Solving Equation to get A value

Matthias Grenié

7 septembre 2018

We start from this equation

$$N_{t+1,i,x} = \frac{k \times \exp\left(-\frac{(\text{trait}_i - \text{env}_x)^2}{2 \times \text{width}^2}\right) \times N_{t,i,x}}{1 + A \times \sum\limits_{j=1,\ j \neq i}^{S} N_{t,j,x}(1 - \delta_{ij}) + B \times N_{t,i,x}}$$

to get realistic value for A and B. We solve $N_{t+1,i,x} = N_{t,i,x}$ with $A = B$ and $1 - \delta_{ij} = 1$ for all i and j and for $\text{trait}_i - \text{env}_x = 0$. We thus get:

$$\begin{aligned}
N_{t+1,i,x} =& N_{t,i,x} \\
\Leftrightarrow N_{t,i,x} =& \frac{k \times N_{t,i,x}}{1 + A \times \sum\limits_{j=1,\ j \neq i}^{S} N_{t,j,x} + A \times N_{t,i,x}} \\
\Leftrightarrow N_{t,i,x} =& \frac{k \times N_{t,i,x}}{1 + A \times \sum\limits_{j=1}^{S} N_{t,j,x}} \\
\Leftrightarrow \cancel{N_{t,i,x}} =& \frac{k \times \cancel{N_{t,i,x}}}{1 + A \times \sum\limits_{j=1}^{S} N_{t,j,x}} \\
\Leftrightarrow 1 =& \frac{k}{1 + A \times \sum\limits_{j=1}^{S} N_{t,j,x}} \\
\Leftrightarrow 1 + A \times \sum_{j=1}^{S} N_{t,j,x} = k& \\
\Leftrightarrow& \boxed{A = \frac{k-1}{\sum\limits_{j=1}^{S} N_{t,j,x}}}
\end{aligned} \tag{1}$$

We can find a value for A heuristically computing it at the last generation for a number of sites