Szeged University
Department of Physical Geography and Geoinformatics

RECREATION AND AGRICULTURE BASED LAND EVALUATION IN THE KÁLI BASIN

(Thesis of PhD dissertation)

Péter Szilassi

Szeged
2004

1. PRELIMINARIES, AIMS OF THE STUDY

One of the greatest challenges of our days is to keep the harmony of the landscape and its inhabitants. For the first time the „sustainable development" expression was used in 1992 in the Environmental Word Forum at Rio, and the term has several (economical, ecological, sociological, etc.) different meanings. The way of its realisation could be studied in different scales (catchment, regional, national and continental).

In this dissertation I will use the „sustainable development" term in a catchment scale, in order to propose a sustainable land use for future, thus, the agro-ecological potentials of the area could be increased, while the conflicts between the different land use types and the environment could be decreased.

I would like to get further than a traditional agro-ecological and recreational research, thus, I will analyse the spatial and temporal structure of land sensitivity, and land carrying capacity of the different land uses. I want to create recommendations for the authorities for the planning of future land use. During the landscape analysis from the agricultural viewpoint I have paid special attention to the analysis of land use history, because in the study area is one of the oldest agricultural areas of Hungary.

1.1. Preliminaries and aims of landscape evaluation from the recreational viewpoint:

In Hungary the research on recreational potentials of some study areas began in the 1980's. The authors (BERÉNYI I. 1986, GALAMBOS J. 1986, 1988, MOLNÁR K.- TÓZSA I. 1983, KERTÉSZ Á 1988, MEZŐSI G. 1985) analysed the suitability of the landscape for different land use forms of recreation (holiday resort, trekking, skiing, etc.). During the evaluation of the landscape from the viewpoint of recreation generally the researchers have used numerical methods to qualify the physical geographical factors (relief, climate, vegetation, soil) of the territory.

The latest researches focused on the creation of the system of „sustainable tourism" (MARTONNÉ ERDŐS K. ET. AL 1996/A, PUCKÓ L. – RÁCZ T. 1998, MIECZKOWSKI Z. 1995, BALOG Á 1995, GEOFFREY W. 1997, ROE D, ET AL. 1997) and on developing new landscape planning methods (MC.NELLY J.A. ET.AL 1992, COAP 1970 IN: COCCOSIS H. – PARPAIRIS A. 1992, (WOLF 1984 IN: COCCOSIS H. – PARPAIRIS A. 1992, FISHER, KRUTILLA, 1972 IN: COCCOSIS H. – PARPAIRIS A. 1992).

The aims of the present study are the following: (1) to evaluate the recreational attractions of the study area (Káli Basin) and to measure the potential sensitivity and real carrying capacity of the study area based on its recreational use; (2) to highlight the aspects of the different recreational forms. I would like to point on the fact, that the recreation based land use in the Káli Basin, and generally in the Hungarian Nature Reserves have not reached the critical limit of their carrying capacity. In comparison with British National Parks the sensitivity of the Hungarian Nature Reserves is higher and the number of visitors is much lower in Hungary. That fact explains the choice of the topic of this dissertation that in Hungary nowadays is an increasing claim for the development of the ecotourism. This trend will be stronger, especially in the Balaton Upland Area, because Lake Balaton is one of the greatest touristic attractions in Hungary.

In the present dissertation the following aims will be realised by applying different methods:

1. To describe of the recreation potential of the Káli Basin, and the spatial characteristics of its attractions.
2. Are there independent touristic attractions in the Káli Basin, or this area is the part of the Balaton Recreation Area, and its recreational objects are just secondary attractions (following the beaches of the Lake Balaton)?
3. To analyse the main land use conflicts between recreation (as a type of the land use) and the environment, and to evaluate the load of recreation.

The knowledge of sensitivity, the level of carrying capacity, and the load of footpaths and the landscape objects are requiring assumptions for optimalisation of the spatial pattern of the ecotourism.

The different forms of the recreation has a different spatial, and temporal effects on landscape, therefore, in the following research I will analyse the conflicts between the recreation and the other land use types, then I will evaluate the land sensitivity compared to recreation, and I will analyse the effects f recreation on landscape.

- What kind of land use conflicts will be created by ecotourism and holiday resorts in the Káli Basin?
- How can we measure the land sensitivity, and the land carrying capacity compared to different forms of recreation?
- How can we evaluate the pressure caused by different forms of the recreation in the research area?

I have evaluated the effects of the ecotourism on landscape objects, on footpaths, then I gave suggestions for the future management of the ecotourism.

1.2. Preliminaries and aims of landscape evaluation from the agricultural viewpoint:

The realization of sustainable agriculture (ÁNGYÁN J. ET.AL. 1999, VÁRALLYAY GY. 2003, BARCZI A. 2000, GRÓNÁS V. 2000, GRÓNÁS V. - FOGARASSY CS. 2000) in the Káli Basin is an important goal, because this area belongs to the catchment area of the Lake Balaton, and it is part of the Balaton Upland National Park. A fundamental question from the viewpoint of the future land use planning is to decide which areas should be withdrawn from the cultivated areas or which areas should be taken into cultivation, to use the agro-ecological potential of these areas with better efficiency and without the increase of erosion. The Hungarian publications, which were published in this topic, mainly focused on making suggestions for the country scale spatial pattern of the sustainable agriculture (ÁNGYÁN J. ET.AL. 1999). The methodology of these studies was worked out within the frame of the National Agricultural and Environmental Protection Program. To establish the criteria for the sustainable agricultural use, in the catchment scale studies the authors mostly evaluated the relief and the soil factors separately (MOLNÁR K. 1983, PÉCSI M. 1991, CSIMA P. 1994, RAKONCZAY J. 1997, BARCZI A. 2000). The application of erosion models in Hungarian landscape studies (KERTESZ Á. ET.AL. 1993, 1997, BARTA K. 2001, CENTERI CS. 2002) created good possibilities to use them in future land use planning with their complex ($t*ha^{-1}*year^{-1}$) soil loss categories instead of traditional relief and the soil categories.

In addition, in those areas, which has similarly long traditions in agriculture and as long land use history as in the Káli Basin, it is worth to consider the landscape historical viewpoint for the planning of future land use (LIPSKY Z. 1995, VERBURG P.H. ET.AL. 1999, SKLENICKA P. - LHOTA T. 2002. LEE T.J. ET.AL. 1999, CORREIA P.T. 2000, ILYÉS Z. 2001, CSORBA P. ET.AL 2001 CSORBA P. 2003). During the present investigation the following steps were realised:

1, First of all, the sociological and agro-ecological causes of the land use change were investigated, and it's effect on the environmental (pedological) factors.

In connection with the social reasons of land use change I wanted to answer to the following questions:

- What kind of social and economical reasons and changed the land use in the Káli Basin? What was the way of these changes?
- Is there a statistical connection between the demographical features of the area and its land use history?

Connected with the agro-ecological reasons of the land use change the following questions should be answered:

- Is there a connection between the productivity number (as a representative index of the agro-ecological capacity of this area) and the temporal change of the land use pattern?

In the study area the effect of land use change on the environment was also investigated paying special attention to the changes of the soil quality caused by durable land use.

- What kind of differences are between the soil qualities of arable land, meadow, pasture and non-cultivated areas in the studied periods.

2. I would like to give suggestions based on the landscape historical studies to create the to-be borders of the main (characteristic) land use types (vineyard and arable land) by answering the following questions:

- Which areas would be reasonable for the new vineyard reconstruction?
- Which areas should be excluded from the vineyards or the arable lands, because of its high ecological value or the protection of these areas.
- Which areas have higher agro-ecological productivity than the average and which areas are more suitable for arable land than others?

3. Finally I will evaluate the productivity capacity of the planned vineyard areas considering the relief of the area.

2. METHODS:

2.1. Methods used in the recreation based landscape evaluation:

I have estimated the attendance of the research area by questionnaires. In the summer of 1998 510 questionnaires were completed by tourist (114 by Germans) and in the summer of 1999 786 tourist answered (75 Germans) in the visitor centre of the Salföld Farm and Hegyes Peak, which all situated in the Káli Basin.

The data of the questionnaires were evaluated using MapInfo 5.2. software, and for the statistical analysis I have used Microsoft Office Excel software.

The footpaths in the research area and the borders of the nature reserve zones were digitalized under Arc View 3.2 software in 1:25,000 scale. A digital elevation map of the Káli Basin was made, which was the basis of the erosion sensitivity map of the research area. The main and

the basic contour-lines were digitalised based on the military map published in 1979, then it was divided into 10 x 10 meter grid cells. I have estimated the changes of the build-up territories using Arc View 3.2 software digitalizing military maps from 1958, 1979 and a 1:10,000 scale aerial photo from 1993. I have investigated bulk density in the measuring points (3-3) on and outside of the footpaths using Packet Vane Tester. I have repeated every sampling three times, then I have calculated their average.

2.2. Methods used in the agriculture based landscape evaluation:

Military maps were fitted to the geo-coordinate system by ERDAS IMAGINE 8.4. software, then these maps were digitalized under Arc View 3.2 software in order to the investigation of the land use change. The following maps were used during the research: First Military Survey from 1784 (scale: 1:28,800), Second Military Survey from 1854 (scale: 1:28,800), Third Military Survey from 1931-1932 (scale: 1:25,000), military maps from 1960-1972 and 1981-1983 (scale: 1:10,000). Data from the scientific literature and statistical data were also collected. I have made a land use map in 2002 based on my own field survey. Aerial photos taken in 1993 (scale: 1:10,000) were also applied to illustrate the expansion of forests.
I have digitalized the soil maps of the area and the cartograms of organic material, Ph, $CaCO_3$ content, soil characteristics which influence the soil productivity and groundwater (MÁTÉNÉ CS. E. 1990/A,B,C). I have overlapped the resulted maps under Arc View 3.2. software and following the method of STEFANOVITS P. ET.AL. (1970) the digital map of productivity number of the Káli Basin was created.

During the analysis statistical data were also used, the diagrams were created by Microsoft Excel 98 software.

CONCLUSIONS

During the analysis of land use types, I have revealed their spatial pattern and its change, their connections with the agro-ecological and recreational potential of the landscape. Additionally, I have evaluated the intensity of the potential and real rate of load on the nature. Besides, I have expressed the sensitivity of the study area versus different land use types. Finally, I have made suggestions on future land use pattern with special respect to the sustainable development of the area.
The results, which were revealed by different methods, are not the appropriate answers to the questions raised in the aims, as far as they do not fulfil all criteria of the sustainability.

3.1. Results of the landscape analysis from the recreational viewpoint:

1. I have evaluated the attraction capability of the Kali Basin using questionnaires. The greatest part of the visitors came from Northern Transdanubia and from Budapest.
2. I have made statistical analysis on the connection between the duration of sunshine and the number of visitors. Considerable part of the Káli Basin visitors came from the coast of the Balaton, thus, the basin is a secondary attraction area of the Balaton Recreational Area. Therefore, we should not analyse the recreation potential of the Káli Basin with traditional (raster based) methods, because it's recreational potential not equal with the total potential of the landscape objects of this area.
3. In general, the tourists visit the basin for short time and they mainly do not stay at local housings. This phenomenon is rather unfavourable, because the local inhabitants can not make a profit from the tourism. Thus, the tourism could not help to stop the dramatic migration from the villages of the Káli Basin, which projects the unfavourable change in land use (the expansion of non-cultivated areas especially on the vineyard areas).
4. The spatial pattern of the tourism in the Káli Basin shows great regional differences. Generally the landscape objects of the basin are not explored from the viewpoint of recreation.
5. I have defined the main land use conflicts between the recreation based land use, and the other land use types (Table 1) (SZILASSI P. 2003/B):

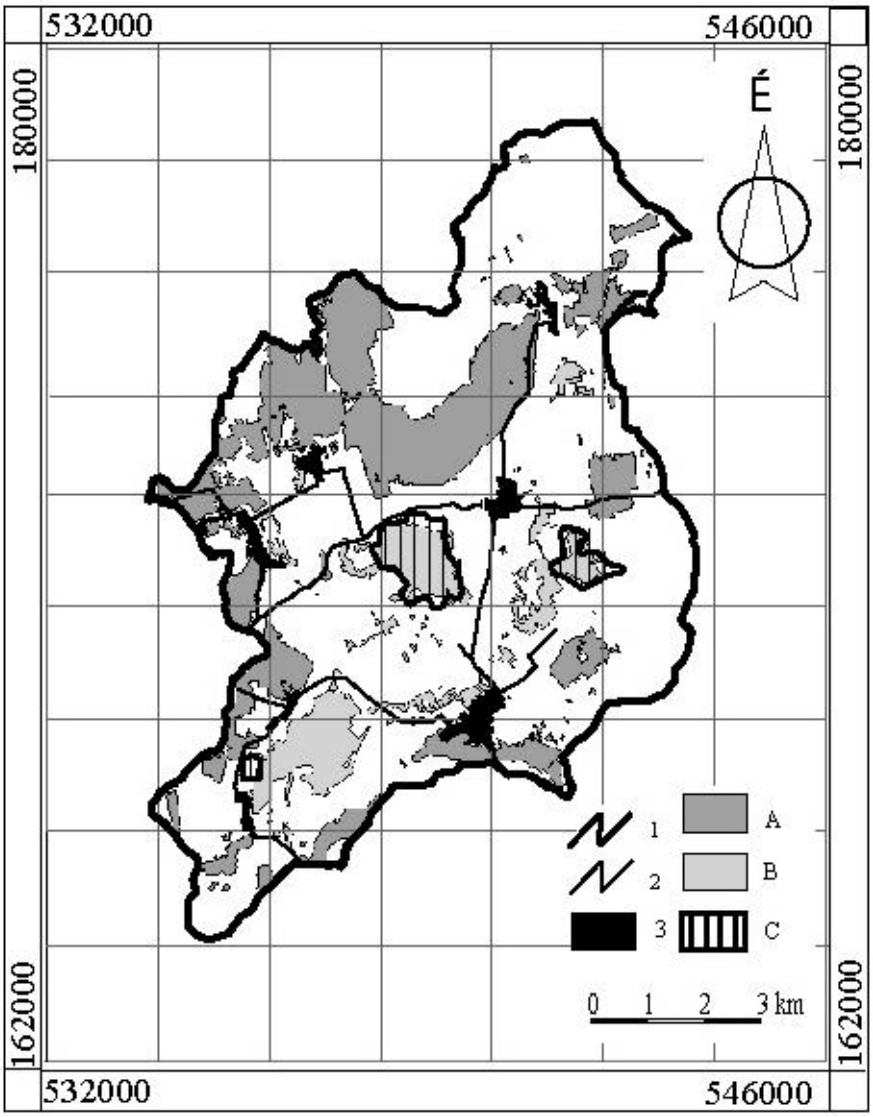
Recreation		Landscape load	
Type	**Area depended parameters**	**Location**	**Form**
Ecotourism (Trekking, mountain-biking, horse-riding)	Footpath and landscape objects and its surroundings	Biosphere	Increase of weed areas
			Decrease of species number and diversity
		Pedosphere	Increase of the bare surfaces and soil bulk density, footpath erosion
Holiday resort	Gardens	Hydrosphere	Groundwater contamination
		Land use	Decrease of vineyard areas and the increase of meadows and grasslands
		Landscape scenery	Increase of built-in areas

(Table 1.) Forms of recreation based landscape load in the Káli Basin

6. I have classified the landscape objects into different real (ecological) carrying capacity categories based on their sensitivity using a Geographical Information System during the classification.
7. I have made suggestions for the conservation management of the different carrying capacity categories.
8. I have done a comparative bulk density surveys on the most sensitive but less loadable footpaths.
9. I have revealed the main conflicts caused by recreation. I have evaluated one of them, the decrease of the vineyard areas and the increase of built-in areas using thematic maps.
10. I have found that rate of groundwater contamination does not reach the hygienic limit in the springs or in the wells of the gardens on the Fekete Hill.

3.2. Results of the landscape analysis from the agricultural viewpoint:

11. There is a strong correlation between the number of the inhabitants and the size of the arable lands, meadows, pasture-lands of settlements. The correlation between the number of the inhabitants in a settlement and the size of the vineyard areas is weaker, because the landowners of vineyards produced vine for the market (mainly for the foreign market).
12. The averages of the productivity number (calculated for every studied year) show that the local farmers recognising the difference in productivity of soils started to cultivate as arable land those areas, which have better productivity.The land use changes in the Káli Basin depended on natural and social causes. While the size of arable lands is mostly effected by the number of inhabitants, the spatial pattern of arable lands was effected by the productivity character of the basin.
14. The degradation of the soils under arable lands is a demonstrable process. These soils are more eroded, they consist less organic material and their upper layer is more acidic, the $CaCO_3$ level is formed deeper. The soils of arable lands have more $CaCO_3$ content than the soils of meadows, pastures or non-cultivated areas.
14. In the case of the Káli Basin the vineyard areas on the hillslopes of the basalt mezas have been dominant part of the landscape, therefore, it is very important to protect them. The historical land use studies can help to locate the potential vineyard areas, thus, we can assign the frame of the future vineyard reconstruction.
15. The disallowance of arable lands should be expanded not only within the "A" conservation zone, but for every area, where meadows, pastures, or non-cultivated areas have been permanent, because their soils have higher natural value than the permanently arable lands (Fig1.)**.**



(Fig 1.) Landscape historical categories with high importance for the future land use planning, and the strictly protected grasslands („A" zone) of the Balaton Upland National Park

1 = catchment area of the Burnót Stream; 2 = paved road; 3 = settlement;
A = at least once has been a vineyard area; B = durable meadows, pasture and non-cultivated lands; C = strictly protected grasslands („A" zone)

16. I have weighted the productivity of the potential vineyard areas with the relief parameters.
17. Considering the erosion sensitivity map, the productivity map, historical and other categories I have made suggestions for the future spatial (sustainable) land use pattern.

PUBLICATIONS PUBLISHED IN THE TOPIC OF THE DISSERTATION:

SZILASSI P. 1999. Possibilities of country development from the point of wiev of tourism – an investigation in the Káli-basin (West-Hungary). – Geographica Pannonica No.3, Novi Sad pp 30–32.

SZILASSI P. 2000. Land use changes on the hillslope of the Fekete-hill (Káli-basin) betweeen 1958 – 1993. –Acta Universitatis Szegediensis Acta Geographica Tomus XXXVII. pp. 93–98.

SZILASSI P. 2001. Influence of weather – as a changing part of landscape elements - on the touristical potentials of the Káli basin. – Acta Climatologica et Chorologica Universitatis Szegediensis Tomus: XXXIV-XXXV. pp. 45-49.

SZILASSI P. – KISS R. 2001. Tájváltozás térinformatikai módszerekkel történő értékelése egy balaton-felvidéki mintaterület (Fekete-hegy) példáján. – Magyar Földrajzi Konferencia Szeged, (CD-Rom)

SZILASSI P. 2003/A. Tájtörténeti, tájvédelmi adalékok a jövőbeni területhasználat tervezéséhez a Káli–medence példáján in.: GAÁL Z. – MÁTÉ F. – TÓTH G. (SZERK). – Földminőség és földhasználati információ a mezőgazdaság versenyképességének javításáért című országos konferencia kiadványa Veszprémi Egyetem, Keszthely pp. 161-171.

SZILASSI P. 2003/B. A rekreációs szempontú tájértékelés elmélete és módszertana a hazai és a külföldi szakirodalom alapján. – Földrajzi Értesítő (közlésre elfogadva)

SZILASSI P. 2003/C. A területhasználatban végbement változások okainak és következményeinek vizsgálata a Káli-medence példáján. – Földrajzi Értesítő (közlésre elfogadva)