

Models of social-ecological systems

The example of eutrophication

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Does an environment-friendly action necessarily lead to an environmentally desirable state? The example of a social-ecological model for lake pollution dynamics allows us to discuss this intuition.

Simplifying a previous model by Suzuki and Iwasa [1], we focus on a two-dimensional model of coupled ODEs representing respectively the ecological subsystem (the lake) and a socio-economic subsystem (polluters). The phase plane shows up to 9 equilibria and up to 4 stable ones. The study of the nullclines explains their number, their stability, and when their basins of attraction disappear.

Analytical conditions for multistability are interpreted empirically, and our models also illustrate the consistency of major evolutionary game theoretical approaches of the modelling of human behaviour.

References

- [1] Y. Suzuki & Y. Iwasa, “The coupled dynamics of human socio-economic choice and lake water system”, *Ecological Research* (2009) 24: 479, doi: 10.1007/s11284-008-0548-3.