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_2 on the population growth of N_1 ; β is the effect of N_1 on the population growth of N_2 .

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