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## Improving Natural Resource Management: Ecological and Political Models (Statistics in Practice)

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While it is widely recognised that socio-economic systems dramatically impact ecosystems, a comprehensive approach that help us to manage these at-risk ecosystems is still being developed. This book attempts to cover this gap by introducing an "Ecosystem Management Tool" (EMT). EMT presents an empirically-calibrated multi-stakeholder political decision process and dynamics of ecosystems as a set of stochastic decision models and computes most politically-feasible environmental protection options.

Scholars studying complex socio-ecological systems highlight that there are two-way feedbacks: political and socio-economic decisions affect the state of the environment, which in turn influences individual and policy decisions. This book adds to the body of literature which tracks one-way effects of political and social decisions on the (dis)balance of ecosystems. While the author recognizes the importance of the reaction of policy-makers on the ecosystems state, this is not an explicit model component. Rather, it is assumed that

stakeholders using EMT will adjust their management plan (e.g., in participatory modelling settings).

To show the functionality and applicability of EMT, the author illustrates a case of the management of the cheetah (which is in the Red List of Threatened Species) in East Africa. The innovative aspect of the book is in presenting an approach to model the *political process explicitly* as an essential part of the environmental management. Based on information collected from various sources (as general and accessible as newspapers and news on the web site of the World Bank or BBC Africa), EMT allows us to explicitly represent various stakeholders and their decisions as drivers of model dynamics, e.g., a president, an environmental protection agency, rural residents, pastoralists and NGOs in Kenya, Tanzania and Uganda (see: [http://www4.uwm.edu/people/haas/cheetah\\_emt/inputfiles/index.html](http://www4.uwm.edu/people/haas/cheetah_emt/inputfiles/index.html)). Thus, the model accounts for culture-specific beliefs and political decision process and allows us to parameterize them accordingly.

The book is accompanied by free web-resources accessible at: [http://www4.uwm.edu/people/haas/cheetah\\_emt/](http://www4.uwm.edu/people/haas/cheetah_emt/). This includes: (i) an open-source web-based ecosystem management model; (ii) an extensive set of web-links on data and information about the African Environment and a guide how to integrate such type of information into EMT; (iii) description of the decision models of stakeholders; (iv) relevant publications. The book can be used for teaching purposes as it provides Exercises at the end of Chapters 6–12, solutions for which can be found on the website mentioned above.

Part I and Chapter 1 of the book set up the scene by introducing the problem of irreversible loss of biodiversity due to the high pressure from socio-economic system. This calls for a change in human belief systems and consequently in behaviour to assure sustainable ecosystem management. Chapter 2 describes the modelling approach based on influence diagrams (IDs), which "constitutes an approach to the modelling of an agent that is similar to an empirically calibrated agent-based simulation model". While the book emphasises the importance of computational models of social interaction and of reflection of power relationships between agents in policy models, a

decent literature review on existing agent-based models (ABMs) for environmental management is absent. From the point of view of a JASSS reader, this is a drawback of the book, since it is not connected to the existing body of literature on environmental ABMs and individual based models. The book proceeds with the description of the case of whale population management and modelling of political-ecological system in developed countries (Chapter 3). Chapter 4 reviews methods for developing an ecosystem management plan and optimization procedure to compute the "most practical ecosystem management plan". Chapter 5 provides an overview of the EMT software components, including the description of IDs used to represent stakeholders in the political decision process.

Chapter 6 in Part II first, reviews the models of political decision-making and then tries to synthesize rational actor models and mental models coming from descriptive approaches within the EMT framework. The discussion about group memory and changes in group perceptions through time is of great interest for a scientist doing social simulation. However, it is disconnected from the ample literature on ABMs studying these issues. Chapter 7 describes the construction of IDs of stakeholders in the case-study area, while Chapter 8 proceeds with IDs for wildlife population. The classifications of political action are discussed in Chapter 9. Chapter 10 deals with wildlife monitoring and Chapter 11 shows the statistical fitting of political and ecological data in the model. Validity of EMT results is discussed in Chapter 12. The latter three chapters focus on various statistical techniques (i.e., data analysis, ways of model calibration and statistical tests for validity and sensitivity), which is the author's main specialization. The statistical methods for the calibration of agent decisions models with empirical data and for the analysis of simulated data may be of special interest for ABM modellers.

Chapter 13 in Part III summarizes the capabilities and drawbacks of EMT. The most relevant aspect for social-simulation scientists is to know that stakeholders IDs do not learn as they interact with each other or with the ecosystem. This is an important drawback from the ABM perspective, which focuses on individual/social learning and adaptation.

The task of modelling the political process of environmental management coupled with the effects, which simulated policies incur on ecosystems, is dramatically challenging. Certainly, the stochastic statistical approach to model dynamics of ecosystems and environmental policy decisions with the explicit separation of involved actors into various influential groups is a step forward. However, here, some elements which are essential for social simulation are missing. Specifically, it is worth mentioning learning via interaction and adaptation, which unfortunately are out of the author's radar screen here. EMT may benefit from the functionalities of ABMs, which have proved to be successful in representing such processes. Moreover, the book presents stakeholders as an aggregated group rather than a collection of interacting individuals in a group. However, interaction between members of a group (e.g., pastoralists or rural residents) can give rise to new strategies of using environmental resources and so to emergent behaviour of the whole group, as ABM studies on environmental management have shown.

This said, I acknowledge that the goal that stands behind this book was very challenging and that the EMT model can represent a good starting point.

