QLSC600

Ecological Dynamics

Assignment 1

<u>Examiners:</u> Prof. Guichard

Date:

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Predator-prey interactions (60 points)

The interaction between caribous and wolves is relatively simple in boreal forests because human impacts on the two species are negligible (which is not the case in tundras) and wolves have abundant alternative prey (such as moose). The following model attempts to describe this interaction:

$$\frac{dN}{dt} = \left[rN\left(1 - \frac{N}{K}\right) \right] - \left[\frac{cNP}{D+N} \right]$$

$$\frac{dP}{dt} = \left[sP\left(1 - \frac{P}{W}\right) \right]$$

where N is the population density of caribous, P is that of wolves, t is time, and all other symbols are constant positive parameters.

1. Show analytically that (0,0), (K,0) and (0,W) are equilibrium points of the model. Derive the conditions for the local stability of each of these points and discuss them. [25 points]

2. Show that the model admits other equilibrium points depending on parameter values. Determine the feasibility of these points in relation to model parameters [15 points].

3. Check the stability of these additional points using the sign of the coefficients of the Jacobian matrix. [10 points]

4. Optional: Run numerical simulations to illustrate the stability of additional equilibrium points you found in (2). For example, you can generate time series with multiple initial conditions. [bonus 5 points]

5. Provide an ecological interpretation of your results. [10 points]