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LAND USE CHANGES IN ÓPUSZTASZER

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Összefoglalás – Az ópusztaszeri mintaterületen az utóbbi kétszáz év térképei alapján meghatároztuk azokat a tájfoltokat, amelyeken a tájhasználat módja nem változott. Az állandó tájhasználatú területek és a domborzat között kapcsolat mutatható ki: a magasabb fekvésű területeken főként szántók, települések és erdők találhatók, míg a gyepek az alacsonyabban elhelyezkedő területeket foglalják el. A tájhasználat kapcsolatrendszerét kutatva szoros kapcsolat mutatható ki a művelés módja és a vizsgált terület népességszámának változása között.

Summary – Permanent land use patches in the Ópusztaszer study area were determined on the evidence of the last two hundred years' maps. A relationship was found between the relief and the permanent land use patches. The ploughland, forest and the built-up area are concentrated on higher elevation. The grassland is located on the low-lying part of study area. By investigating the relations of land use change significant correlation was found between the increase in the number of inhabitants in the study area and the type of land cultivation.

Key words: land use change, relief, population

1. STUDY AREA AND METHODS

The study area is located in the southern part of Hungary, near the river Tisza (*Fig. 1*). It consists of the territories of Ópusztaszer and Baks villages. These villages have existed since 1947 that's why the earlier data refer to the northern part of the Pallavicini estate (*Inventory of the Pallavicin's demesne*, 1868; *Vályi and Zombori*, 1996). Both villages and their territories are situated at the meeting point of three different landscape types. The north-eastern and eastern parts of the study area are a sandy plain belonging to sandy Kiskunság. The northern part is a loess plain with sodic soils and the southern part is an alluvial plain belonging to the alluvium of the river Tisza. The boundary between the flood plain (the average altitude is 78 m above sea level) and the other two landscapes (the average altitude varies between 79 – 81 m above sea level) is a clearly visible step unlike the boundary between loess and sandy landscapes (*Somogyi and Marosi*, 1990).

The aim of our research is to determine the relationship between land use types and geographical factors. Land use change was studied at first. There is no detailed data about land use before the *First Military Survey* (1783-1784 in the study area) so the basis is this military map. Later maps like *Cadastre Maps* (from 1854, 1878, 1883) and *Military Maps* (from 1950, 1991) were compared to the map of the First Military Survey. The result is some patches where, on the evidence of the maps, land use has not changed for more than 200 years. The permanent land use type patches were compared with the relief. The relief was chosen from a range of different geographical factors because it can be represented easily and detailed in the case of this study area and there are not enough data about the soil

and the groundwater system. The relief map was created from a Military Map from 1991. Two types of area were defined in each landscape, based on altitude. One is the base area and the other is the higher area. The altitude of the base area is below 80 m in the floodplain and below 82.5 m above the sea level in sandy and loess landscapes. The higher areas are above the former values. We used ArcView 9.1 program for the comparison. After that we intended to investigate the causes of land use changes. The changes occurred through time so link was found between the change and some geographical time parameters.

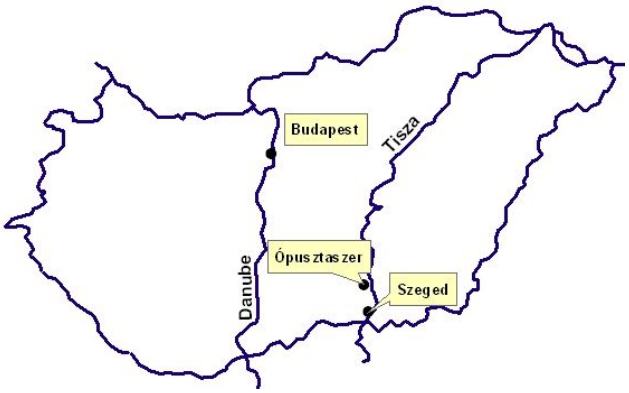

Fig. 1 Situation of the study area in Hungary

2. LAND USE CHANGES IN THE MODEL AREA

The end of the eighteenth century as basis time is advantageous for several reasons. There are enough data and the land use had been similar for centuries. South and Middle Hungary were occupied by the Turkish Empire in the sixteenth and seventeenth century. The population of these areas decreased and extensive animal husbandry predominated because of the prevailing confusion. This farming lasted until the end of the eighteenth century and this situation is described by the First Military Survey. The extension of ploughland increased from the early nineteenth century. It reached its maximum extension in the middle twentieth century. There is a change parallel with the ploughland area increasing; reforestation (*Fig. 2*). The results of the map comparison are the permanent land use patches. There are nine permanent ploughlands, which have been subjected to arable farming for at least 220 years. There are more patches which have been ploughed for 150 years. These patches were compared to the relief of the study area.

2.1. Land use types of the loess plain

There are three permanent cultivated ploughland patches and most of the present ploughland has been under cultivation for at least 150 years. The relationship between the relief and the ploughland is visible (*Table 1*). 51.9% of the permanent cultivated ploughland and 40.71% of the present ploughland are situated on higher elevation. There is little grass land on it, only 4.86% of the total grassland. The rest of the higher areas are forest and built-up areas (*Fig. 3*).

Table 1 The distribution of land use types on loess plain

	Loess plain		Higher part of loess plain	
	hectares	%	hectares	%
Ploughland	668	32.21	272	52.20
Grassland	10988	53.01	53	10.26
Forest	106	5.10	54	10.34
Built-up area	201	9.68	141	27.17

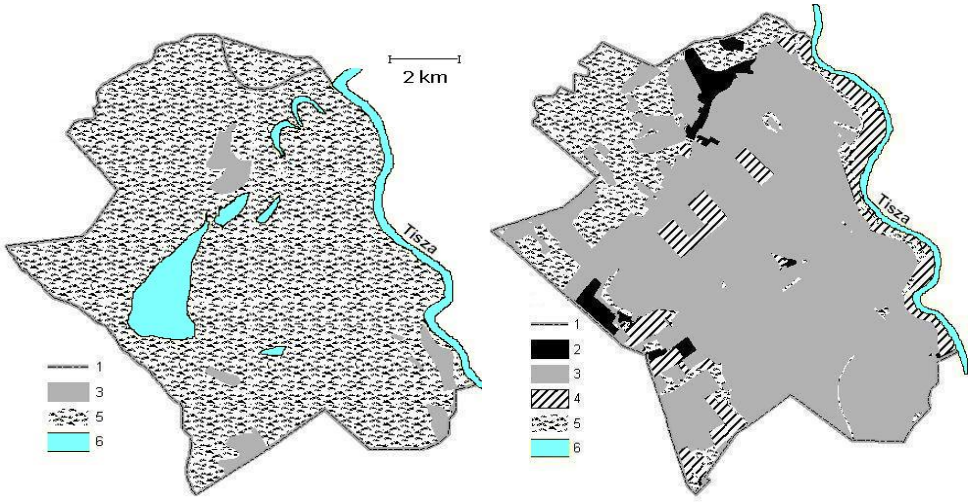

Fig. 2 Land use types of the study area in 1784 (above) and in 1990 (below).
Legend 1- boundary of study area; 2- built-up area; 3- ploughland; 4- forest; 5- grassland; 6- river, lakes.

Fig. 3 Land use on the loess plain (above) and on the higher part of loess plain (below).
Legend 1- boundary; 2- built-up area; 3- ploughland; 4- forest.

2.2. Land use types of the sandy plain

There are two permanent ploughlands and the present ploughland area has been cultivated for 150 years. The relationship between the land use and the relief is similar as well. 87.58% of the permanent ploughland and 98.13% of the presently cultivated ploughland is on the higher area, but only 50.37% of the higher land is ploughed. The rest of it is either forest or built-up area. However the grassland is situated in both types of altitude areas.

2.3. Land use types of the alluvial plain

The permanent ploughland patches are only situated on the higher area. But there is no relationship between the present cultivated ploughland and the relief. Most parallel of the alluvial plains are protected by dams against the river Tisza. The dams were built from the 1850's and resulted in ploughland spreading on the former flood area. The ploughland extends 85% of the surface today. The exceptions are some former river beds and the present flood area.

The relationship between the type of the land use and the relief is evident. The ploughland, the built-up area and the forest have been concentrated on the higher area. The correlation in case of the ploughland is smaller and decreases the parallel with the ploughland extension. The relationship is not significant particularly in the alluvial plain. The former flood plain is protected by dams and canals against the water. Thus the water system of the alluvial plain is the most transformed from the three land types of the study area. The effect of elevation is negligible on the land use.

3. INTERPRETATION OF THE LAND USE CHANGE

Two geographical time parameters were chosen to investigate the relations of land use. One is rainfall, which represents the water regime. The relationship between relief and land use draws attention to the role of water. Changes in the available amount of water or the water moving transforms land use, like it happened in the alluvial plain. The nearest settlement which has long-term climatologic observations is Szeged where the regular measurements began in 1864 (*Hajósy*, 1975). Budapest has longer term time series than Szeged but Budapest is 150 km from Ópusztaszer. Relationship between the data of the two observatories is strong (correlation coefficient of the annual rainfall 0.767 with 133 data pairs). Thus Buda`s data were used completing the data of Szeged in the early term.

The other parameter is the number of inhabitants (*Census of Hungary*, 2001). These data include the population of Ópusztaszer, Baks and Dóc. It was necessary to add inhabitants of Dóc to the population of study area because the data of eighteenth century contain the population of Dóc as well (*Barta*, 1981).

The two parameters mentioned above were compared to the parameters that represent the land use changes. These are the extension of ploughland, forest or grassland at several dates. There is no relationship between the parameters of the land use changes and the ten-year average precipitation. The correlation coefficients are between -0.237 and 0.341 with 7-10 data pairs. If the ten-year average precipitation of each month is compared to the land use change parameters the largest correlation coefficient is -0.689 between the

August average rainfall and the ploughland extension. But this value is too near the value of 5% significance level as well.

The relationship between parameters of land use change and the population is significant. The values of correlation coefficients are 0.961 between the population change and the ploughland extension, 0.791 between the population change and the forest extension and -0.935 between the population change and the grassland extension. All values are above the 1% significance level. Thus there is a clearly visible relationship between the population changes and land use changes. Similar results were published in connection with a Transdanubian study area (*Szilassi*, 2003.).

4. CONCLUSION

Land use is a result of the inhabitants' decisions. The question was what factors influenced the decision. The choice of cultivation type depends on the relief. The relief presumably refers to the role of the groundwater; observations of the groundwater level prove this. The physical landscape factors, like the relief mean only potentialities. The real land use depends on social and economic pressure like the number of inhabitants or increase of population.

This result is acceptable easily in connection with an autarchic community, but this study area was a capitalist estate until 1945. Thus there is the question of whether the change in the number of inhabitants is a cause or a consequence of ploughland increase. This question is difficult to answer because population is considered manpower and consumer at the same time and these are not separated.

REFERENCES

Barta, L., 1981: Az 1828. évi országos összeírás Csongrád megyében. [Country Survey of 1828 in Csongrád county. (in Hungarian)] *Tanulmányok Csongrád megye történetéből 5*, 5-45.

Cadastre map of Pusztaszer 1854. OSZK-TK (National Széchenyi Library, Map Collection)

Cadastre map of Pusztaszer 1877. OSZK-TK (National Széchenyi Library, Map Collection)

Cadastre map of Pusztaszer 1883. OSZK-TK (National Széchenyi Library, Map Collection)

Census of Hungary, 2001: *Területi adatok 6.6. Csongrád megye II.kötet.* [*Local data 6.6. County of Csongrád volume 2.* (in Hungarian)]

First Military Survey, 1784, HMT (Map Collection of Museum of Hungarian Military History), 1:28800

Hajósy, F., 1975. A csapadékok havi és évi összegei Magyarországon a mérések kezdetétől 1970-ig. [The monthly and annual amount of the rainfall in Hungary from the beginning of the measure till 1970. (in Hungarian)] 355.

*Inventory of the Pallavicin's demesne***,** 1868.

Military map, 1950, HMT (Map Collection of Museum of Hungarian Military History), 1:25000.

Military map, 1991, 1:25000

Somogyi, S. and Marosi, S., 1990: Magyarország kistájainak katasztere. [Cadastre of microregions of Hungary. (in Hungarian)] 87-91.

Szilassi, P., 2003: A területhasználat változásának okai és következményei a Káli-medence példáján. [Causes and consequences of land use change on the example of the Káli Basin (in Hungarian)] *Földrajzi Értesítő 52/3-4*, 189-214.

Vályi, K. and Zombori, I., 1996: *Ópusztaszer. Száz magyar falu könyvesháza. [Ópusztaszer. Book collection of hundred Hungarian willages*. (in Hungarian)] 190.