EEB 5301 Homework 3

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Spring 2017

Problem 1

Part a

Figure 1 shows that interspecifc competition dominates the interaction, the cotinga population will go extinct and the fruit dove population is safe.

The y-intercept of the purple dove line is defined by $\frac{k}{\alpha_{dc}}$ and the x-intercept of the orange cotinga line is defined by $\frac{k}{\alpha_{cd}}$. Since $k_c = k_d$, we assume k=1 for graphical simplicity.

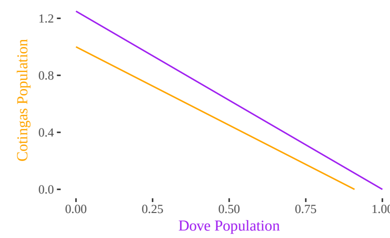

Figure 1: Fruit Dove and Spangled Cotingas Phase Diagram

Part b

In Figure 1, the conclusions based on the intercepts of the axes are constrained by the following be true: $\frac{k_c}{\alpha_{cd}} < k_d$ (x-axis) and $k_c < \frac{k_d}{\alpha_{dc}}$ (yaxis). If the carrying capacity of the Cotingas violates these constraints then the conclusions in Part a would change.

Problem 2

The zero growth isocline is found by setting each population growth rate to zero, $\frac{dN_1}{dt} = 0$. The intercepts for the absolute case can be found as:

$$0 = r_1 N_1 (1 - \alpha_{11} N_1 - \alpha_{12} N_2)$$

$$0 = 1 - \alpha_{11} N_1 - \alpha_{12} N_2$$

Putting the equation in a linear mx+b format:

$$N_1 = \frac{1}{\alpha_{11}} - \frac{\alpha_{12}}{\alpha_{11}} N_2$$

The intercepts for the N_1 zero growth line are $\frac{1}{\alpha_{11}}$ and $\frac{1}{\alpha_{12}}$. The N_2 zero growth line intercepts can easily be shown to be $\frac{1}{\alpha_{22}}$ and $\frac{1}{\alpha_{21}}$

Problem 3

Part a

Part b

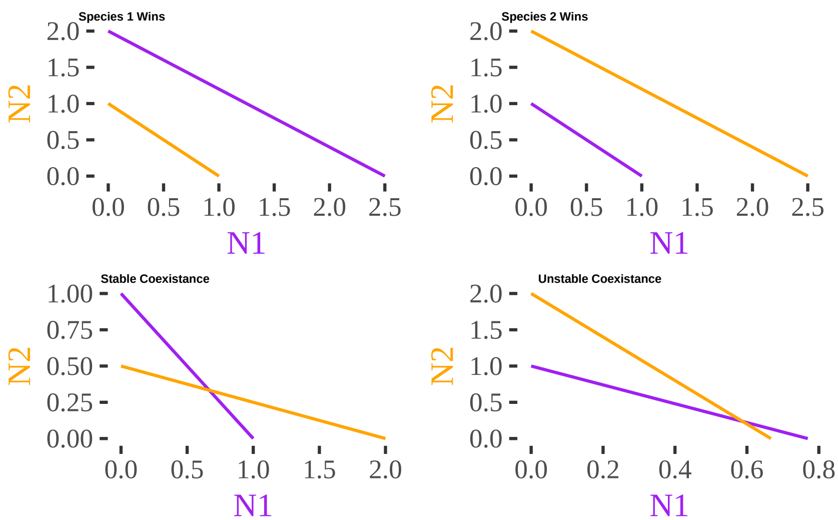

Figure 2: Four Competition Scenarios from absolute Lotka-Volterra Equations