From Generalized Lotka-Voltera (GLV):

Assuming has linear relationship with all species density, except species i and j:

Excluding and from the makes sure the interaction between species i and j, as well as intra-species interactions, are counted by only and will not be further altered by either species i or j’s density.

GLV becomes:

To implement the growth rate in R, assuming a 3 species community with linear dependency of :

Where:

The diagonal of matrix is set to 0

We can show the last term of the R code is indeed the last term of GLV by expanding its matrix form:

The first item above will multiply by and hence 0 for all the first coefficient.

We can also assume a higher order dependency of on all species density:

GLV becomes: