

Integrated Spatial Modelling – Calculating Economic and Ecological Indicators within GIS



Introduction

Due to the fact that when implementing any spatial planning process one must know whether a decision will have the expected outcome or not, it is wise to use relevant indicators, which should display the resulting effects. This was done by using a set of billable indicators for the economic and the ecological issues relevant to the households evaluated in the study area.

These indicators are mostly - but not all - specific to the area. Hence, a combined method of calculation is used for the spatial indicators within GIS (Geographical Information System), and a spreadsheet-calculator for the non-spatial indicators. The resulting model has three main parts.

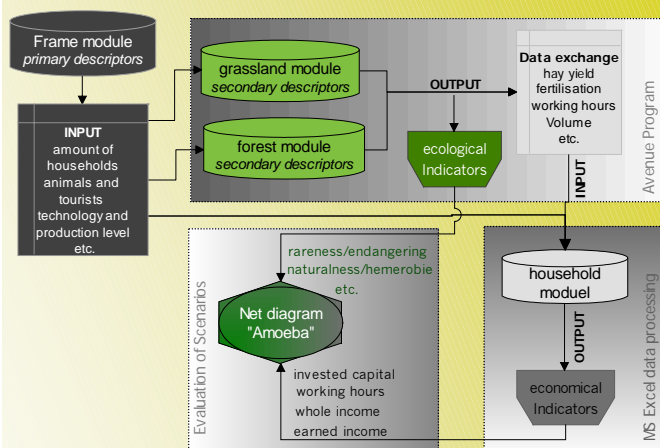
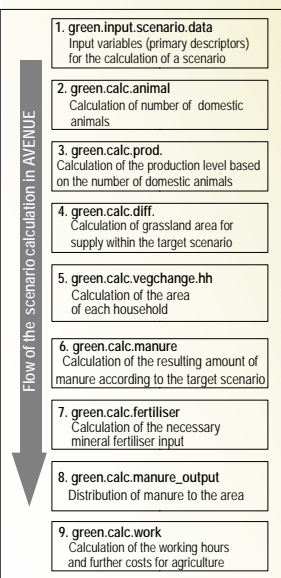


Fig. 1: Data-Flow within the non-spatial and spatial components

Methods for the development of model-based scenarios

The three main parts of the model are:

- Household module
- Forest module
- Grassland module with the integrated calculation of the land use suitability potential



A set of data that varies within the possible scenarios has to be entered as input. This data is processed for the main components (forest, grassland). Every module within the model calculates the sectoral indicators, which combined provide an estimation of the characteristics of the whole indicator set.

The main parts of the model were programmed using AVENUE, the programming language of ArcView. Fig 2. Features an example of this calculation process from the grassland module.

The processing of the economic data in the household module is carried out externally using MS Excel.

Fig. 2: Example of the AVENUE programme flow within ArcView, illustrated using the grassland module

The land use suitability is determined using EMDS (Fig. 3), a freely available SDSS-extension for ArcView, developed by the USDA Forest Service (REYNOLDS et al. 1999).

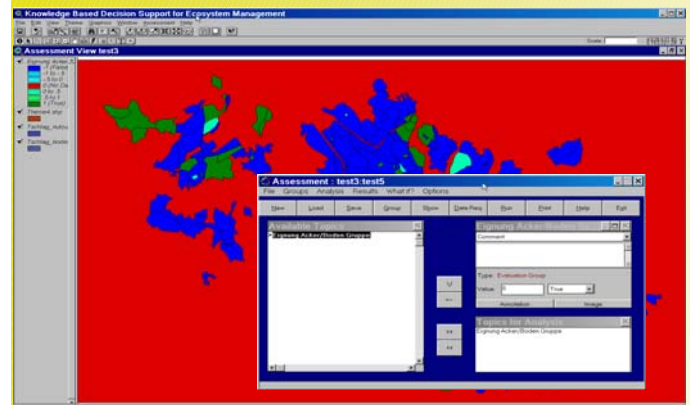


Fig. 3: Calculating the potential for different land use capabilities with a fuzzy-logic based spatial decision support system (SDSS) integrated into ArcView (REYNOLDS et al. 1999).

Results and Discussion

The future development trends and scenarios in the Apuseni Mountains were defined in a multidisciplinary discussion. For the provisional evaluation of the different scenarios, a set of ten indicators was depicted as an amoeba diagram.

The amoeba approach is a multidimensional graphic representation of the interaction between humans and the environment (WEFERING et al. 2000), suitable for the analysis of links between the various indicators and the involvement of various stakeholders in the process of integrated assessment.

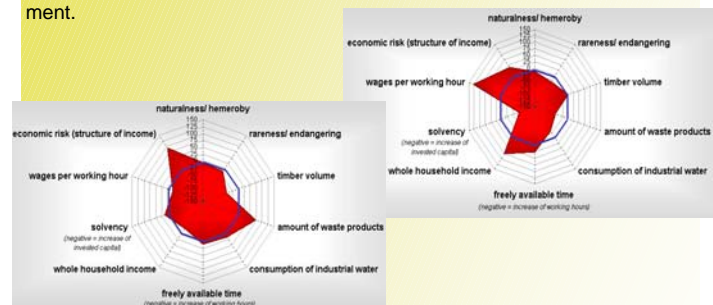


Fig. 4: Example for the indicator results of two scenario types depicted as an amoeba diagram. Left amoeba "Evolutio": EU membership in the year 2017, sustainable development in forestry, agriculture and tourism- right amoeba "Traditio": none EU accession in the year 2017, traditional way of production

As an approach involving the merging of non-spatial data with spatial data was used, a mixed method calculating the sectoral indicators was chosen. Therefore, problems in relation to data integrity and redundancy have to be taken into consideration.

The flexible calculation of the indicators makes it possible to start participative planning processes and to provide rough estimations as to what the certain planning decisions will yield.

References

REYNOLDS, KEITH M. (1999): *EMDS Users Guide (Version 2.0): Knowledge-based Decision Support for Ecological Assessment*. Gen. Tech. Rep. PNW-GTR-XX. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 63 S.

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