

Impacts of subsidy policy on farmer households, land use and nutrient flows at regional level



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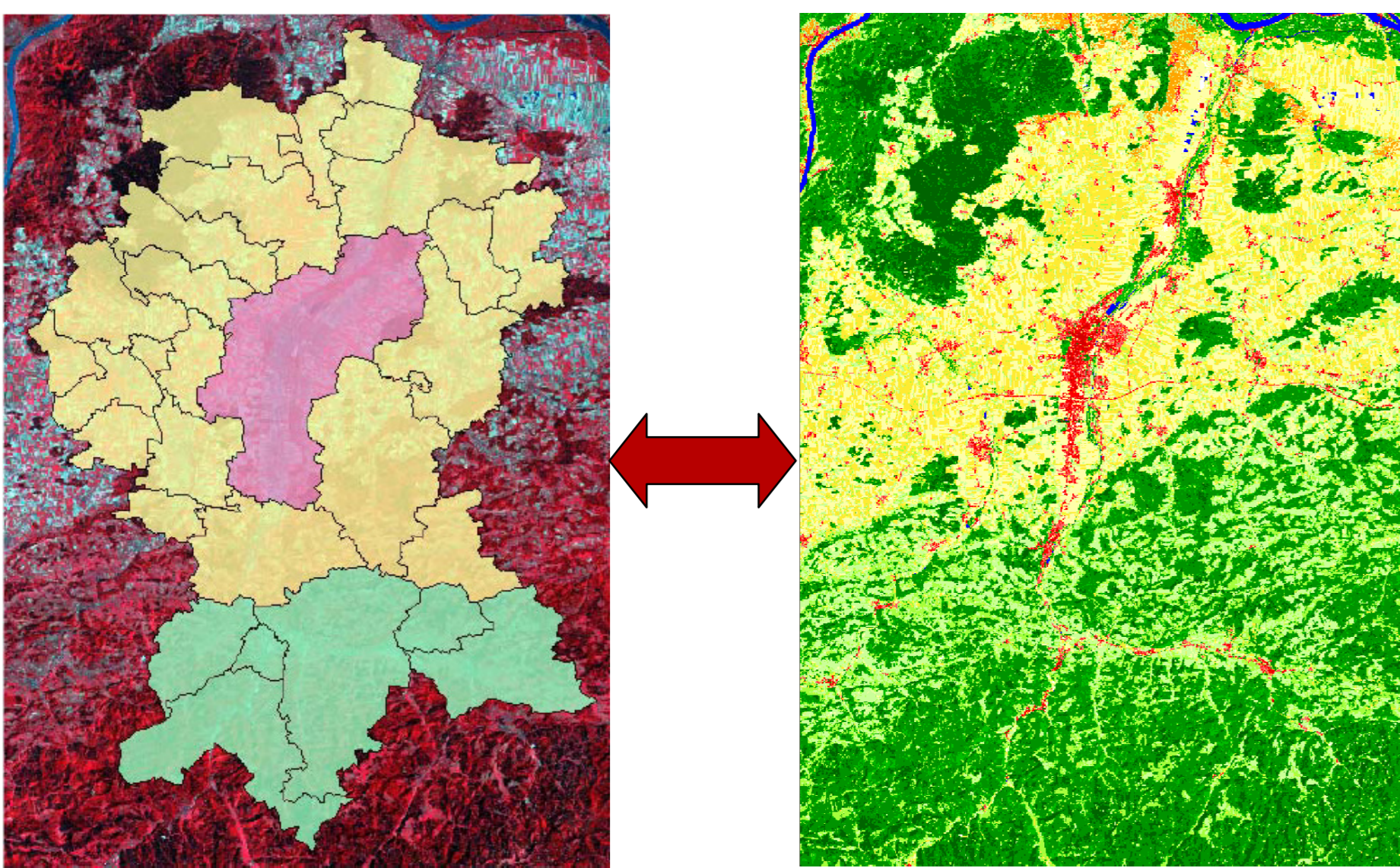
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Introduction

Existing scientific models mostly reflect theories and concepts developed within single disciplines. They usually focus on either ecological, social or economic aspects. The concept of social-ecological systems (Fischer-Kowalski und Weisz 1999) integrates all three aspects. Thus, to analyse socio-ecological systems and impacts of external drivers on these systems, approaches of different disciplines are needed. Modelling provides the possibility to integrate social-science based approaches with concepts from the natural sciences (van der Leeuw 2004). The presented model belongs to this new type of models that can deal with local situations and aim to integrate biophysical issues (e.g., land use) with socio-economic factors.

The region

The model was applied for a case study in a rural region in Lower Austria (the Traisen valley). This agrarian dominated region represents a broad variety of different farming production types, typical for Austria's agricultural system.



From satellite data to land-cover maps: The region under study 'St.Pölten Umland' (about 80.000ha) is characterised by diverse land use

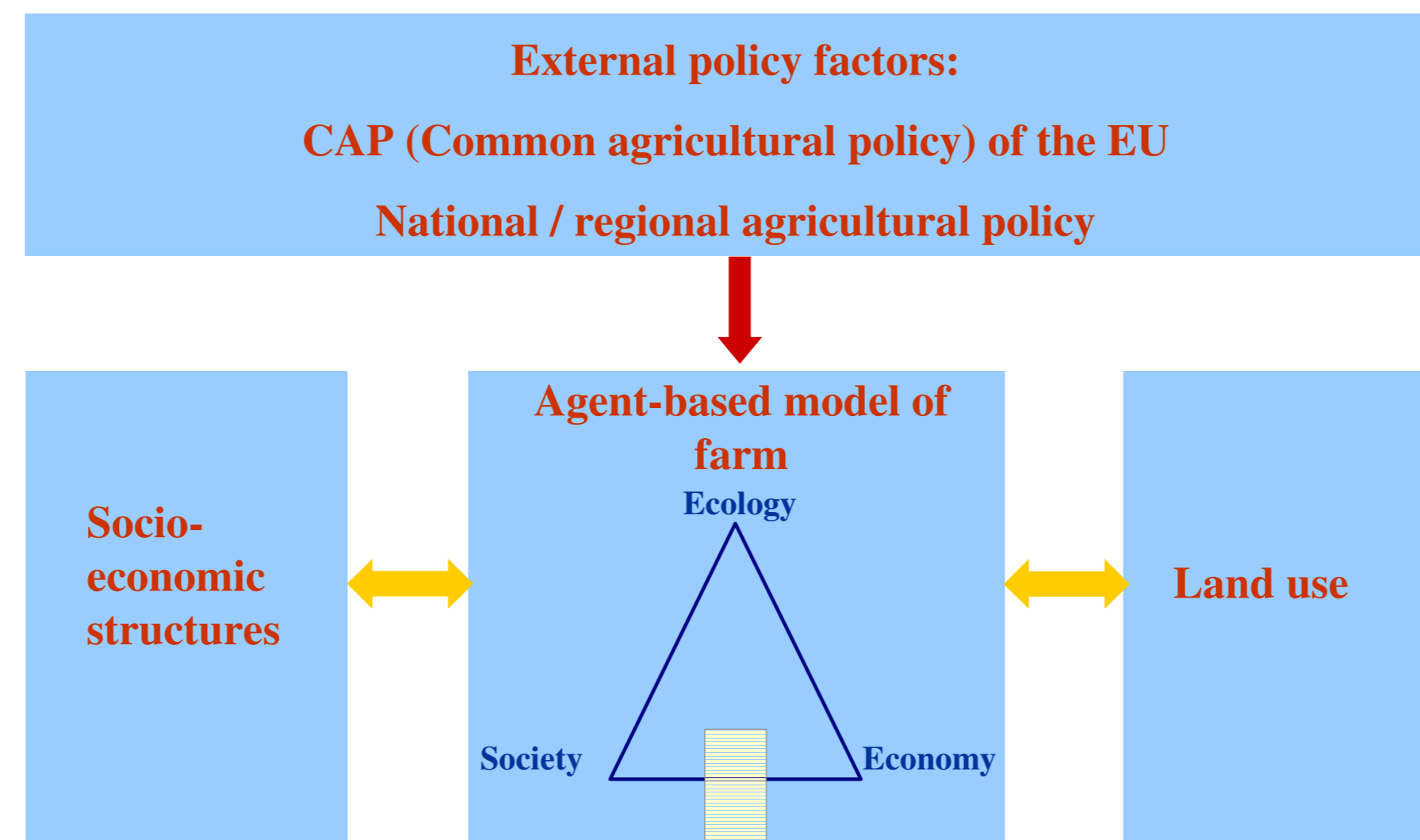
The region is confronted with numerous environmental and social problems, such as accelerated structural change and a high dependency on subsidy payments, mainly regulated on a supranational level (European Union). Currently, the EU's Common Agricultural Policy (CAP) shifts from coupled to decoupled transfer payments. Thus, the CAP Reform sets incentives for farmers to allocate resources according to market demand and prevailing natural conditions.

Our research questions were:

- What are the main effects of the CAP reform 2006 on the socio-economic and ecological situation of agriculture in the region?
- What are the influences of changes in subsidies on land use?
- How do political interventions affect the type of agricultural production, farm income and family working time?
- Do effects of policy reforms differ between women and men?
- What are possibilities and constraints of participatory model building?

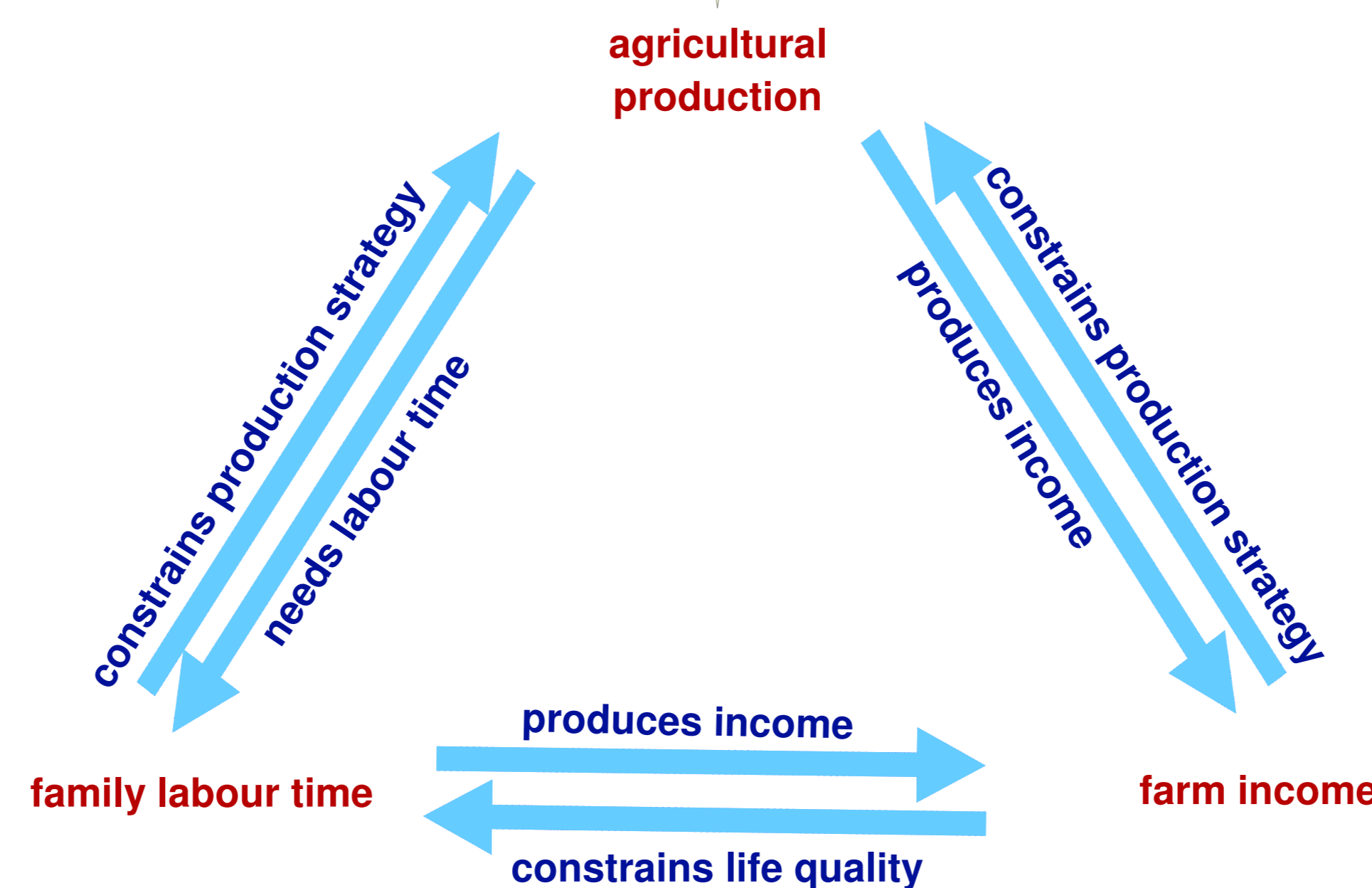
The model concept

The model combines an agent-based module used to simulate farm households with a system dynamic module that simulates changes in land use and accordingly subsistence flows such as nitrogen flows. Thus, the model as a whole allows to simulate changes in socio-economic structures such as income and workload of farmsteads as well as land use. Dynamics of the model are driven by assumptions on changes in the external conditions of agricultural policy on different levels.



Agent-based models enable a formalized representation of social systems and consists of single virtual agents and their environment. Agents interact with both, other agents and their environment. Agents have a certain knowledge of the system they belong to (Ferber 1999). The behaviour of the agents is affected by the system they are part of and by changes of their environment. Simultaneously, the behaviour of the whole system depends on the individual behaviour of each agent. In our model only one type of agents exist – farmsteads. The model analyses the decision-finding process of each farm along a 'sustainability triangle' in which each corner represents one of the core sustainability corners (social / ecological / economic dimension). To apply this so called 'magic triangle of sustainability' (Fischer-Kowalski 1997) for farms, the three dimension are:

1. Agricultural production, such as land use and livestock (ecological dimension)
2. Income of all family members, living on the farm (economic dimension)
3. Family labour time (social dimension)



The interactions between the three corners can be described as follows:

1. Land use and time use: Every strategy of using land requires a specific amount of working hours. According to the number of people living on a farm only a certain amount of working hours is available.
2. Land use and income: Each square meter and each agricultural activity needs and creates a certain amount of income.
3. Time use and income: Time used as working time determines the amount of income. In turn, income constraints activities in leisure time or requires working time.

The analysis of decision-making within this triangle requires to implement each agent with its internal structure in terms of family structure such as family members living on the farm, their age, task on the farm (i.e. agricultural working time), etc. Single farms of different production types are implemented as agents, that are influenced by changes of their environment. Consequently, they change their production strategy in terms of intensification or try to reduce or extent their possession of land by interacting with their neighbours via a regional rental land market.

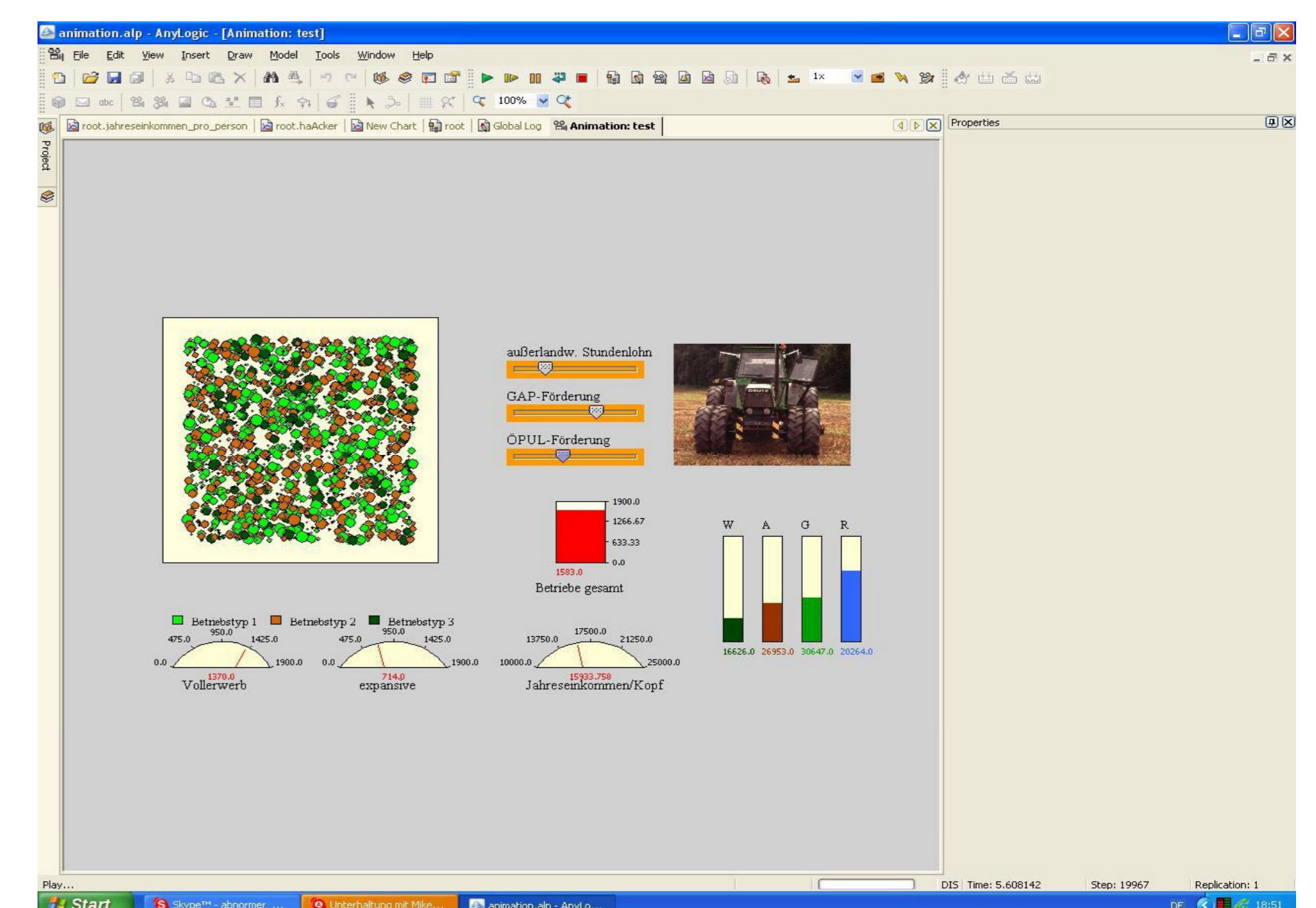
Implemented possible reactions of the farms

The model can assess mid and long-term effects induced by assumptions on changes in the external conditions. Implemented possible reactions on the changing framework include:

- Intensification and technological innovation of production
- Increase of farm size and decrease of number of farms in the region
- Diversification of production
- Increase of non-agricultural labour time
- Abandonment of farms...

Models in participatory processes

Right from the beginning, relevant regional actors (farmers as well as politicians) were involved in the modelling process. Interviews, focus groups and workshops allowed to discuss research questions, model assumptions and model design.



Surface of the agent-based model (AnyLogic)

In this context, the use of the modelling software AnyLogic, programmed in Java, provides an appropriate illustrated surface that allows to use this tool in participatory processes.

Conclusions

- CAP 2006 reinforces the current trends of structural change in agriculture. National subsidy programmes try to mitigate these CAP effects.
- Current trends include an intensification of agricultural production, increasing work loads and decreasing agricultural incomes.
- Only few farms manage to survive as full-time farmers in the study region.
- Promising strategies of farmers to mitigate these trends are co-operation between farmers and improved marketing of local products.
- The CAP reform influences the social structure, changing the everyday life of all family members dependent on their age and gender.
- The model allows to analyse socio-ecological systems on a local scale, thus exploring how elements of socio-ecological systems are interrelated.
- The model helps researchers and stakeholders to develop and evaluate strategies for a more sustainable regional development.

Literature:

- Ferber, J. 1999, "Agent and Society," in *Multi-Agent Systems: An Introduction To Distributed Artificial Intelligence*. Addison Wesley, Harlow, England, pp. 8-24.
- Fischer-Kowalski, M., Haberl, H., Hüttler, W., Payer, H., Schandl, H., Winiwarter, V., & Zangerl-Weisz, H. 1997, *Gesellschaftlicher Stoffwechsel und Kolonisierung von Natur. Ein Versuch in Sozialer Ökologie* Gordon & Breach Fakultas, Amsterdam.
- Fischer-Kowalski, M. & Weisz, H. 1999, "Society as Hybrid Between Material and Symbolic Realms. Toward a Theoretical Framework of Society-Nature Interaction", *Advances in Human Ecology*, vol. 8, pp. 215-251.
- van der Leeuw, S. E. 2004, "Why Model?", *Cybernetics and Systems*, vol. 35, no. 2-3, pp. 117-128.

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