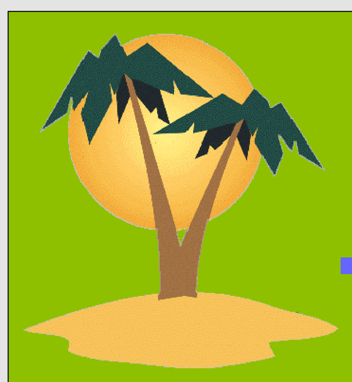

Too Much Forest – Too Little Coconuts

Modeling Change in Local Socio-Ecological-Systems

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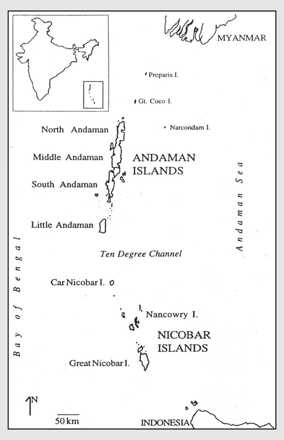
Introduction

Change is an intrinsic feature of socio-ecological-systems Understanding change in socio-ecological-systems requires an approach able to include theories and data of different disciplines. This poster describes two modeling projects dealing with changes in local socio-ecological systems. In both projects models of the socio-ecological system are constructed with the aim to help the stakeholders navigate their system in a desired and sustainable future.

The presented models belong to a new type of model that can deal with local situations and aim to integrate biophysical issues (e.g., land use) with socio-economic factors (see also **Linking agent-based models with stock and flow models)**



The Nicobar Islands

The Nicobar Archipelago is situated south of the better known Andaman Islands in the Bay of Bengal and belongs to India. The indigenous people of the Islands are protected by Indian laws, which strongly regulate the access to the Islands. The Islanders made there living from fishing, gathering of NTFP, animal husbandry (hens and pigs –mainly used for ritual purposes) and coconuts, which are exported as copra. Rice is imported (Singh 2003) .

The Islands are rich in endemic species and the fringing reefs surrounding them are the most biodivers in the whole region.

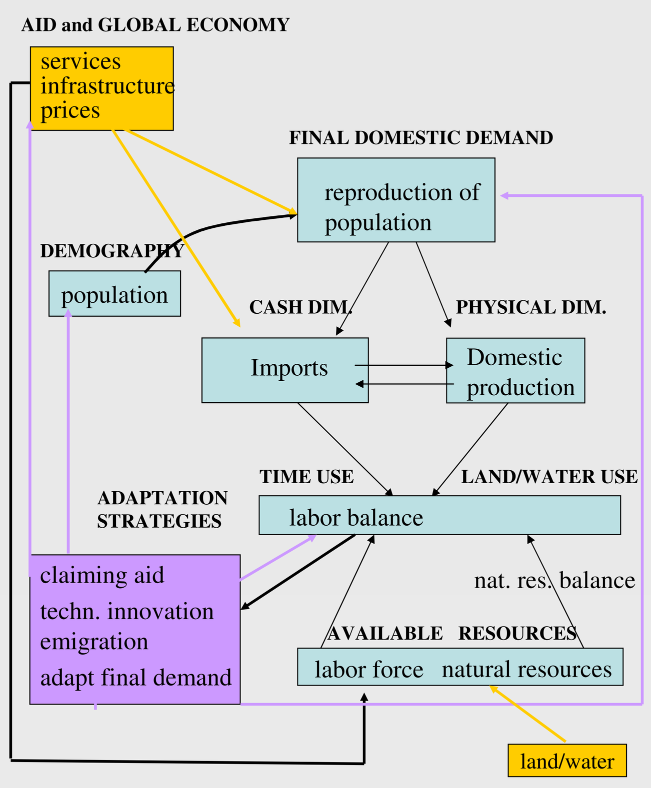
System shifts occurring

The islands were devastated by the 2004 Tsunami. Despite the destructions caused by the Tsunami waves, the transition processes on the Islands from a traditional to a money-based society was busted through the different relief efforts funded from governmental agencies and NGOs in the aftermath of the Tsunami.

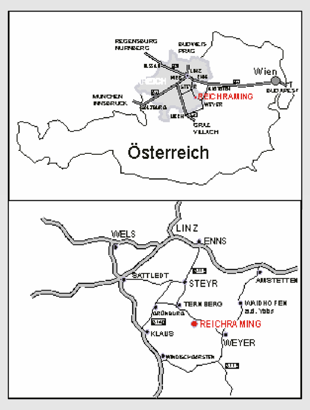
The Model

The model will provide assistance in finding development paths that are most likely to meat the following goals: (1) Maintenance of socio-cultural integrity and self-determination (collective empowerment). (2) Revival and maintenance of basic livelihood and well-being. (3) Allow or contribute to the regeneration of the archipelago's terrestrial and aquatic ecosystem and minimize pressures upon them.

The simulation model can be used to find the links between the three goals, to test and to discuss different development paths by integrating different views during the development process of the model and with the finished model itself It is planed to implement a gaming approach, where the "software-agents" are replaced by the real world actors "playing" with the model.



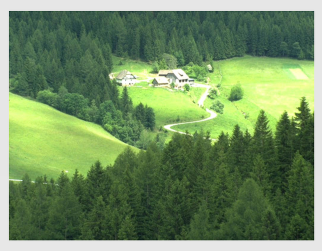
Basic Structure and components of the "Nicobars People Model" NPM

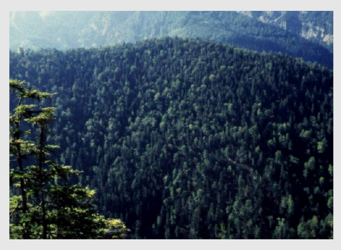


Reichraming

Reichraming is a small village with about 2000 inhabitants in the Eisenwurzen Region of Upper Austria. Forests cover at least 80% of the area of Reichraming. Agriculture is almost exclusively based on extensive cattle rearing and suffers of low incomes. Commuting to regional centers such as Steyr and Linz accounts for a significant proportion of gainful employment.

A big portion of the Reichraming area lies in the "Eisenwurzen National Park" hosting Austria's largest coherent forest and one of the few unmodified watersheds of the Alps.





System shifts occurring

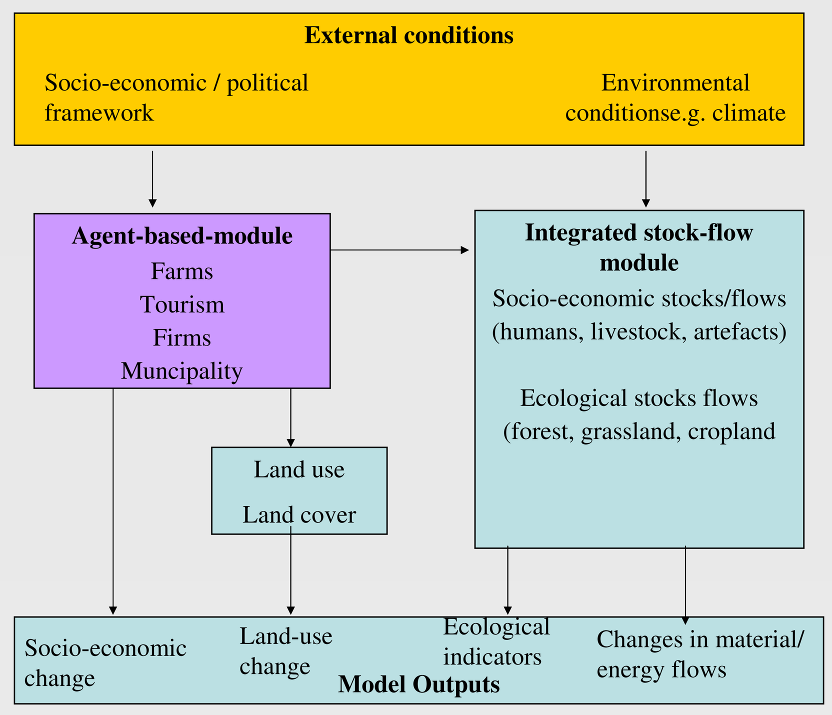
With the end of wood-demanding industries in the region and with more and more farmers capitulating a massive reforestation resulted which is today perceived as an important challenge for a continuation of human habitation of the region.

The Model

The model should be able to simulate the effects of changes in the income of farmers, working times, and land-use on the social, economic and ecological material-flows and a set of ecological indicators. The model will integrate an agent based actors model with a material flow model simulating the carbon and nitrogen flows.

The model should be able to reconstruct the historical and simulate the future development of the region

The model will be developed in a participative way and be used as a decision aid tool by the local and regional actors. For the construction of the decision structure of the SERD Agents see Partizip A Poster.



Basic structure and components of the Reichraming model "Simulation of Ecological Compatibility of Regional Development " (SERD)

Research Questions

Theory

How can biophysical processes be connected to communicative-social processes?

How do changes in the socio-economic system translate to the natural systems and vice versa?

Can the resilience (Gunderson et al 2002) of socio-ecological systems be measured / are there indicators?

Application

How can the understanding of these processes contribute to a successful conservation of bio-(and cultural-) diversity?

How can models of socio-ecological systems be used in conservation issues?

Methodology

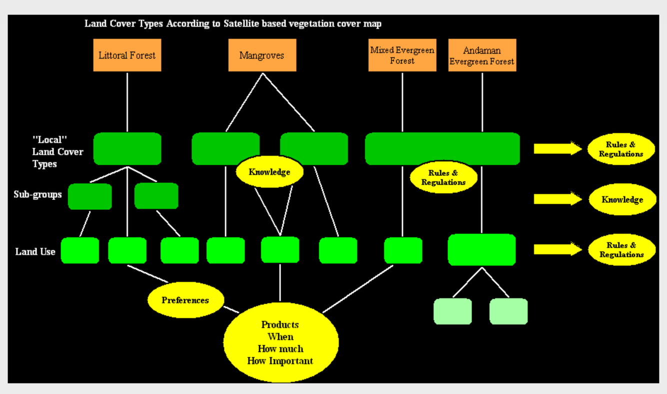
How can hard data be integrated with "soft data" in a meaningful way?

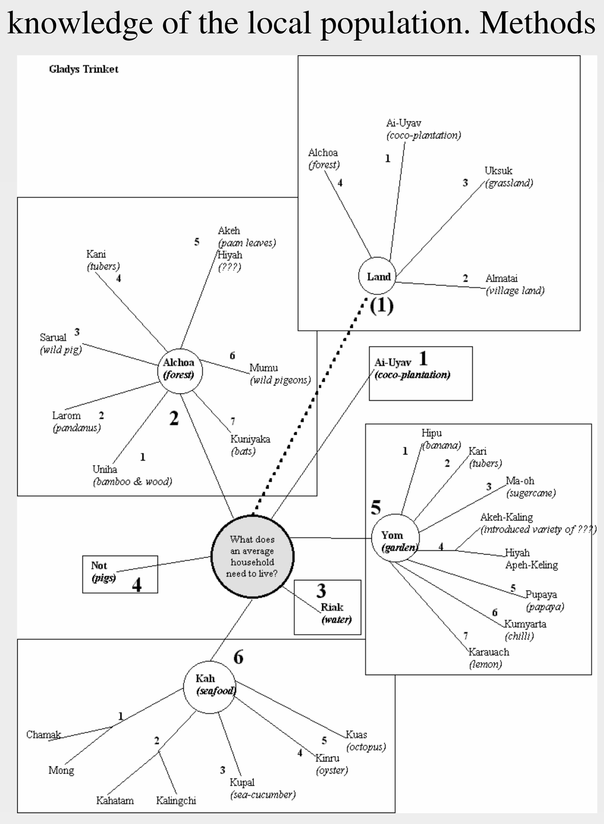
How can structural / qualitative changes in ecosystems e.g. changes in biodiversity, species abundances be integrated in the models?

The social system

Participative data collection

When modeling local socio-ecological systems "soft data" like preferences, perceptions, values, religious believes etc., are very important. In most cases it is also helpful to access the traditional knowledge of the local population. Methods like participative mapping or spidergrams are quite suitable for natural resource issues (Lyann et al 2002).

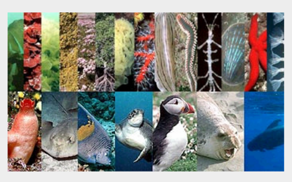




Spidergram showing the weighted needs of a household on Trinket Island

Participative modeling

The actors themselves whose behavior is represented in the model and who are supposed to later use the models for decision-making and strategic planning, participate and contribute to the modeling process. This guarantees that the model captures issues that are of relevance to the actors involved. This way of modeling can be seen as rout to build dialog and a means for a co-production of knowledge and social learning rather than a means to develop a predictive forecast (Pahl-Wostl 2001)

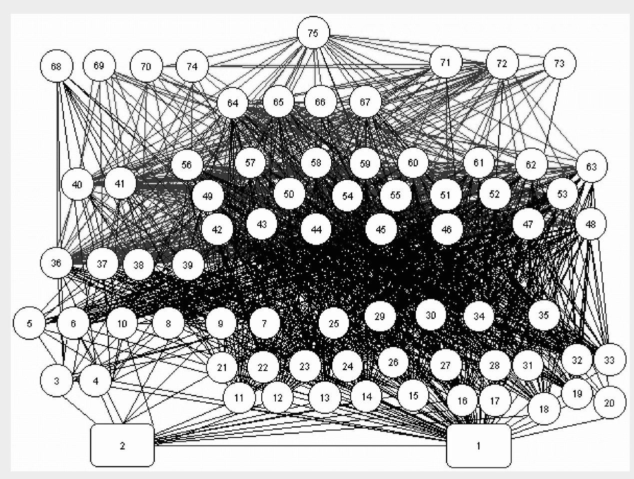


The natural system

Ecosystems possess intriguing structural qualities, such as hierarchy, scale, nesting, dissipative structures, and autocatalytic design (Abel et al 2003). Focusing only on material & energy flows is not sufficient when complex issues like diversity, resilience or functional aspects (ecosystem services) are addressed. Structural information i.e. landscape composition, design of food webs, cross scale interactions also have to considered.

Degradation of natural systems

In a situation of transition people may use there ecosystems in a new way. They may not have institutions regulating these new uses and have limited knowledge about the impacts on the system. (Bennet et al 2005). Addressing this issues requires not only modeling the changes in stock and flows but also shifts in species harvested (due to changes in gear & traditions), changes in seasonality or place of harvest and the effects on other species i.e. of high conservation value (i.e. dungeon) (Christensen 2004).



Food Web denoting Species interactions for the Northwest Atlantic (FWDP 2006)

Conclusion and Outlook

- Both, social and ecological systems need to be considered when planning sustainable resource use or conservation measures.
- In a local setting participation can be crucial for the success of a project.
- Especially when models are designed to be used as decision aid educational or planning tools it is important to involve the future users as soon as possible in the modelling process.
- Find the right scale of complexity for the model parts representing the ecological respectively the social systems.
- Find a feasible ways to address biodiversity in the models.
- Address issues of interaction between actors in transition process.

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