

The influence of land use changes on the floristic composition of grasslands in the Apuseni Mountains, Romania

Introduction

A traditional land use system in the Apuseni Mountains, Romania, and its potential for sustainable development, is currently being investigated in an **interdisciplinary research project** [PROJECT APUSENI] co-ordinated by the University of Freiburg. The University of Agriculture Sciences in Cluj-Napoca is also involved, together with a number of other German and Romanian partners. The study focuses on mountain villages where people continue to live principally from subsistence production, animal husbandry, forest use and wood processing.

The **hay meadows** are fertilised with manure and harvested using a scythe, following a traditional method, once or twice a year, according to the distance of the settlement.



Spreading manure in spring with sledge and fork

Hay making in summer with scythe and hay rake

These extensively used meadows have a remarkably rich species diversity and high numbers of rare plants. The grasslands are of secondary origin, with low productivity and inferior forage quality. The poor quality of the forage is due to missing or low fertilisation only with manure. The grasslands are formed by many species with low protein contents (reduced percentage of fodder grasses and legumes), and large numbers of sclerophyllous grasses (*Festuca*, *Nardus*) and plants from other botanical families.

The **central aims** of the grassland studies of the project are:

- **Situation analysis** of the traditional land use techniques in agriculture.
- Problem orientated **experimental research** to analyse the effect of different fertilisation regimes on yields, the sward quality of the meadows and the botanical composition.
- **Evaluation** of the value to nature conservation (e.g. biodiversity, naturalness) and the site related yield potential for the different grassland types, using data from terrestrial surveys (dry matter production, botanical composition, etc.) and GIS-techniques.
- **Development of scenarios** relating to the future development of mountain grassland under varying economic and political conditions and constraints. This modelling process will be done using the "grassland module", one element of an integrated landscape model being applied in the overall project context.
- **Development of strategies** and methods for **sustainable management** and fertilisation techniques through interdisciplinary and participatory processes.

Study area and situation analysis

The **study area** is situated in the mountain village of Ghejari, in the central part of the Apuseni Mountains, at an altitude of 1150 m. The climate in Ghejari is montane with a mean annual temperature of ca. 5°C, and mean annual precipitation of 1 200 mm. Periodically wet to moderately moist, fertilised sites generally consist of hay meadows of the class Molinio-Arrhenatheretea, and produce between 25 and 40 dt/ha hay during a growing season. Moderately dry, unfertilised soils on limestone are mostly grazed and are classified as Festuco-Brometea. Moderately acidic, unfertilised soils are meadows or grazing land of the Nardo-Callunetea.

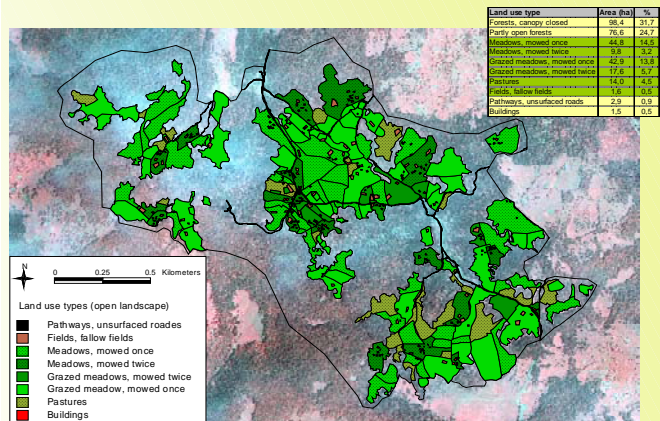


Fig. 1: Land use types of the open landscapes in the study area, the Ghejari village with a surrounding area of 306 ha.

The first part of the study is defined as a **situation analysis**, including the investigation of the floristic composition and yield potential of different grassland types (Fig.2). The description of the traditional land use techniques in agriculture and the parcellary land-use mapping is shown in Fig. 1.

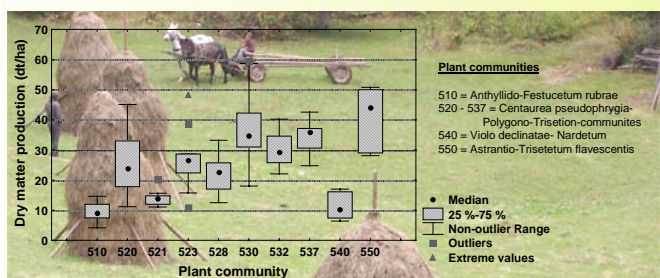
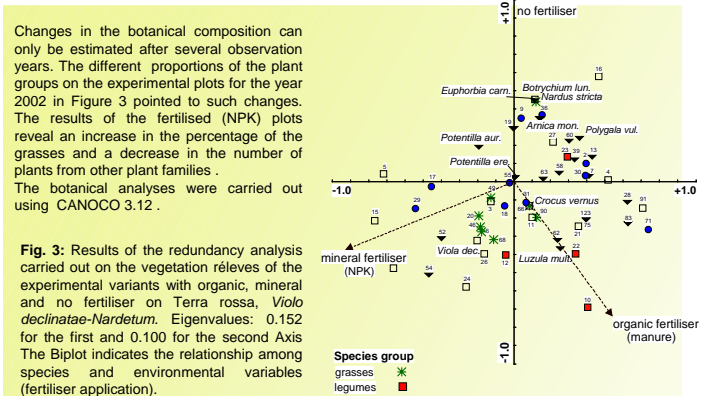


Fig.2: Yearly dry matter production (dt/ha) for the most common plant communities of grassland in the study area

Experimental Research

Three **fertiliser experiments** based on a design with different intensities of mineral and organic fertiliser were established to analyse the effects of different fertilisation regimes on yield and the botanical composition. The experiments were carried out on a permanent plot design with four observation periods.

The results of the experimental research lay the foundations for the development of land use scenarios and strategies for sustainable management techniques in agriculture.



Evaluation and development of scenarios

The second part of the study deals with the **identification of indicators and the evaluation** of grassland use in terms of nature conservation and economics. The value to nature conservation was based upon the criteria of naturalness/hemeroby, and of rareness/endangerment. Important economic indicators are the site related yield potential of the different grassland types and the working time. Additionally, the suitability of agricultural use to specific sites is evaluated and mapped.

The results of the situation analysis and the evaluation lay the foundation for the creation of **model based scenarios** relating to the future development alternatives for mountain grasslands under varying economic and political conditions and constraints. This modelling process is an component of an integrated landscape model, developed in interdisciplinary cooperation and being applied in the overall project context of the PROJECT APUSENI.

For the evaluation of the different scenario results, a set of ten economic and ecological indicators are depicted as an amoeba diagram, which is a multidimensional graph representation of the interaction between humans and environment [1].

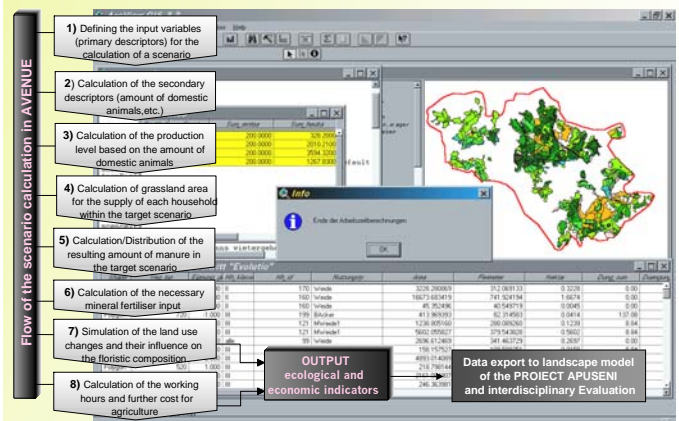


Fig. 4: Spatial modelling of land use scenarios for agriculture within a Geographical Information System

References:

- [1] Rusdea, E., Reif, A., Povara, I. & Konold, W. (Hrsg) (2004): Perspektiven für eine traditionelle Kulturlandschaft in Osteuropa. Ergebnisse eines inter- und transdisziplinären Forschungsprojektes in Osteuropa. Culterra 34, in print