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LANDSCAPE EVALUATION ON SODIC LAND OF PÉLY AT HUNGARY (ECOTOPE-FORMING VALUE)

L. KÜRTI and I. BÁRÁNY-KEVEI

Department of Climatology and Landscape Ecology, University of Szeged, P.O.Box 653, 6701 Szeged, Hungary
E-mail: kurtiliv@freemail.hu

Összefoglalás: A tanulmány egy német tájértékelési módszer felhasználásával értékeli egy magyar szikes táj ökotópképző értékét. Az értékelés alapját az adott területen megtalálható vegetáció adja. A vegetáció tulajdonképpen nem más, mint az abiotikus tényezők indikátora az ökoszisztémában. A biotikus és abiotikus tényezők együttesen alkotják a térben lehatárolt ökotópot. Az ökotóp a táj eltartóképességéről ad információt, mely bizonyos határig képes magát fenntartani és megújítani. A kapott eredmények az előzetes várakozásoknak megfeleltek, a táj ökotópképző értéke közepesnek minősíthető.

Summary: In the landscape ecology there is several methods to evaluate the each landscape. This should be very important for other practical sciences like engineering and natural protecting. The study area is already protecting, but it needs rehabilitation.We used the method after a German landscape method. This method is based on the local vegetation, because the vegetation is the indicator of the abiotic factors in the eco-system. The ecotope is able to keep itself on a certain level and can regenerate itself. So it should be give us some information about the landscape-household system. The result, what we got, corresponds to our previous expectations; the ecotope forming value is average on the study area

Key words: landscape evaluation, ecotope, sodic land, plant association and communities

INTRODUCTION

Landscape ecology is an emerging science, with complex character and heterogeneous content, but with a clearly philosophical (epistemological) background (*Zonneveld,* 1990). It examines together the dynamic of spatial variegation of the earth-surface, the space and time-relation between the landscapes, it takes research on the influence of the spatial heterogeneity to the biotic and abiotic processes, and it is occupied in landscape planning (*Risser et al.,* 1984). The aim of landscape ecology is to reveal the dynamic of energy and material flow in the eco-systems, to analyze the answers of eco-systems to the anthropogenic influences and know the indicators of these processes. To examine all of these factors together several methods were known.

One of the methods is to determine the ecotope-forming value. The ecotope-forming value gives information about the landscape-household capacity, which is good to know in the point of view of landscape using.

We used this method to evaluate grassland on the sodic lands of Pély. The base of the investigation was the local vegetation, because the plants are the indicators of the various conditions of landscape.

The aim was to examine if the present landscape use is harmonious with the landscape-support capacity, and what kind of limiting and risky factors are in the present system. We also analyzed the alternative landscape using.

Previously the each abiotic factor was examined in the point of view the different landscape using: f.e. the soils were evaluated in old crown to show how it is valuable (*Lóczy*, 1989). At Hungary the first great complete landscape evaluation was made by Csorba P. in the basin of Bodrogkeresztúr in the end of the '70 (*Csorba,* 1989).

The ecotope forming value was appeared in the Hungarian references just few years ago (*Bárány-Kevei,* 1997). The first, who used this method to evaluate *Bárány-Kevei*, who utilized it to evaluate the forests around Bodony. We also used the same method, but the characters of this area were different in our case.

METHODS AND STUDY AREA

The sodic land of Pély is situated on the northern part of the Great Hungarian Plain, on the middle-flood area of Tisza. Its development was determinate by the neighbourhood of Tisza until the human appearance (*Fig. 1*).

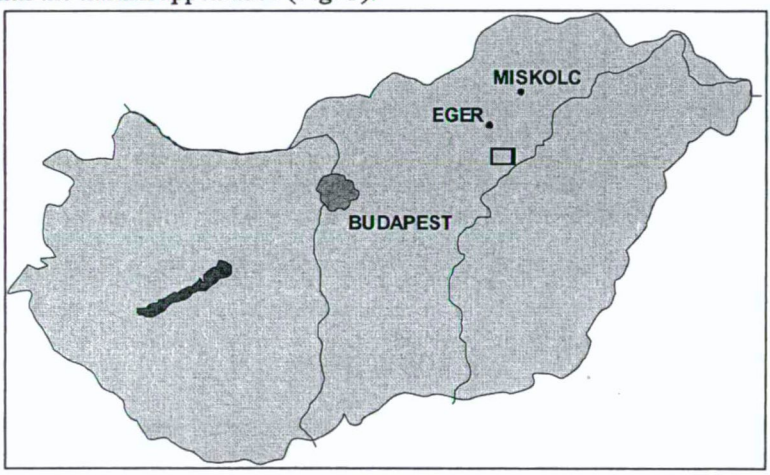

Fig. 1 The situation of the study area in Hungary

Till 17th century the inhabitants have lived in a strong relation with their natural environment: they used the grasslands for grazing between the marshes. With the growing of the local population they needed to cultivate more and more field. From this time more marshes were drained and dried up. There were two periods when these works have got a great impulse: the control of Tisza and the great canal-buildings in the 1950 years. The disappearance and degradation of various biotopes were the consequences of these processes. After than the landscape was appointed to the National Park, it was more important to restore the conditions natural or close to natural conditions. In the present day a mosaic landscape should be seen with many different plant associations (*Fig. 2*).

As the plant- associations give the base of the evaluation, so we had to need a vegetation map and the exact composition of species of each association (*Marks et al.*, 1989). The National Park helped us in this work. We have found the following communities on the study area:

1. Reeds (Scripo-Phragmitetum) (*Koch,* 1926)
2. Sodic field with foxtail grass (Argrosti-Alopecuratum pratensis) (*Soó,* 1947)
3. Sodic field with Beckmannia eruciformis (Agrostio-Beckmannietum) (*Soó,* 1933)
4. Sodic field with grass (Achilleo-Festucetum pseudovine) (*Soó,* 1945)
5. Sodic field with wormwood (Artemisio-Festucetum pseudovine) (*Rapcs and Soó,* 1947)

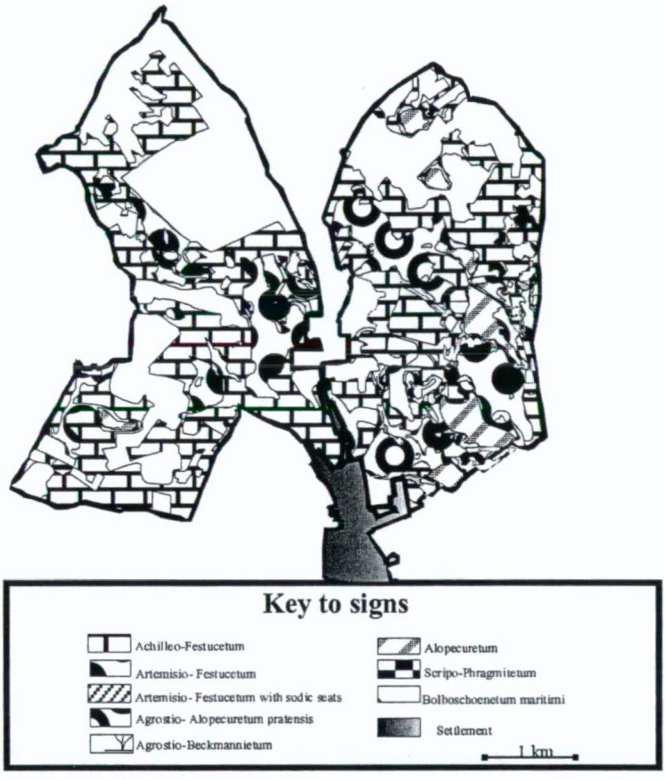

Fig. 2 The vegetation map of the study area

The ecotope-forming value, which expresses the productivity of the landscape, is determinated by the potentials of landscape. But the conditions of landscape do not form ecotope by themselves. So the ecotope- forming value comes into being in the ecotope, which is determinated in space, through the effect system of biotic and abiotic components of landscape. The ecotope is able to regenerate and maintain itself till a certain level. The ecotopes constitute biotopes for the life assemblage of animals and plants (biocoenosis is formed by the species of animal and plants living together in symbiosis) (*Bárány-Kevei,* 1997).

The stable biotopes are able to keep or restore their equilibrium condition after a longer time, owing to their high stability and regenerator capacity.

The ecotope-forming value depends on the maturity, the naturalness, diversity and the anthropogenic influence of the community in a plant association. These components should be numericated by field work and mapping, inclusion. It is obvious that this

procedure aims at the evaluation of the biotic components. But the values show the support capacity of the landscape, and at the same time they are the indicators of the change of conditions of the landscape.

Maturity of the communities

The maturity is the stage in the cyclical pattern of community stage in the plant succession. The succession development advances to the climax stage, which is the final stage, and the vegetation reaches a state of equilibrium with the environment. The succession is natural if the line of the stages is suited to the natural potentiality. The succession is secondary if it was formed by human impact. After the deforestation a secondary succession is formed. Unfortunately on most part of the study area we have found secondary vegetation, which is the consequence of the grazing during centuries and the drainage. The maturity should be measured on a scale from 1 to 5, and the initial stage got 1, while the climax stage got 5 (*Table 1*).

Table 1 The values of the maturity

Degree of the maturity	Title
5	Climax community
4	Stable communities (they are stable with conditions external)
3	Long life additional comm.
2	Pioneer and short life add. comm.
1	Pioneer comm. In the initial stage

The naturalness of the plant association

The association is natural when it is up to the ecological conditions, it can regenerate easily answering to the perturbing impacts, elements. We determinate the naturalness with field work and category according to Simon, which means that we considered how high is than rate of the natural species in the community.

The naturalness should be measured on a scale from 0 to 5, and the association is closer to the most natural stage it get more points (*Table 2*).

Table 2 The classes of naturalness

Class of naturalness	Nomination	Value
1	Close to natural	5
2	Semi-natural	3
3	Far from natural	1
4	Artificial	0

The diversity of the community

The diversity means that the association is rich structurally and it has high number of species. Generally the ecosystems with high diversity are stable, which means that the

energy- and material flux is well organized in the system. At the same time after a deep perturbation it regenerates more difficult, like in the simple organized systems. In normal case the climax-ecosystems have larger diversity then the pioneer or the following associations. We determinate the diversity with the species richness and structural diversity.

$$D = (G + S)/2$$

Where (D) is diversity, (G) is species richness and (S) is structural diversity.

As we wrote, as the larger number of the species grow the stability of the system, the structural diversity make to be stable the ecotope. This means that large structural variety gives larger point to the association. For example: if there is 40 or more species in the association, the D value will be 5, but if the number of the species 10 or less the D-value will be 1 (*Table 3*).

Table 3 The values of the richness of species

Number of species	Value
> 40	5
31 - 40	4
21 - 30	3
11 - 20	2
1 - 10	1

In the case of the structural diversity we examined what kind of percent the each structural unit has in the spatial structure of the community. We analyzed grassland in this research, we saw two structural unit, that means low-grass (lower than 30 cm) and high-grass unit (higher than 30 cm) appeared in this landscape (*Table 4*).

Table 4 The classification of the structural diversity

Height of vegetation units	50 – 100 %	25 – 50 %	5 – 25 %
High wood (10-20 m)	1	0.6	0.3
Low wood (10 m alit)	1	0.6	0.3
Bush (higher than 2 m)	1	0.6	0.3
Low bush (lower than 2 m)	0.5	0.3	0.2
Grass higher than 30 cm	1	0.6	0.3
Grass lower than 30 cm	0.5	0.3	0.2

Anthropogenic damage of the eco-system

The semi-natural and secondary plant associations and eco-systems answer with reduced productivity to the perturbation human activity (*Table 5*). The damage of the ecological condition should be the consequence of anthropogenic erosion, cultivation, drainage disordered, road buildings, irrigations, irregular depositions etc.

Table 5 The classification of the anthropogenic influence

2	Under small influence	1 – 2	4
3	Influenced	2 – 5	3
4	Damaged	5 – 20	2
5	Very damaged	20 – 50	1
6	Very hard damaged	Above 50	0

Description of evaluation

To simplify the procedure of valuation we ordered the values of the associations to the orders of the certain indicators. With this method we can save the field work of maturity and diversity and naturalness.

At determination of naturalness degree we considered how great the rate of the species referring to natural state was. (F.e protected species, pioneer species, and companion species) If the communities taking depart from the normality, than we must evaluate the order of indicators one by one. We must point out the anthropogenic damage in every case if we could not it determinate exactly.

We get the ecotope-forming value when we add together all values of the indicators:

$$EFV = M+N+D+A$$

Where: EFV-ecotope-forming value
M-maturity
N-naturalness
D-diversity
A-anthropogenic influence

This method can be used solely at the real species staff of ecosystem and plant association. The available highest value is 20, while the lowest is 1.5. Our results are in the *Table 6.*

Table 6 The Ecotope-forming values on the study area

Type of the community	Maturity	Naturalness	Diversity	Anthr.influence	EFV
Reeds	3	5	1.65	4	13.65
Sod.f.w.foxt.grass	3	3	2.05	2	11.05
Sod.f.w.wormwood	4	3	2.05	3	12.05
Sod.f.w.Beckmannia	4	3	2.75	3	12.75
Sod.f.w.grass	3	3	2. 55	2	10.55

In the point of view of maturity there is no great variability on the study area. In the most case the associations are long life additional communities or natural succeeding communities. We have found higher level, lasting communities. These were the sodic meadows and wormwood sodic fields. We have not found association in climax stage, which means that there is no natural association on the study area. All association had significance anthropogenic influences. Especially, if we consider that there were several great marshes at the end of the 19th century.

The value of diversity is very low. There are no associations rich in species and the structural diversity is neither variable. In fact this has two types in the area: low and high grass. The diversity is highest in case of sodic fields with Beckmannia eruciformis.

If we examine the naturalness, we have to establish that the natural following, or close to nature conditions are dominant, but the signs referring to degradation have been already appeared. The appearance of the reed indicates this phenomenon, and probably it is connected with the increase of the nitrogen loading.

All of the communities are influenced by anthropogenic activities. Their composition of species is disturbed which is well shown by the great number of the weeds. The anthropogenic influence is not only the grazing, but other agricultural, and not agricultural activities. For example the using of the ways besides the meadows should be the cause of the breaking up of the grass. But the protected area is enclosed by plough-lands, so their cultivation affects them. This means partly that the wed species spread.

On our study area the ecotope-forming value is between 10 and 14. The sodic field with foxtail grass, sodic field with grass, sodic field with wormwood have an average EFV. While the reeds and sodic fields with Beckmannia eruciformis got a high value.

These values correspond to our previous expectations. This means that the biotope developed here are relatively stables. The landscape-household capacity is not so high, and it is in a sensitive equilibrium with the present landscape using, because this is a cultivated (culture) landscape developed during centuries. The quantity of the biomass is not so much during a year, because of the low grass plant associations, and great part of them dries in the summer. In the autumn we can notice a secondary green shoot, but this has not great importance. Furthermore the yearly yield of grass depends on the climatic conditions of the given year too. This should be told all of the plant associations, but it is right especially in case of sodic lands, where extreme ecological conditions dominate. The local vegetation should be degradated if the landscape using does not correspond to the ecological conditions. Presently the study area is used as grazing land by sheeps and cows.

The National Park has begun rehabilitation. In this framework the old marsh would be restored as water–biotope, like in the 17th century. Probably in the close future the diversity is going to augment and the rate of the water- biotopes rises also, which should make changes in the local vegetation and fauna.

CONCLUSION

With regard to the study area, we can say that the sodic lands of Pély possess diverse ecotopes, but their landscape support capacity is average. The change in the natural conditions is the consequence of the human activities in the 15th century. For the moment the present ecotopes are in equilibrium with the landscape use, and as this is a protected area it should consider the viewpoint of the protection too during the usage.

In our opinion a regional, development plan is needed which support the sheep and cattle-farming with the possibility the processing, because Pély, the settlement is a poor, disadvantaged village. On the other hand to maintain these ecological conditions the area needs to be used as a grazing land.

We hope that the rehabilitation will be efficient, and the local water-biotopes will be more diverse than today, and the ecological conditions improve also.

This analysis is based on the vegetation and hereby it takes the abiotic factors into consideration, because the vegetation communities are determinated by soil, climate, etc. As all ecological investigation, this is also based on a state survey temporary, so it would be advisable to repeat it certain intervals as a monitoring-system. As well as it is worth to compare other landscape evaluation methods.

This method needs some addition (other ecological indicators, or method) and also we should make more investigation to correct its insufficiency, or to propose a motion to specify the each factors.

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