BASE

Metapopulations and internal colonization

There's an assumption in the last model ([Metapopulations and propagule rain - Tutorial in EcoVirtual](#)) that we can get rid off: the assumption that the propagule rain is constant. Instead, we can make the colonization rate a function of the percentage of occupied patches. In a simple formulation of this model, the propagule source is just from within the system (closed system) and the probability of colonization increases linearly with the proportion of occupied patches.

The model

This way, our model does not have a constant colonization rate p_i, but a probability of colonization that depends on the number of occupied patches:

$$p_i = if$$

here i is a constant that indicates how much the colonization probability increases with every new occupied patch. This way, the more occupied patches we have, the greater is the probability that new patches will be occupied. Substituting this new formula for p_i in our old equation, we have:

$$\frac{df}{dt}=if(1-f)- p_e f $$

Equilibrium

The fraction of the occupied patches in equilibrium(**F**) changes to:

$$ F=1-\frac{p_e}{i} $$

Simulation

Let's see this first-hand by simulating this situation. As in the last exercise, we have created an R function that runs the simulation for us. As before, this function simply draws random colonization and

extinction events for every patch at every time step, following the model's rules. It then shows the graph and an occupancy matrix for every time interval.

Argumentos função

The parameters are:

option	parameter	definition
data set	R object	where the results are stored
Maximum time	$tmax$	Number of model iterations
columns	cl	number of habitat columns in the landscape
rows	rw	number of habitat rows in the landscape
initial occupance	$f0$	initial number of occupied patches
colonization coef.	ci	colonization coefficient
prob. extinction	pe	extinction probability

Now you can simulate the model with the values you chose. For example,

```
tmax = 100
ncol = 10
nrow = 10
f0 = 0.1
ci = 1
pe = 0.5
```

> Play around with the model for a while by changing the parameters and try to answer the following questions:
>
> - is there any difference between this model and the *seed rain*, keeping the shared parameters equal?
> - does the position of a patch in the landscape affect its p_i or p_e? Is this realistic?
> - are there any combinations of i and p_e that cannot exist?
> - what is the meaning of a negative **F**?
> - in which situation the equilibrium is $\hat{f} = 1?$

Scenario suggestions

```
tmax = 100
cl = 10
```

```
rw = 10
f0 = 0.1
ci = 0.5
pe = 0.5
```

To learn more

- **Gotelli, N. 2007. Ecologia.** Londrina, Ed. Planta. Capítulo 4.
- **Stevens, M. H. 2009. A primer of ecology with R.** New York. Springer.Capítulo 4.
- **Gotelli, N. 1991. Metapopulation models: the rescue effect, the propagule rain, and the core-satellite hypothesis.** The American Naturalist, 138: 768-776. pdf no site do autor

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