REALIZING THE CONNECTION BETWEEN MINIMIZING SOIL EROSION AND OPTIMIZING BIODIVERSITY

H. Muehle and B. Ch. Meyer
UFZ Centre for Environmental Research Leipzig-Halle, Dept. of Conservation Biology, Grabaum, R., OLANIS Expertensysteme GmbH Leipzig

Abstract
In a landscape, which is poor in structural elements such as hedges, small woods, edges, and fruit tree alleys, the project "IUMBO" (Integrative Realization of Method of Multicriteria Landscape Assessment and Optimization at Querfurt Region) – running from autumn 2002 to springtime 2006 - is in progress. The aim of this project is to increase biodiversity, and to minimize soil erosion in an intensively used landscape like the "Querfurter Platte". It is carried out within an area of nearly 4.2 ha belonging to the project partner "Agrarunternehmen Barnstädt".
The aims of the partners are:

- Providing the area with more structural elements (hedges, fruit tree alleys, water protection stripes, grass balks, hamster protection stripes);
- Assessment and prediction of target species occurrence and their dynamics;
- Integration of biotic functions into a special method of assessing and optimizing landscape functions, development of evaluation methods for biotic functions;
- Development of a digital user manual with the goal of transferring the results into landscapes similar to the Querfurter Platte.

Beside these aims the combination of different types of biotopes at the Querfurter Platte is aspired. This includes a connection with structural elements of the neighbouring agricultural enterprise. The results attained to date are described.

Additional Keywords: assessment, optimization, soil erosion, biodiversity

Introduction
The aim of the project IUMBO is to increase the number of structural elements in intensively used agricultural landscapes like the so called Querfurter Platte. Such landscapes are poor in structural elements like hedges, woods, edges, and fruit alleys. Increasing the number of elements is a possibility to improve biodiversity. In particular the key species red kite and hamster shall be protected or resettled in the tested region. The approach "draft of landscape planning" covers nearly 4.200 ha belonging to the project partner "Agrarunternehmen Barnstädt". The project partners want to convert farmland into hedges, wood and groves. Existing interrupted rows of fruit trees will be completed, grass edges applied and a part of the area will be altered into hamster protection stripes. The project is based on the method MULBO (Multicriteria Landscape Assessment and Optimization) (*Grabaum et al. 1999, Mühle et al. 2001, Meyer and Grabaum 2003*), and wants combine biotic, abiotic and aesthetic goal-functions. The results of the project will be published as a book and a CD-ROM to enable the transfer of the new methods to similar regions.

Material and methods
The method "MULBO" was applied in order to find areas for alternative land use options in agricultural land and to increase the number of structural elements. At present, the MULBO method combines the assessment and the optimization of abiotic landscape functions to find out new areas for the transformation aiming at extensive use or the incorporation of woods and bosks. It integrates the results (land use options) into a landscape plan. This plan could be seen as an optimal compromize between different landscape functions.

The soil erosion has been calculated according to the universal soil loss equation (fig. 2). The limits of tolerance have been assessed according to *Meyer and Krönert 1998* (table 1):

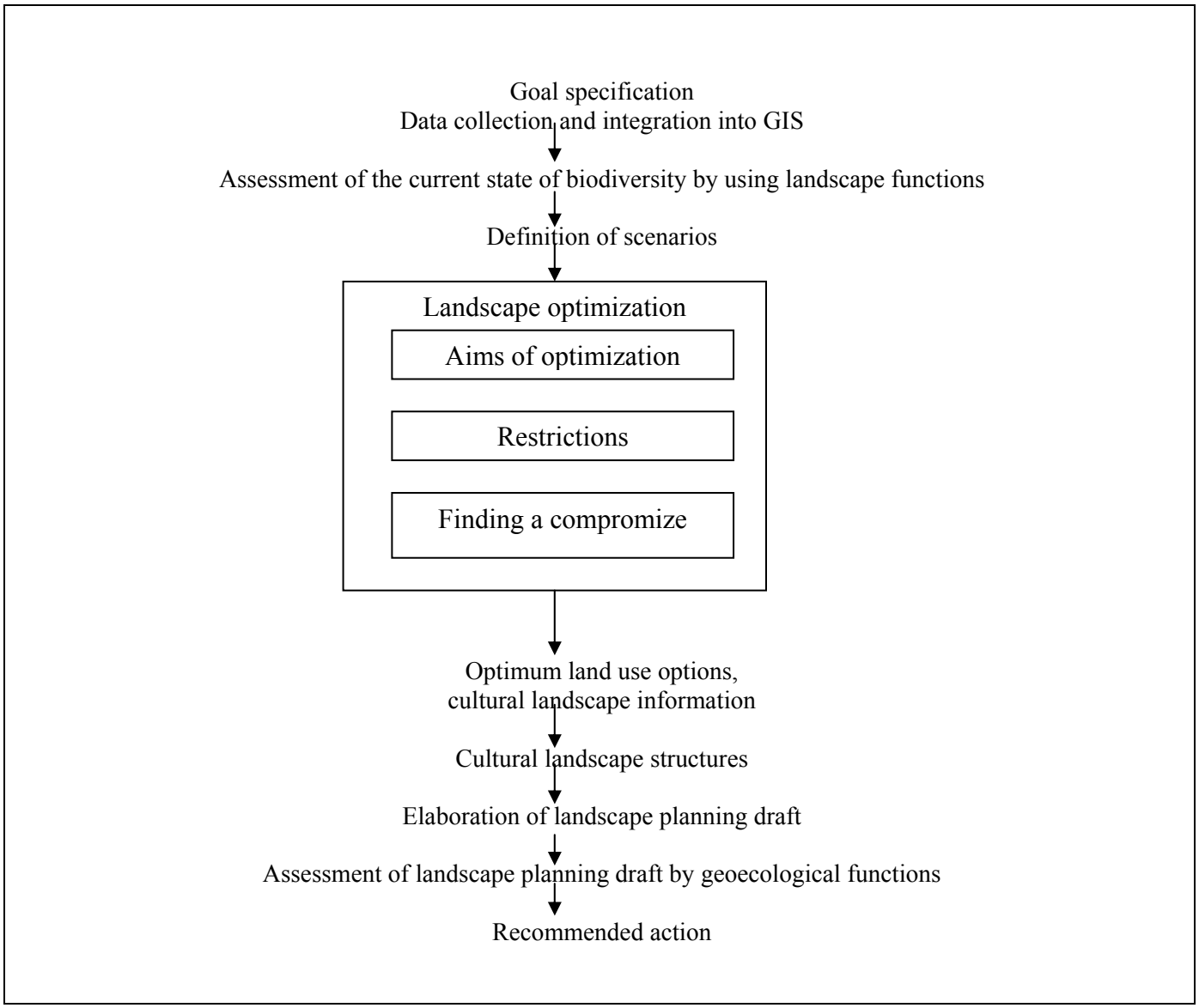

Figure 1. MULBO-Method (acc. to *Grabaum et al. 1999*)

Universal Soil Loss Equation

(acc. to *WISCHMEYER & SMITH 1978)*

$$A = R \times K \times LS \times C \times P$$

A = Average annual soil loss
R = Erosivity of the climate
K = Soil erodibility
L = Slope length
S = Slope steepness
C = Cover -management
P = Supporting practices

Figure 2. Universal Soil Loss Equation.

Table 1. Limits of tolerance assessing soil erosion in the central part of Germany with highly fertile soils

erosion per year (t/ha)	estimation	class of assessment
0 to 0.5	low	1
0.51 to 1.0	tolerable	2
1.01 to 1.5	increased	3
1.51 to 2.0	highly increased	4
higher than 2	extremely increased	5

This classification has been favoured by the authors because of the dangerousness of soil erosion for soil fertility and for the preservation of soils. Therefore, the tolerance value proposed by *Schwertmann et al. (1987)*:
tolerance value (t/ha and year) ≤ index of land quality/8 hasn't been accepted by the authors. Highly fertile soils are to protect, and therefore a very low soil erosion or a soil erosion near 0 will be accepted.

Results
The aims of optimization were the following:
- decreasing soil erosion
- keeping a high productivity
- increasing water retention.

All of the aims have got the same importance. For planning new hedges and alleys (linear elements of a landscape) served the old path network. With the help of the new draft of landscape planning the landscape will be altered. Biodiversity increases as follows: The area of nature conservation increased by + 590 %, the area of linear structural elements increased by + 89 %. The potential water erosion was diminished by -34 % (t/ha and year). Wind erosion was diminished by -43 %. Water retention stayed the same. The productivity was kept, the yield area (with an index of land quality more than 80) increased by +1 %, but the yield of the whole enterprise decreased due to diminishing the fields.

Discussion
The MULBO method is a good instrument to assess the effect of individual landscape functions such as soil erosion. Our aim is the integration of biotic landscape functions into this method. Therefore, in the framework of IUMBO the project partners are developing methods to assess such biotic landscape functions, that means wildlife habitats of birds and animals like red kite (*Milvus milvus*), hamster (*Cricetus cricetus*), hare (*Leptus europaeus*), corn bunting (*Emberiza calandra*) and different small mammals. These habitats become determined in the tested region (the area in the agricultural enterprise Barnstädt), and in the reference region (near Leipzig, between the towns Taucha and Eilenburg). All these functions should be optimized, that means, a good compromise between them is to be found out. For instance, the habitats for hares were determined in the reference region.To protect the hamster, in the tested region protecting stripes (broadness 20 m) and different length were applied. The agricultural enterprise Barnstädt is responsible for the arrangement of protecting stripes and the formation of the seed mixture. Till this day they have sowed different mixtures, consisting for instance of sunflowers, phacelia, buckwheat, clover and grass.

The woods, bosks, hedges and tree alleys serve as hideaway of different animals and plants, and we hope for a high biodiversity in the regions. Nevertheless, *Jeanneret et al. (2003)* say: "There are no general models relating overall species diversity to landscape diversity." Therefore a digital handbook is planned in IUMBO to transfer the results to other fertile landscapes (Börde regions).

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