1 Metasim population structures

First assume a landscape composed of 2 stage local demographies. Let's say there are 9 populations. Dispersal occurs when an adult's offspring wind up in a new population. The local demography looks like this:

```
> S <- t(matrix(c(0.1, 0, 0.5, 0.3), nrow = 2))
> R <- t(matrix(c(0, 1.1, 0, 0), nrow = 2))
> M <- t(matrix(c(0, 0, 0, 1), nrow = 2))
> print(S)

     [,1] [,2]
[1,]  0.1  0.0
[2,]  0.5  0.3

> print(R)

     [,1] [,2]
[1,]    0  1.1
[2,]    0  0.0

> print(M)

     [,1] [,2]
[1,]    0    0
[2,]    0    1
```

1.1 Island structure

The matrices representing this island structure looks like this:

```
> Sland <- matrix(rep(0, (18 * 18)), nrow = 18, ncol = 18)
> from <- rep(c(0, 1), 9)
> to <- rep(c(1, 0), 9)
> s <- 0
> for (i in 1:dim(Sland)[1]) for (j in 1:dim(Sland)[2]) if (from[j] *
+     to[i]) Sland[i, j] <- s
> for (i in seq(1, 17, 2)) {
+     Sland[i, i] <- S[1, 1]
+     Sland[i, i + 1] <- S[1, 2]
+     Sland[i + 1, i] <- S[2, 1]
+     Sland[i + 1, i + 1] <- S[2, 2]
+ }
> Rland <- matrix(rep(0, (18 * 18)), nrow = 18, ncol = 18)
```

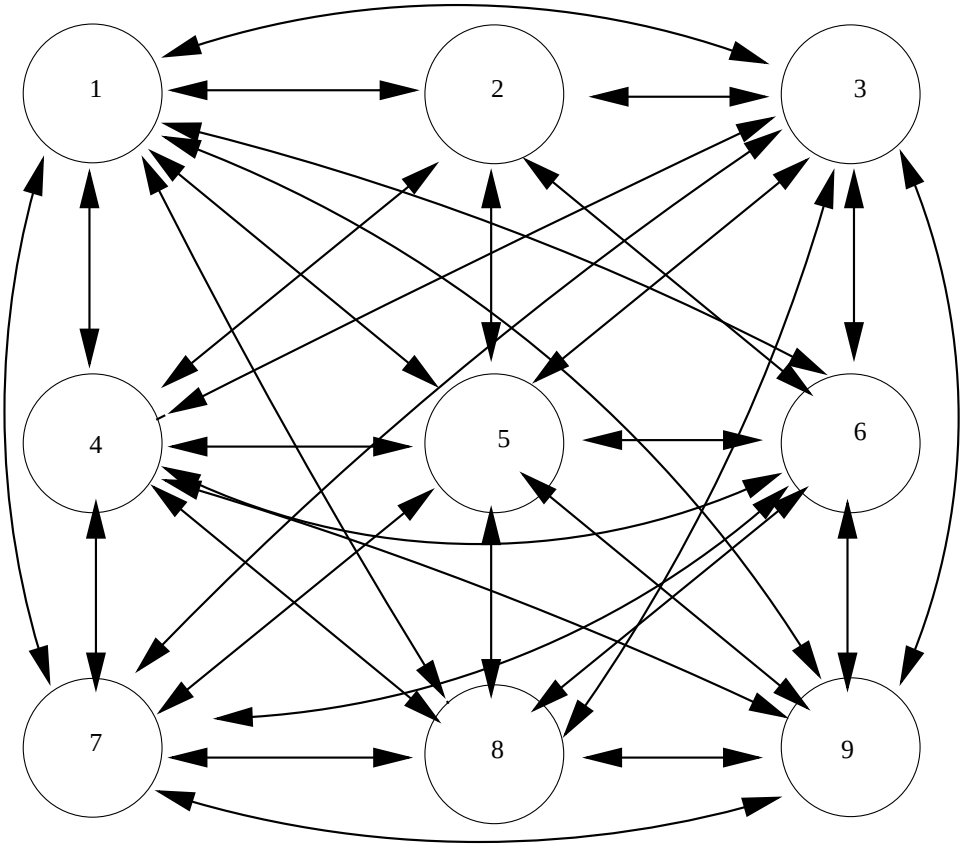

Figure 1: Island population structure.

```
> m <- 0.01
> from <- rep(c(0, 1), 9)
> to <- rep(c(1, 0), 9)
> for (i in 1:dim(Rland)[1]) for (j in 1:dim(Rland)[2]) if (from[j] *
+     to[i]) Rland[i, j] <- m
> for (i in seq(1, 17, 2)) {
+     Rland[i, i] <- R[1, 1]
+     Rland[i, i + 1] <- R[1, 2]
+     Rland[i + 1, i] <- R[2, 1]
+     Rland[i + 1, i + 1] <- R[2, 2]
+ }
> Mland <- matrix(rep(0, (18 * 18)), nrow = 18, ncol = 18)
> f <- 0.01
> from <- rep(c(0, 1), 9)
> to <- from
> for (i in 1:dim(Mland)[1]) for (j in 1:dim(Mland)[2]) if (from[j] *
+     to[i]) Mland[i, j] <- f
> for (i in seq(1, 17, 2)) {
+     Mland[i, i] <- M[1, 1]
+     Mland[i, i + 1] <- M[1, 2]
+     Mland[i + 1, i] <- M[2, 1]
+     Mland[i + 1, i + 1] <- M[2, 2]
+ }
> print(Rland)
```

```
      [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10] [,11] [,12] [,13]
 [1,]    0 1.10    0 0.01    0 0.01    0 0.01    0  0.01     0  0.01     0
 [2,]    0 0.00    0 0.00    0 0.00    0 0.00    0  0.00     0  0.00     0
 [3,]    0 0.01    0 1.10    0 0.01    0 0.01    0  0.01     0  0.01     0
 [4,]    0 0.00    0 0.00    0 0.00    0 0.00    0  0.00     0  0.00     0
 [5,]    0 0.01    0 0.01    0 1.10    0 0.01    0  0.01     0  0.01     0
 [6,]    0 0.00    0 0.00    0 0.00    0 0.00    0  0.00     0  0.00     0
 [7,]    0 0.01    0 0.01    0 0.01    0 1.10    0  0.01     0  0.01     0
 [8,]    0 0.00    0 0.00    0 0.00    0 0.00    0  0.00     0  0.00     0
 [9,]    0 0.01    0 0.01    0 0.01    0 0.01    0  1.10     0  0.01     0
[10,]    0 0.00    0 0.00    0 0.00    0 0.00    0  0.00     0  0.00     0
[11,]    0 0.01    0 0.01    0 0.01    0 0.01    0  0.01     0  1.10     0
[12,]    0 0.00    0 0.00    0 0.00    0 0.00    0  0.00     0  0.00     0
[13,]    0 0.01    0 0.01    0 0.01    0 0.01    0  0.01     0  0.01     0
[14,]    0 0.00    0 0.00    0 0.00    0 0.00    0  0.00     0  0.00     0
[15,]    0 0.01    0 0.01    0 0.01    0 0.01    0  0.01     0  0.01     0
[16,]    0 0.00    0 0.00    0 0.00    0 0.00    0  0.00     0  0.00     0
[17,]    0 0.01    0 0.01    0 0.01    0 0.01    0  0.01     0  0.01     0
```

```
[18,]    0 0.00    0 0.00    0 0.00    0 0.00    0  0.00     0  0.00     0
      [,14] [,15] [,16] [,17] [,18]
 [1,]  0.01     0  0.01     0  0.01
 [2,]  0.00     0  0.00     0  0.00
 [3,]  0.01     0  0.01     0  0.01
 [4,]  0.00     0  0.00     0  0.00
 [5,]  0.01     0  0.01     0  0.01
 [6,]  0.00     0  0.00     0  0.00
 [7,]  0.01     0  0.01     0  0.01
 [8,]  0.00     0  0.00     0  0.00
 [9,]  0.01     0  0.01     0  0.01
[10,]  0.00     0  0.00     0  0.00
[11,]  0.01     0  0.01     0  0.01
[12,]  0.00     0  0.00     0  0.00
[13,]  1.10     0  0.01     0  0.01
[14,]  0.00     0  0.00     0  0.00
[15,]  0.01     0  1.10     0  0.01
[16,]  0.00     0  0.00     0  0.00
[17,]  0.01     0  0.01     0  1.10
[18,]  0.00     0  0.00     0  0.00
```

> print(Mland)

```
      [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10] [,11] [,12] [,13]
 [1,]    0 0.00    0 0.00    0 0.00    0 0.00    0  0.00     0  0.00     0
 [2,]    0 1.00    0 0.01    0 0.01    0 0.01    0  0.01     0  0.01     0
 [3,]    0 0.00    0 0.00    0 0.00    0 0.00    0  0.00     0  0.00     0
 [4,]    0 0.01    0 1.00    0 0.01    0 0.01    0  0.01     0  0.01     0
 [5,]    0 0.00    0 0.00    0 0.00    0 0.00    0  0.00     0  0.00     0
 [6,]    0 0.01    0 0.01    0 1.00    0 0.01    0  0.01     0  0.01     0
 [7,]    0 0.00    0 0.00    0 0.00    0 0.00    0  0.00     0  0.00     0
 [8,]    0 0.01    0 0.01    0 0.01    0 1.00    0  0.01     0  0.01     0
 [9,]    0 0.00    0 0.00    0 0.00    0 0.00    0  0.00     0  0.00     0
[10,]    0 0.01    0 0.01    0 0.01    0 0.01    0  1.00     0  0.01     0
[11,]    0 0.00    0 0.00    0 0.00    0 0.00    0  0.00     0  0.00     0
[12,]    0 0.01    0 0.01    0 0.01    0 0.01    0  0.01     0  1.00     0
[13,]    0 0.00    0 0.00    0 0.00    0 0.00    0  0.00     0  0.00     0
[14,]    0 0.01    0 0.01    0 0.01    0 0.01    0  0.01     0  0.01     0
[15,]    0 0.00    0 0.00    0 0.00    0 0.00    0  0.00     0  0.00     0
[16,]    0 0.01    0 0.01    0 0.01    0 0.01    0  0.01     0  0.01     0
[17,]    0 0.00    0 0.00    0 0.00    0 0.00    0  0.00     0  0.00     0
[18,]    0 0.01    0 0.01    0 0.01    0 0.01    0  0.01     0  0.01     0
      [,14] [,15] [,16] [,17] [,18]
```

```
 [1,]  0.00     0  0.00     0  0.00
 [2,]  0.01     0  0.01     0  0.01
 [3,]  0.00     0  0.00     0  0.00
 [4,]  0.01     0  0.01     0  0.01
 [5,]  0.00     0  0.00     0  0.00
 [6,]  0.01     0  0.01     0  0.01
 [7,]  0.00     0  0.00     0  0.00
 [8,]  0.01     0  0.01     0  0.01
 [9,]  0.00     0  0.00     0  0.00
[10,]  0.01     0  0.01     0  0.01
[11,]  0.00     0  0.00     0  0.00
[12,]  0.01     0  0.01     0  0.01
[13,]  0.00     0  0.00     0  0.00
[14,]  1.00     0  0.01     0  0.01
[15,]  0.00     0  0.00     0  0.00
[16,]  0.01     0  1.00     0  0.01
[17,]  0.00     0  0.00     0  0.00
[18,]  0.01     0  0.01     0  1.00
```

1.2 2-d steppingstone structure

Haven't worked out the code for these yet.

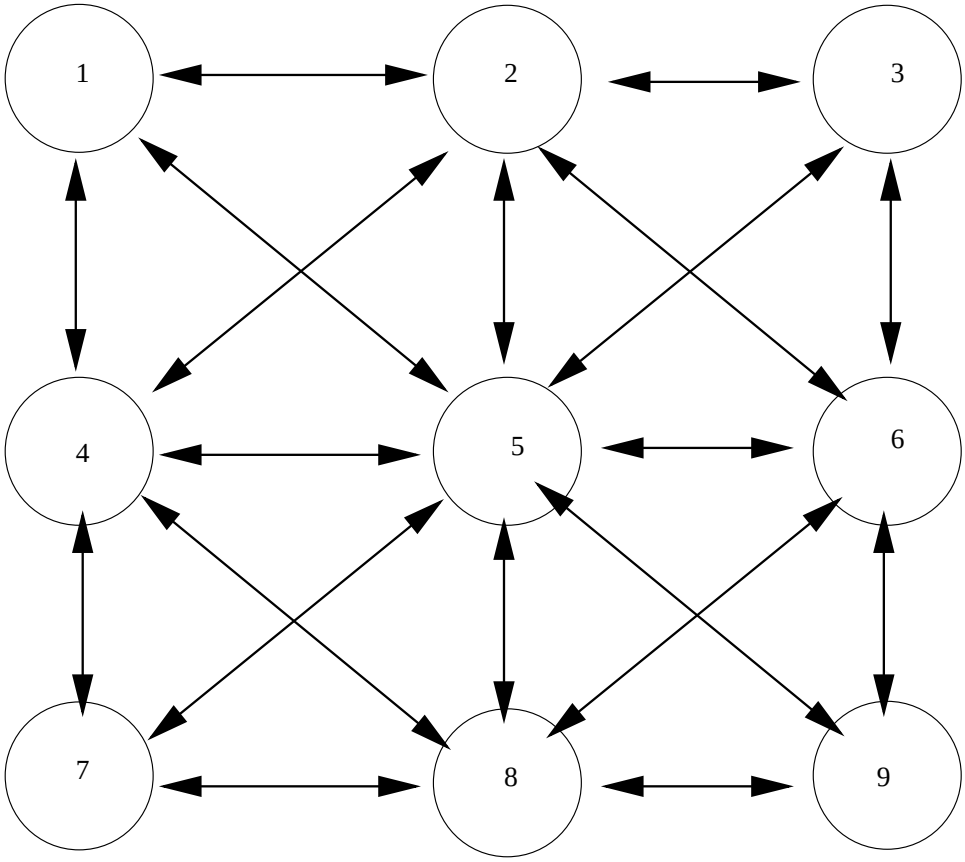

Figure 2: 2-dimensional stepping stone population structure.