

A dynamical system for the modeling of ecosystem services provided by urban green spaces

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Robust and resilient city governance hinges on the interactions among social, economic and environmental factors. The future implications of present choices may only be explored by models capturing the complex feedbacks among the several factors that contribute to cities well-being and governance. Here we present a stylized mathematical model aimed at capturing the key links among the urban green spaces, their provision of ecosystem services and the population which benefits from them. The model variables are the percentage of green urban space able to furnish a certain ecosystem service, the quality of such ecosystem service, and the population that benefits the ecosystem services provided by green urban space. These variables are dynamically related by a set of nonlinear evolution equations that allow us to explore different forms of interactions and feedbacks. The model outcomes are compared with real situations obtained through a synthesis of extensive data from cities around the world. The influence of the various parameters and the possibility of shifts of stable solutions to periodic behavior are explored along with the role of exogenous inputs (new area acquisition or population immigration) resulting from different political and governance choices.