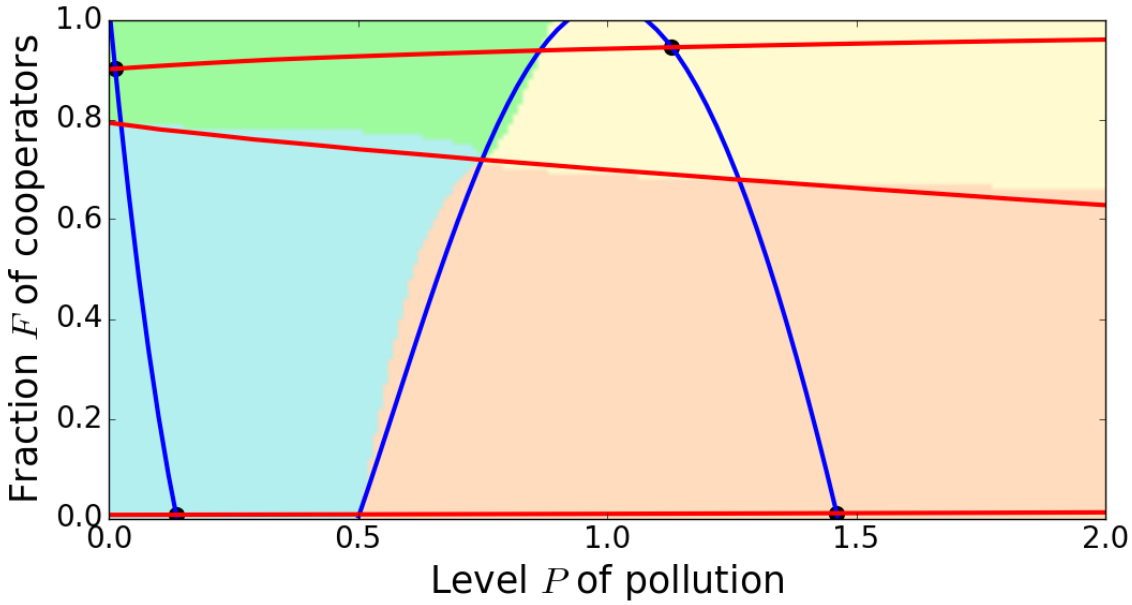
A SOCIAL-ECOLOGICAL MODEL OF LAKE POLLUTION

Project and/or thesis (BSc, Msc)



Background

Freshwater lakes can show two alternative stable states:
- one with clear water, high biodiversity and plenty of ecosystem services when the pollution is low;
- one with turbid water, low biodiversity and little ecosystem services when the pollution is high.
The level of pollution depends on the nutrient input into the environment by humans.

Modelling approach

Simple system of two ordinary differential equations (ODEs): continuous time, no space.
The ecological part is represented by the continuous dynamics of lake pollution.
The anthropogenic release of pollutants is represented as a collective choice between an individual polluting option and a “green” option. Its dynamics follows the incentive to pollute less depending on:
- a baseline, which economically favours polluting;
- the ecological concern for the lake pollution;
- the social concern for what the other humans choose.

Tasks

Mathematics: study the nullclines, equilibria, stability
Computational: (re)produce phase plane diagrams and simulations
Extension: in the incentive to pollute less, formulate the economic baseline as a function of two individual options (environmentally friendly vs. nutrient input rates)

Requirements

Knowledge of mathematical modeling with differential equations (*Gleichungsbasierte Modelle I*)

Contact

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