Mini-rotations - Trophic overyielding and infection dynamics

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Working through ideas for the mini-rotations project

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1 Background

Previous work has shown that the coexistence of a pair or mixture of species can reach higher abundance than the species with the highest carrying capacity

2 Methods

We start from the assumption of two species competing, in a Lotka-Volterra model. We use the form of Abrams (2022, pg. 39), which includes terms for both inter- and intra-specific competition. We then have

$$\frac{dN_1}{dt} = N_1(r_1 - \alpha_{11}N_1 - \alpha_{12}N_2) \tag{1}$$

$$\frac{dN_2}{dt} = N_2(r_2 - \alpha_{21}N_1 - \alpha_{22}N_2) \tag{2}$$

The relation to the original generalized Lotka-Volterra model (as pointed out by Abrams 2022) is that $\alpha_{ii} = \frac{1}{K_i}$ and $\alpha_{ij} = \frac{\alpha_{ij}}{K_i}$.

Model Parameters	
Term	**Description**
N_i	Abundance of species i
r_i	Growth rate of species i
α_{ii}	Intraspecific competition within species i
α_{ij}	Interspecific competition between species i and j

Table 1: Parameter values for our model systems

Since we are also ultimately interested in the dynamics when one of these competing species is infected with some type of pathogen, we can additionally consider species 1 as being infected with a generalized pathogen.

Source: Article Notebook