

THE OPTIMAL STRATEGY TO IMPROVE FOOD CHAIN ELEMENT CYCLES - DEVELOPMENT OF AN INTERNET BASED SOIL BONITATION SYSTEM POWERED BY A GIS OF 1:10 000 SOIL TYPE MAPS

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Introduction

Improper use of land resources and suboptimal economical consideration of profitability of agronomy lead to unsustainable production. The strategic approach resulting in improved food chain element cycles is based on proper use of land resources. Physical conditions of land as well as economical conditions determine the optimal use of every field.

The problems arising from the use of the only legally established Hungarian soil bonitation number, (that is land quality index used for state taxation, land exchange, appropriation, subsidy calculation etc.) the Gold Crown ("Aranykorona", or AK) are numerous. After more than one hundred years' use of this there is need for an improved index which could not only substitute the AK, but provide the basis of a complex set of land management operations for securing sustainable production possible all over the European Union. Therefore, after a project intended for developing an algorithm for a scientifically based parameter of soil quality (D-e-Meter) (Gaál et al., 2003) a new project started to develop a contemporary method for the assessment of land value.

Methods

The previous project developed an internet-based soil quality index which is based on the statistical interpretation of the "AIIR" soil and yield database collected in the years between 1980 and 1985 from the field records kept at the farms. These data were collected from 60 000 fields covering yearly 4 000 000 ha.

The „D-e-Meter” soil quality index for croplands is based on the statistical average of the yield of specific crops of the individual soil subtypes. The calculation of the soil quality index is further facilitated by other factors, such as soil acidity, soil textural class, soil Organic Matter etc.

Results and discussion

In the frame of the present project „Land quality, land value and sustainable land use in the European Union” we develop indices similar to the D-e-Meter index, but now for forests and grasslands as well. The main topic of the project is the development of an economic index which incorporates not only the land quality index, but also its economical value.

The basis of the calculations is the Geographical Information System (GIS) of soil resources linked to a database (Vass et al., 2003). The database provisional unit of the internet-based system contains continuously updated data of each field on soil cultivation, soil improvement, events resulting in yield loss (drought, wild animals, etc.), fertilization, and plant protection. In the GIS the field is identified at the level of cadastral unit of land registry, genetic soil map unit and farmer as well.

Important steps of the new project were the compilation of the schemes for the calculation of soil quality indices for forest soils (Fig. 1.) and grassland soils (Fig. 2.). Both indices are based on the productivity of the land and respect the traditions of forestry and animal husbandry, respectively. In the case of forestry a favorable condition is the existence of a large database on yearly forest tree stock growth with detailed soil description (Bidló et al., 2003). There are less data available on the grasslands due the limited economic importance at the moment of the grasslands. In this case the most important production indicator is carrying capacity (Dér et al., 2003).

The calculation of land value index is based on the soil quality index of the individual field (Fig. 3.). Here the range of producible crops is an important factor.

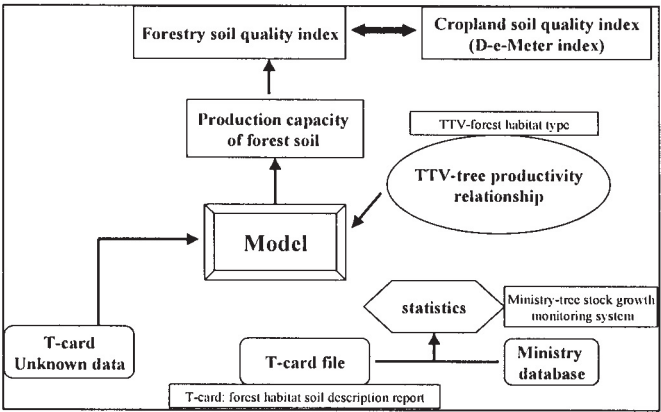


Figure 1. Calculation scheme of soil quality for forest soils

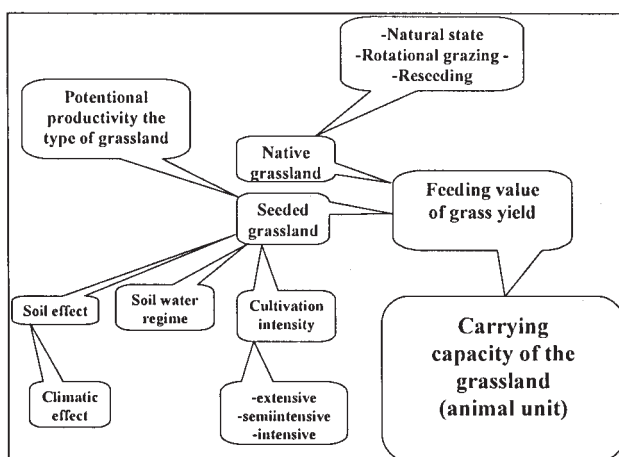


Figure 2. Calculation scheme of soil quality index for grassland soils

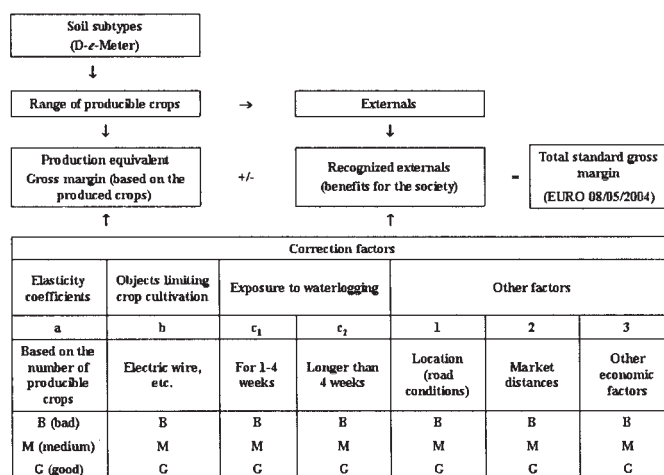


Fig. 3. Calculation of land value index

Conclusions

The system is unique in its capability of providing up-to-date index of soil quality and land value based on a GIS. The geographical information is provided by national map databases on genetic soil maps at the scale of 1:10 000. The automatic algorithms are easy to update, can be made legally bond and provide a transparent system of land taxation, calculation of subsidies, appropriation. This way a multifunctional system will be available that promotes an optimum use of land resources that is very favourable for the maintenance of beneficial food chain element cycles.

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