Introduction to Theoretical Ecology Assignment 6

Graphical Analysis of Lotka-Volterra Competition Model

The Lotka-Volterra competition model can be written in terms of the carrying capacities of the two competing species N_1 and N_2:

$$\frac{dN_1}{dt} = r_1 N_1 (1 - \frac{N_1 + \alpha N_2}{K_1})$$

$$\frac{dN_2}{dt} = r_2 N_2 (1 - \frac{N_2 + \beta N_1}{K_2})$$

, where r_1 and r_2 are the intrinsic population growth rates; K_1 and K_2 are the carrying capacities; α is the effect of N_1 on the population growth of N_2; β is the effect of N_2 on the population growth of N_1.

1. Find all possible equilibrium population sizes of the two species. (5 pts)

2. Use graphical analysis to determine the stability of the system for all possible scenarios. Please (1) show the stability criteria in each scenario; (2) mark the equilibrium points (both stable and unstable) in the phase plane; and (3) denote all the intercepts between the isoclines and axes. (10 pts)