior to urbanisation

More detailed discussion of these parameters can be found in:

Conole, L. E., & Kirkpatrick, J. B. (2011). Functional and spatial differentiation of urban bird assemblages at the landscape scale. *Landscape and Urban Planning*, 100(1-2), 11–23. doi:10.1016/j.landurbplan.2010.11.007

```
# load envar
envar.clade2a <- read.table("qgis.envar.clade2a.txt", header = T)
ef2a <- envfit(clade2a.mds, envar.clade2a, permu = 1000)
```

Re-plotting the NMDS ordination space with fitted vectors shown as arrows. Directional difference shows different gradients. Arrow length indicates strength of relationship to the data.

```
plot(clade2a.mds, display = "sites", main = "Urban adapter birds - assemblage 2a")
plot(ef2a, p.max = 0.05, col = "black")
```

The matrix of vectors, and their significance in explaining the ordination, is shown below.

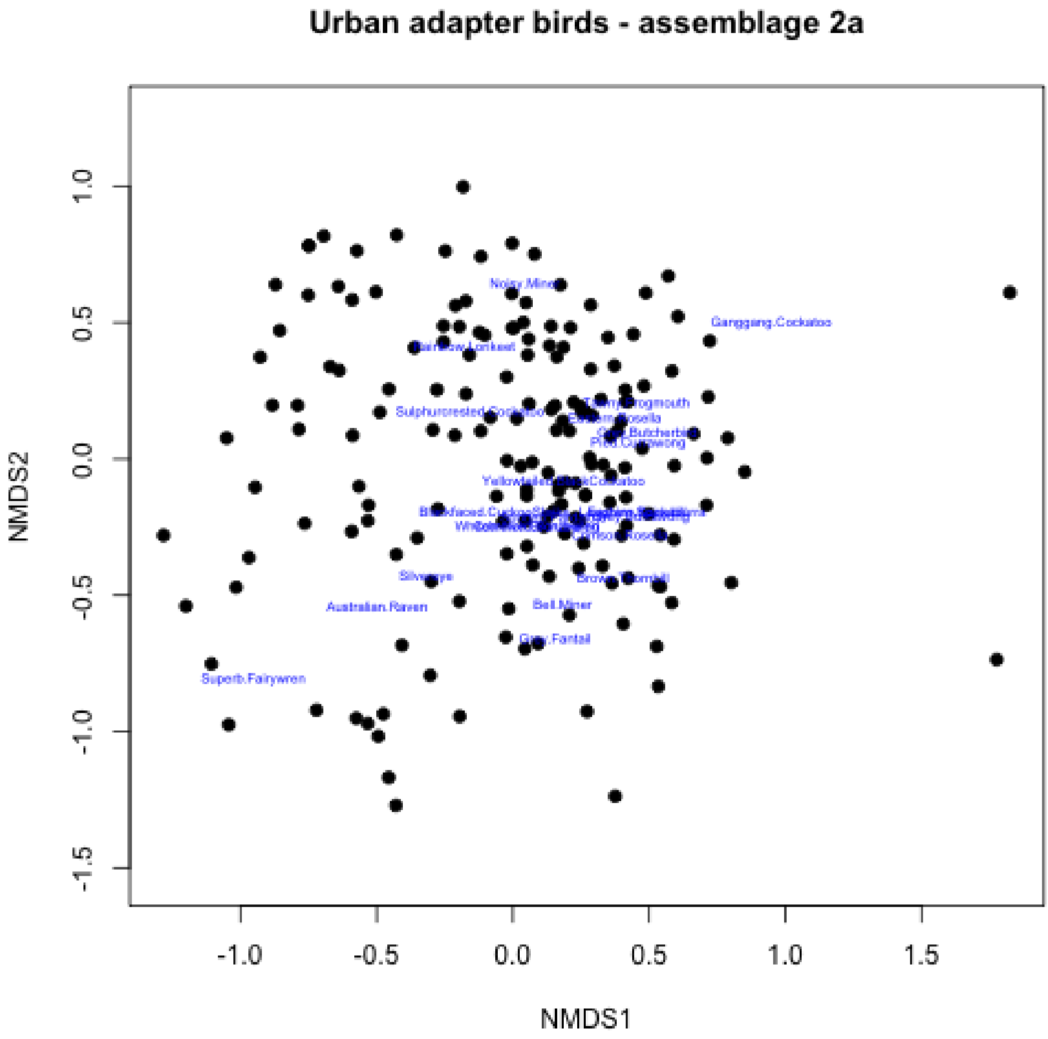


Figure 1: plot of chunk Plot first two dimensions of NMDS ordination

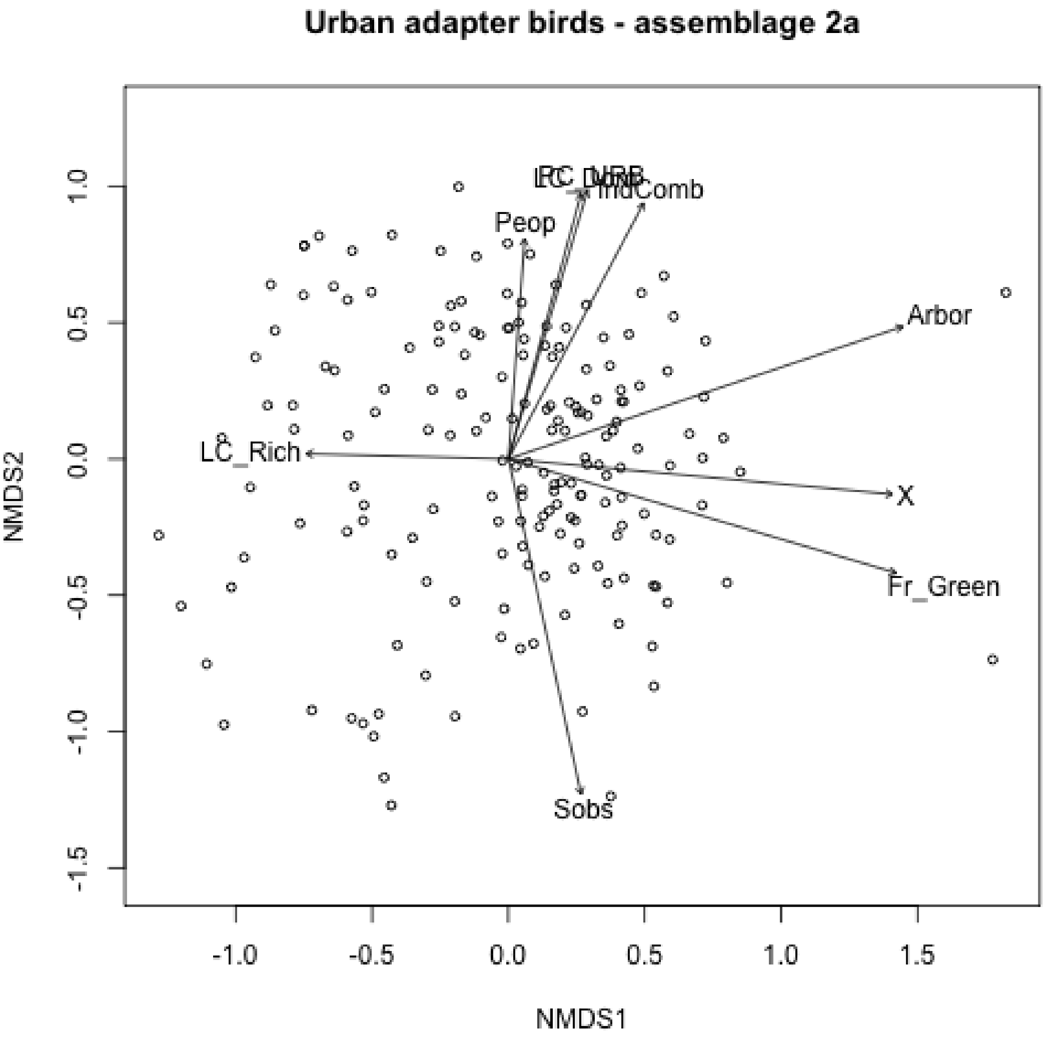


Figure 2: plot of chunk Plot NMDS ordination with vectors

```
ef2a
```

```
##
## ***VECTORS
##
##            NMDS1  NMDS2   r2 Pr(>r)
## X          0.996 -0.092 0.12  0.001 ***
## Y          0.616 -0.788 0.01  0.555
## IndComb    0.468  0.884 0.07  0.001 ***
## Peop       0.074  0.997 0.04  0.025 *
## Dwell      0.015  1.000 0.03  0.096 .
## Fr_Green   0.959 -0.283 0.13  0.001 ***
## LC_Rich   -1.000  0.026 0.03  0.038 *
## LC_Dom     0.265  0.964 0.06  0.008 **
## PC_URB     0.283  0.959 0.06  0.004 **
## Sobs       0.212 -0.977 0.10  0.001 ***
## Arbor      0.948  0.318 0.14  0.001 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## P values based on 1000 permutations.
```

# Script for running 'bayespref' analysis on Frequency Greenspace data frame

This is an R Mardkown file which sets out the basic 'bayespref' analysis that I ran on Grequency Greenspace data and urban tolerant birds in:

Conole, L. E. (2013). Habitat-of-origin predicts degree of adaptation in urban tolerant birds. PeerJ PrePrints. doi:10.7287/peerj.preprints.156v2. https://peerj.com/preprints/156v2

In this example I have reduced the number of MCMC steps (to 50) and burn-in generations (to 10) to expedite generation of the example output. In the analysis for the paper I used 5000 MCMC steps and 1000 burn-in generations.

```
library(bayespref)
```

```
## Loading required package: coda
## Loading required package: lattice
## Loading required package: MASS
## Loading required package: MCMCpack
## ##
## ## Markov Chain Monte Carlo Package (MCMCpack)
## ## Copyright (C) 2003-2014 Andrew D. Martin, Kevin M. Quinn, and Jong Hee Park
## ##
## ## Support provided by the U.S. National Science Foundation
## ## (Grants SES-0350646 and SES-0350613)
## ##
## Loading required package: RColorBrewer
```

```
fg <- read.table("fg.2ab.txt", header = T)
fg
```

```
##     pop adapter exploiter
## 1     1       0         0
## 2     1       0         0
## 3     1       0         0
## 4     1       0         0
## 5     1       0         0
## 6     2       0         0
## 7     2       0         0
## 8     2       0         0
## 9     2       0         0
## 10    2       0         0
## 11    2       0         0
## 12    3       6         9
## 13    3       1         7
## 14    3       2         8
## 15    3       5        14
## 16    3       2        13
```

```
## 17    3       1        12
## 18    3       9        19
## 19    3       1         9
## 20    3       0        11
## 21    4      12        21
## 22    4      11        19
## 23    4       4        15
## 24    4       2        13
## 25    4       3        15
## 26    4       2         7
## 27    4       3         4
## 28    4       0         4
## 29    4       1         8
## 30    4      12        21
## 31    4       4        12
## 32    4       3        12
## 33    4      10        17
## 34    4       2        14
## 35    4       8        18
## 36    4      13        16
## 37    4       3        12
## 38    4       4        16
## 39    4       4        16
## 40    4       2         9
## 41    4       9        16
## 42    4      18         1
## 43    4       3        22
## 44    4       1        12
## 45    4       6        22
## 46    4       4        11
## 47    5       6        19
## 48    5       3        16
## 49    5       3        12
## 50    5       2        10
## 51    5       4        17
## 52    5       1         8
## 53    5      18        20
## 54    5       3         7
## 55    5       5        18
## 56    5       0        11
## 57    5       5        14
## 58    5       1         9
## 59    5       1        15
## 60    5       3        13
## 61    5       3        11
## 62    5       2        17
## 63    5       3        17
## 64    5       5        16
## 65    5       5        12
```

```
## 66     5      1          16
## 67     5      5          12
## 68     5      6          21
## 69     5     10          16
## 70     5     20          18
## 71     5     11          18
## 72     5      3          13
## 73     5      3          14
## 74     5      3          12
## 75     5      3          15
## 76     5     11          21
## 77     5      1          12
## 78     5      0           5
## 79     5     12          17
## 80     5      7          22
## 81     5      5          15
## 82     5      6          14
## 83     5      4          16
## 84     5      4          22
## 85     5     19          17
## 86     5     16          22
## 87     5      8          21
## 88     5      6          17
## 89     5      4           7
## 90     5      7          15
## 91     5      5          10
## 92     5     11          16
## 93     5     11          21
## 94     5      1           1
## 95     5      7          18
## 96     5     14          18
## 97     5     11          19
## 98     5     10          18
## 99     5      8          16
## 100    5      8          10
## 101    5      1          11
## 102    5     19          12
## 103    5     19          23
## 104    5     10          15
## 105    5      4          17
## 106    5      6          19
## 107    5     10          17
## 108    5      2          14
## 109    5      7           8
## 110    5      7          18
## 111    5      5          17
## 112    5      5          17
## 113    5     12          18
## 114    5      9          18
```

```
## 115    5        12            10
## 116    5        19            15
## 117    6         2            10
## 118    6        19            17
## 119    6        11            22
## 120    6        11            15
## 121    6         6             7
## 122    6        17             9
## 123    6        17            13
## 124    6         9            18
## 125    6        13            18
## 126    6         8            18
## 127    6         8             8
## 128    6         2            10
## 129    6         5            10
## 130    6         1            15
## 131    6         9            20
## 132    6        10            18
## 133    6         9            12
## 134    6        17            21
## 135    6         5            17
## 136    6         4            16
## 137    6         8             7
## 138    6         5            14
## 139    6        12            12
## 140    6         6            16
## 141    6        13            12
## 142    6         6            15
## 143    6         5             6
## 144    6         5            14
## 145    6         8            10
## 146    6         8            14
## 147    6         2            14
## 148    6         2            10
## 149    6         4            10
## 150    6        22            12
## 151    6         4            12
## 152    6         5            12
## 153    6        14            11
## 154    6         2             9
## 155    6        13            12
## 156    6         6            12
## 157    6         4            11
## 158    6         7            15
## 159    6         3            15
## 160    6         1            12
## 161    6        19            18
## 162    6         5            11
## 163    6        15            15
```

```
## 164   6      15        13
## 165   6      13        14
## 166   6      15         7
## 167   6       7        21
## 168   6       3         8
## 169   6       7        18
## 170   6      20        23
## 171   6      16        18
## 172   6       5        16
## 173   6      13        16
## 174   6       8        12
## 175   6       1        12
## 176   6      21         9
## 177   6      15        16
## 178   6       2         9
## 179   6      19        21
## 180   6       8        17
## 181   6       4         8
## 182   6      11        16
## 183   6      12        21
## 184   6       4        16
## 185   6      15        21
## 186   6      10        10
## 187   6       5        22
## 188   6      19         9
## 189   6      17        13
## 190   6      20        15
## 191   6       6        13
## 192   6      11        10
## 193   6       3        18
## 194   6       6        13
## 195   6       7         9
## 196   6      20         8
## 197   6      11        18
## 198   6       6        18
## 199   6      14        21
## 200   6       5        13
## 201   6       3        18
## 202   6      10        14
## 203   6       1        15
## 204   6      15        13
## 205   6       9        14
## 206   6      13        20
## 207   6      15        21
## 208   6      11        16
## 209   6      22        12
## 210   6      10        11
## 211   6       5         7
## 212   6       8        14
```

```
## 213    6       20          19
## 214    6        8          13
## 215    6       10          17
## 216    6       11          16
## 217    6       14          17
## 218    6       10          13
## 219    6        6          16
## 220    6        1          10
## 221    6       18          16
## 222    6        7          12
## 223    6       16           7
## 224    6       18          15
## 225    6       20          18
## 226    6       15           7
## 227    6        5          18
## 228    6       10          16
## 229    6        4          15
## 230    6       11          20
## 231    6       20          19
## 232    7       19          11
## 233    7        1          11
## 234    7       11          13
## 235    7       19          12
## 236    7       20          13
## 237    7       10          20
## 238    7       20          11
## 239    7        9          14
## 240    7       13          14
## 241    7        6          14
## 242    7        9          14
## 243    7       18           6
## 244    7       18          12
## 245    7        2          13
## 246    7       19           9
## 247    7       14          12
## 248    7       21          13
## 249    7        2          14
## 250    7       17          21
## 251    7        1           9
## 252    7       16          11
## 253    7        4          12
## 254    7       17          11
## 255    7       12          12
## 256    7       20          13
## 257    7       16          21
## 258    7        2           9
## 259    7       16          15
## 260    7       15          12
## 261    7       19          13
```

```
## 262    7          4             16
## 263    7          1             15
## 264    7          5             22
## 265    7          5             16
## 266    7         20             20
## 267    7          2             13
## 268    7         11             15
## 269    7          2             10
## 270    7         17             11
## 271    7          9             16
## 272    7         10             14
## 273    7         17             17
## 274    7         11             10
## 275    7          1              8
## 276    7         10             14
## 277    7         13             10
## 278    7          9             14
## 279    7         19             19
## 280    7         14             11
## 281    7         13              9
## 282    7         18              8
## 283    7         21             23
## 284    7         10             19
## 285    7         21             13
## 286    7          7              3
## 287    7         15             16
## 288    7         12             10
## 289    7          8             16
## 290    7         18             18
## 291    7         21             21
## 292    7          7             12
## 293    7         13             19
## 294    7          1             12
## 295    7         12             10
## 296    7         21             11
## 297    7         17             12
## 298    7         13             16
## 299    7         12              2
## 300    7         14             17
## 301    7         13             17
## 302    7          7              8
## 303    7         12             17
## 304    7          7              4
## 305    7          6             10
## 306    7         14             19
## 307    7          9             19
```

In the data frame ‘fg’, column headings and the data to which they refer are as follows:

- pop indicates population; in this case referring to 7 binned intervals of Frequency Greenspace in the larger data set
- adapter indicates species richness of urban adapter birds at a given site within the Frequency Greenspace bin
- exploiter indicates species richness of urban exploiter birds at a given site within the Frequency Greenspace bin

```r
fgm <- as.matrix(fg)
fgpref <- bayesPref(pData = fgm, mcmcL = 50, pops = T, dicburn = 10)
```

```
## current mcmc step: 1;   p(M|D):  -952.8
## dic =  1155
```

Calculating individual bin (pop = population) preferences was achieved by partitioning the larger dataframe (fg) into the 7 data bins and running the same analysis (as above) separately for each bin.

# Script for plotting Frequency Greenspace preference data from 'bayespref' analysis

This is an R Mardkown file which contains a 'ggplot2' script for plotting urban tolerant bird preference for Frequency Greenspace bins from a 'bayespref' analysis that I ran in:

Conole, L. E. (2013). Habitat-of-origin predicts degree of adaptation in urban tolerant birds. PeerJ PrePrints. doi:10.7287/peerj.preprints.156v2. https://peerj.com/preprints/156v2

```
library(ggplot2)
```

```
fgprefs <- read.table("FG.birds.CI.txt", header = T)
fgprefs
```

```
##    bin     urban median.pref   low    up
## 1  2.0   Adapter       0.206 0.126 0.292
## 2  2.2 Exploiter       0.794 0.708 0.874
## 3  3.0   Adapter       0.279 0.222 0.347
## 4  3.2 Exploiter       0.721 0.653 0.778
## 5  4.0   Adapter       0.289 0.268 0.330
## 6  4.2 Exploiter       0.701 0.670 0.732
## 7  5.0   Adapter       0.396 0.367 0.423
## 8  5.2 Exploiter       0.604 0.577 0.633
## 9  6.0   Adapter       0.460 0.424 0.494
## 10 6.2 Exploiter       0.540 0.506 0.576
```

In the data frame 'fgprefs', column headings and the data to which they refer are as follows:

- bin refers to 7 binned intervals of Frequency Greenspace within the larger data set,
- urban refers to the two urban tolerant bird assemblages of Adapter and Exploiter,
- median.preference is the median population preference for that Frequency Greenspace bin,
- low indicates the lower 95% confidence interval around the median,
- up indicates the upper 95% confidence interbal around the median.

Using 'ggplot2' to plot the habitat preferences at landscape scale for urban adapter and exploiter birds is achieved with the following script:

```
p = ggplot(fgprefs, aes(x = bin, y = median.pref, shape = urban))
p = p + geom_pointrange(aes(ymin = low, ymax = up), size = 1.5, xlim = c(1:6))
p = p + labs(x = "Frequency Greenspace", y = "Median preference")
print(p)
```

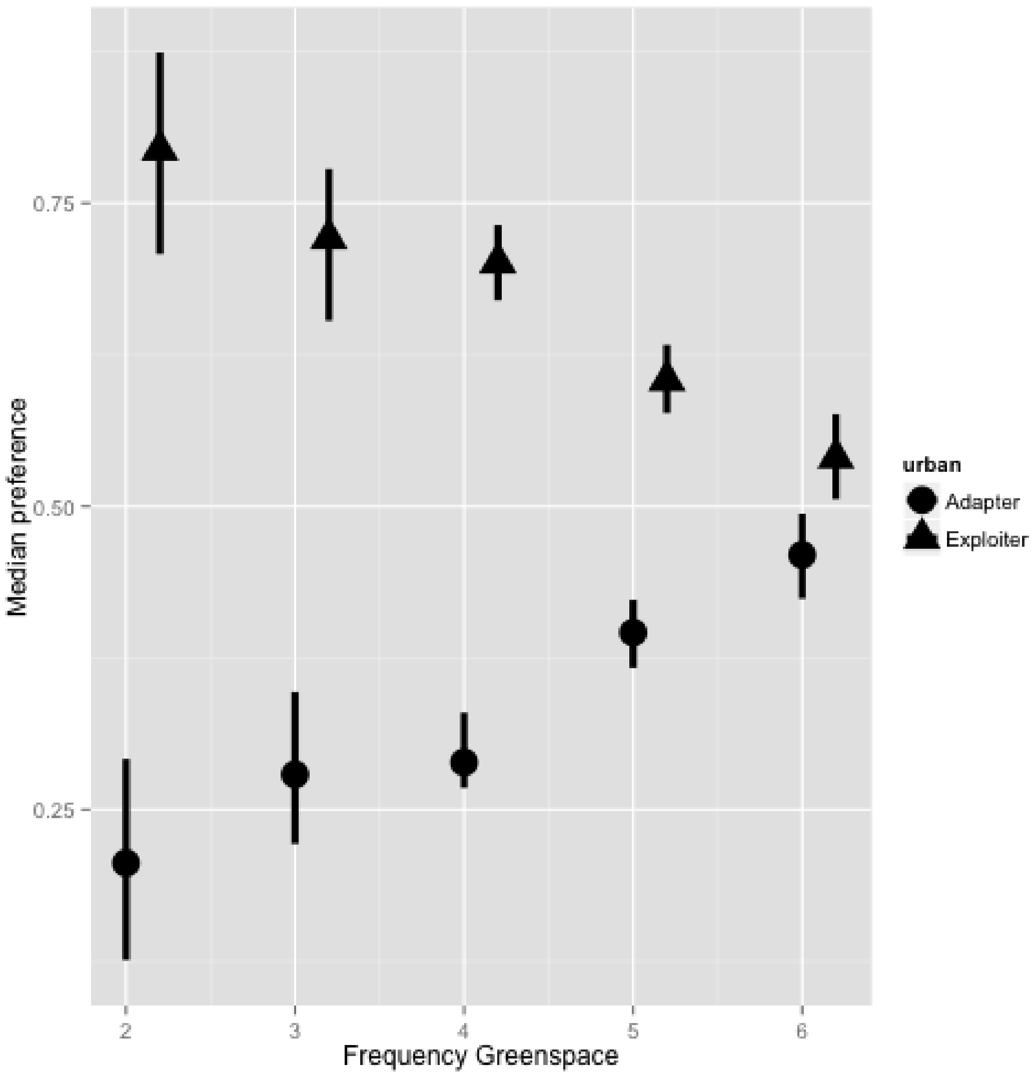


Figure 1: plot of chunk ggplot2 median preference of urban tolerant birds