Barro Colorado Island

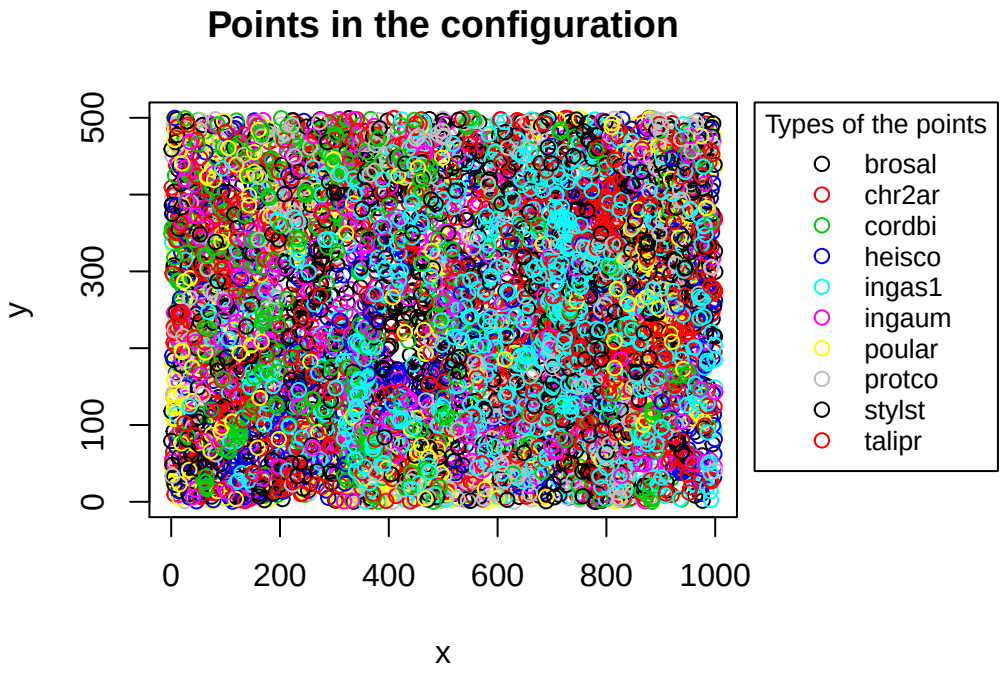
```
library(ppjsdm)
#> Registered S3 method overwritten by 'spatstat':
#>   method     from
#>   print.boxx cli
library(spatstat)
#> Loading required package: spatstat.data
#> Loading required package: nlme
#> Loading required package: rpart
#>
#> spatstat 1.64-0       (nickname: 'Susana Distancia')
#> For an introduction to spatstat, type 'beginner'
#>
#> Attaching package: 'spatstat'
#> The following object is masked from 'package:ppjsdm':
#>
#>     marks
library(plot.matrix)
remove(list = ls())

source("../R/get_bci.R")

set.seed(1)
```

This vignette explains how to use the `ppjsdm` package with the Barro Colorado Island (BCI) dataset. We begin by loading the data with only the most prevalent species.

```
number_of_species <- 10
bci <- get_bci(least_prevalent = 50, most_prevalent = 50 + number_of_species - 1)
configuration <- bci$configuration
window <- bci$window
```

The point configuration is plotted below.

```
par(mar = c(5, 4, 4, 13) + 0.1)
plot(configuration, window = window)
```

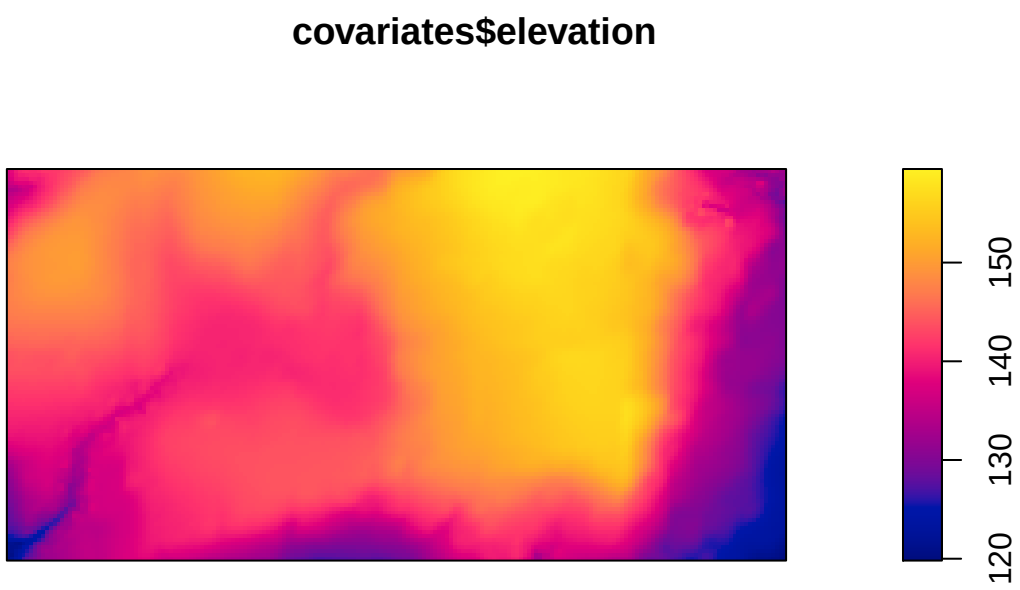


The BCI dataset also contains a series of environmental covariates. The easiest to obtain are the elevation level and the elevation gradient, since they are included in `spatstat`.

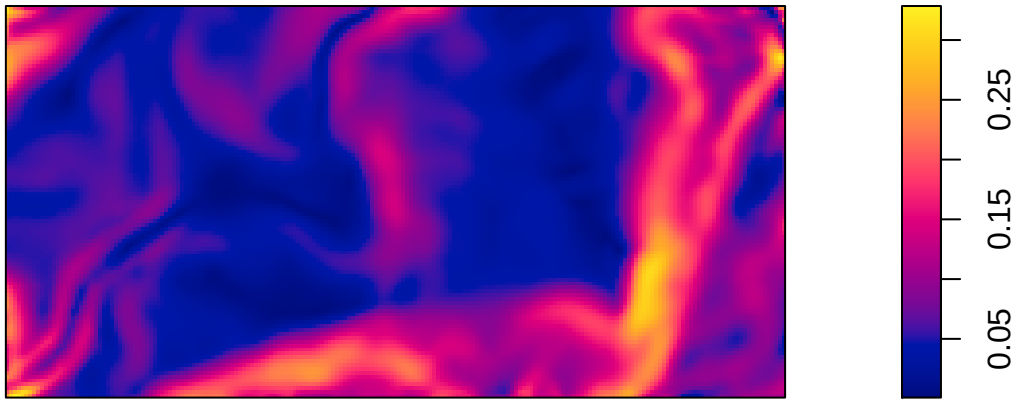
```
covariates <- list(elevation = spatstat.data::bei.extra$elev,
                   gradient = spatstat.data::bei.extra$grad)
```

Plotting covariates maps is easy in `spatstat`.

```
plot(covariates$elevation)
```




```
plot(covariates$gradient)
```



The matrix `short_range` defined below models short range interaction radii within a species (on the diagonal), and between species (outside the diagonal). One could play around with different interaction radii, but any homogeneous interaction radius of less than 10 m tends to work well.

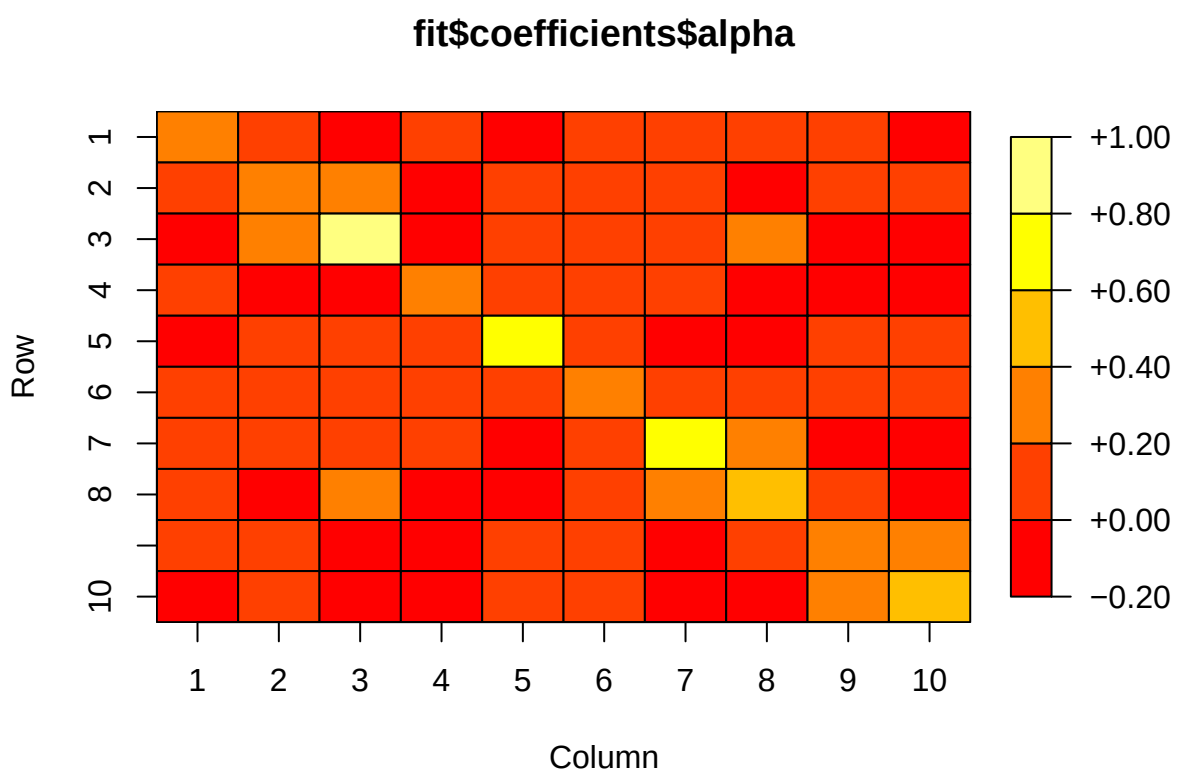
```
short_range <- matrix(5, number_of_species, number_of_species)
medium_range <- matrix(10, number_of_species, number_of_species)
long_range <- matrix(30, number_of_species, number_of_species)
```

Fitting the model to the dataset is then quite easy.

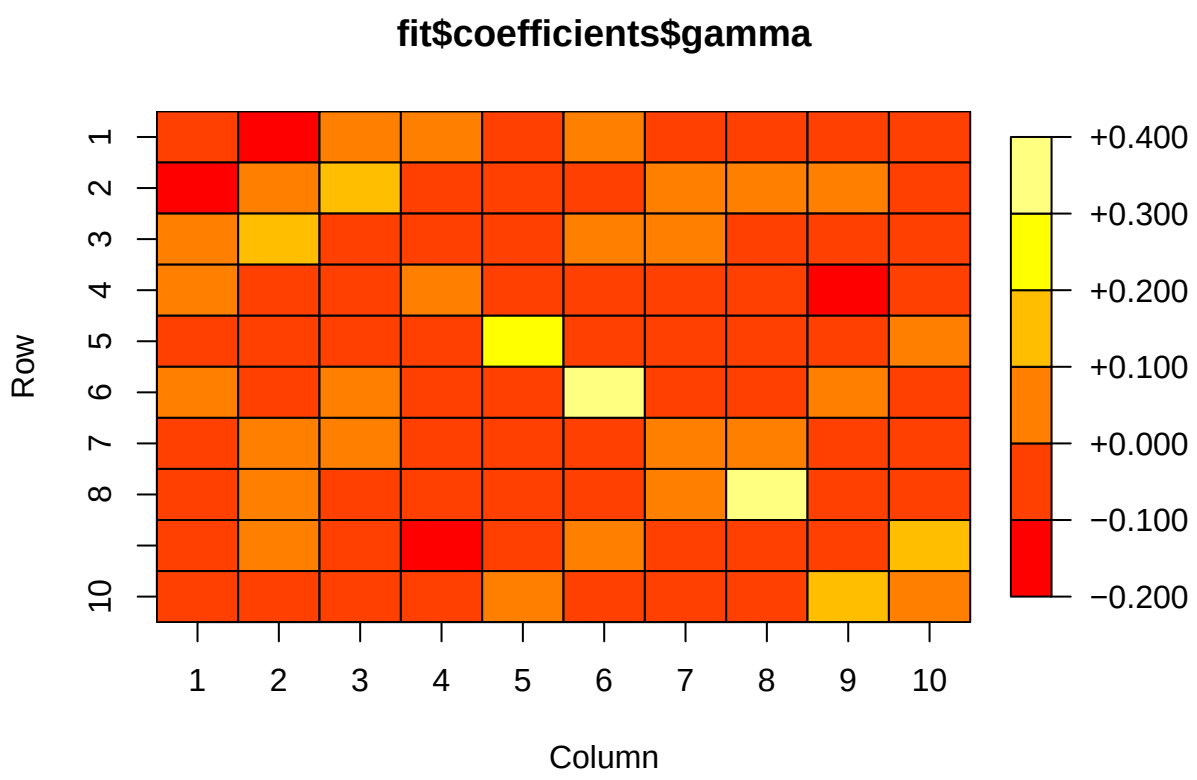
```
tm <- Sys.time()
fit <- ppjsdm::gibbsm(configuration,
                      window = window,
                      covariates = covariates,
                      model = "square_exponential",
                      medium_range_model = "square_exponential",
                      short_range = short_range,
                      medium_range = medium_range,
                      long_range = long_range,
                      use_glmnet = FALSE)
print(Sys.time() - tm)
#> Time difference of 30.8636 mins
print(fit$coefficients)
#> $beta0
#>  [1] -8.868809 -5.800297 -8.501512 -5.602515 -8.644028 -6.037851 -7.255743
#>  [8] -7.988091 -6.308194 -8.148471
#>
```

```
#> $alpha
#>               [,1]        [,2]        [,3]        [,4]        [,5]       [,6]
#>  [1,]  0.322882856  0.01582286 -0.16061927  0.18750204 -0.01356918 0.12118856
#>  [2,]  0.015822860  0.28070443  0.34700964 -0.09280009  0.09304434 0.01956562
#>  [3,] -0.160619271  0.34700964  0.81634783 -0.09912690  0.14335616 0.07617087
#>  [4,]  0.187502043 -0.09280009 -0.09912690  0.23024557  0.03245643 0.10873336
#>  [5,] -0.013569182  0.09304434  0.14335616  0.03245643  0.65350065 0.09447264
#>  [6,]  0.121188558  0.01956562  0.07617087  0.10873336  0.09447264 0.32290687
#>  [7,]  0.171681864  0.09340024  0.02563108  0.14011802 -0.09313944 0.01990862
#>  [8,]  0.009154634 -0.03377196  0.36664509 -0.10646945 -0.06307685 0.07194816
#>  [9,]  0.013037508  0.15530421 -0.10358175 -0.03078258  0.06726222 0.02595107
#> [10,] -0.058847418  0.19027653 -0.15392747 -0.11831902  0.05112524 0.14615726
#>               [,7]         [,8]        [,9]        [,10]
#>  [1,]  0.17168186  0.009154634  0.01303751 -0.058847418
#>  [2,]  0.09340024 -0.033771963  0.15530421  0.190276531
#>  [3,]  0.02563108  0.366645093 -0.10358175 -0.153927472
#>  [4,]  0.14011802 -0.106469452 -0.03078258 -0.118319023
#>  [5,] -0.09313944 -0.063076848  0.06726222  0.051125235
#>  [6,]  0.01990862  0.071948161  0.02595107  0.146157262
#>  [7,]  0.77799290  0.235114315 -0.01105947 -0.071104738
#>  [8,]  0.23511432  0.504415320  0.09847485 -0.008093074
#>  [9,] -0.01105947  0.098474850  0.21103563  0.203188993
#> [10,] -0.07110474 -0.008093074  0.20318899  0.534467131
#>
#> $gamma
#>               [,1]         [,2]         [,3]        [,4]         [,5]
#>  [1,] -0.044193492 -0.119470206  0.003999119  0.03208859 -0.009968259
#>  [2,] -0.119470206  0.088988115  0.116079455 -0.03253881 -0.072775436
#>  [3,]  0.003999119  0.116079455 -0.010568106 -0.09092381 -0.087608744
#>  [4,]  0.032088588 -0.032538813 -0.090923812  0.09481737 -0.021679955
#>  [5,] -0.009968259 -0.072775436 -0.087608744 -0.02167995  0.243755141
#>  [6,]  0.061146585 -0.081113741  0.042825737 -0.03902428 -0.058446942
#>  [7,] -0.028303286  0.009989958  0.023731060 -0.05225533 -0.030885773
#>  [8,] -0.088751317  0.075255333 -0.074994345 -0.07475883 -0.008437995
#>  [9,] -0.061557400  0.028317488 -0.052903211 -0.12993744 -0.096872056
#> [10,] -0.022531852 -0.004550045 -0.085398576 -0.03790499  0.077415109
#>               [,6]         [,7]         [,8]        [,9]        [,10]
#>  [1,]  0.061146585 -0.028303286 -0.088751317 -0.06155740 -0.022531852
#>  [2,] -0.081113741  0.009989958  0.075255333  0.02831749 -0.004550045
#>  [3,]  0.042825737  0.023731060 -0.074994345 -0.05290321 -0.085398576
#>  [4,] -0.039024278 -0.052255331 -0.074758834 -0.12993744 -0.037904992
#>  [5,] -0.058446942 -0.030885773 -0.008437995 -0.09687206  0.077415109
#>  [6,]  0.343641022 -0.054962422 -0.004659402  0.03605900 -0.080329512
#>  [7,] -0.054962422  0.095260655  0.010321799 -0.05915154 -0.040412481
#>  [8,] -0.004659402  0.010321799  0.301665505 -0.09540621 -0.023671022
#>  [9,]  0.036059000 -0.059151535 -0.095406210 -0.08988904  0.108223206
#> [10,] -0.080329512 -0.040412481 -0.023671022  0.10822321  0.015444313
#>
#> $beta
#>                [,1]       [,2]
#>  [1,]  1.823985e-02  2.2770151
#>  [2,] -7.894710e-03  2.2247844
#>  [3,]  1.424914e-02 -1.1715318
```

```
#>  [4,] -1.171549e-03  0.8419639
#>  [5,]  1.383047e-02  0.3633732
#>  [6,] -7.007331e-03 -0.8589954
#>  [7,] -5.533971e-06  6.4723942
#>  [8,]  7.014231e-03  1.8479493
#>  [9,]  3.260489e-03  0.2907156
#> [10,]  1.133721e-02  0.5894472
#>
#> $short_range
#>       [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10]
#>  [1,]    5    5    5    5    5    5    5    5    5     5
#>  [2,]    5    5    5    5    5    5    5    5    5     5
#>  [3,]    5    5    5    5    5    5    5    5    5     5
#>  [4,]    5    5    5    5    5    5    5    5    5     5
#>  [5,]    5    5    5    5    5    5    5    5    5     5
#>  [6,]    5    5    5    5    5    5    5    5    5     5
#>  [7,]    5    5    5    5    5    5    5    5    5     5
#>  [8,]    5    5    5    5    5    5    5    5    5     5
#>  [9,]    5    5    5    5    5    5    5    5    5     5
#> [10,]    5    5    5    5    5    5    5    5    5     5
#>
#> $medium_range
#>       [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10]
#>  [1,]   10   10   10   10   10   10   10   10   10    10
#>  [2,]   10   10   10   10   10   10   10   10   10    10
#>  [3,]   10   10   10   10   10   10   10   10   10    10
#>  [4,]   10   10   10   10   10   10   10   10   10    10
#>  [5,]   10   10   10   10   10   10   10   10   10    10
#>  [6,]   10   10   10   10   10   10   10   10   10    10
#>  [7,]   10   10   10   10   10   10   10   10   10    10
#>  [8,]   10   10   10   10   10   10   10   10   10    10
#>  [9,]   10   10   10   10   10   10   10   10   10    10
#> [10,]   10   10   10   10   10   10   10   10   10    10
#>
#> $long_range
#>       [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10]
#>  [1,]   30   30   30   30   30   30   30   30   30    30
#>  [2,]   30   30   30   30   30   30   30   30   30    30
#>  [3,]   30   30   30   30   30   30   30   30   30    30
#>  [4,]   30   30   30   30   30   30   30   30   30    30
#>  [5,]   30   30   30   30   30   30   30   30   30    30
#>  [6,]   30   30   30   30   30   30   30   30   30    30
#>  [7,]   30   30   30   30   30   30   30   30   30    30
#>  [8,]   30   30   30   30   30   30   30   30   30    30
#>  [9,]   30   30   30   30   30   30   30   30   30    30
#> [10,]   30   30   30   30   30   30   30   30   30    30
par(mar = c(5.1, 5.1, 4.1, 4.1))
plot(fit$coefficients$alpha)
```




```
plot(fit$coefficients$gamma)
```




```
print(fit$aic)
#> [1] 16504.26
print(fit$bic)
#> [1] 17554.87
```