BURIED HUMUS LAYERS IN THE SZIGETKÖZ REGION OF HUNGARY

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Abstract: Naturally buried humus layers arise from soils developed during long interruptions in river sediment deposition and covered with a renewed sedimentation. It was known that there are spots of such layers distributed on the wide alluvial area on both side of Danube river between Dunakiliti and Győr. The share of such known spots in the Szigetköz region was estimated as 3-4% of the whole territory, but it was suspected to be much more frequent as undiscovered.

Buried humus layers may considerably alter the soil agronomic properties, can play important role in environmental protection, and knowledge about the pattern of their distribution can help in describing the sediment development history of the region.

Analysis of more than 1000 soil profiles in the Mid-Szigetköz area proved that spots with buried humus layer can make more than 20% of the territory. However, the spots are usually small, they are not forming large continuous territories.

There are limited data about the surface topography and its change during the time of development of these ancient soils, but the geographic distribution of some local features can help us. Such features are the thickness of Holocene fine sediment covering the gravel layer, and the presence of meadow soils usually occupying relative depressions. The maps of these features were digitised, derived distance maps were generated and overlaid with the digital map of spots with buried humus layers.

For that region the most common fine sediment thickness is 2-3 m. The overlay analysis in GIS revealed that the occurrence of buried humus layer increases considerably at locations with fine sediment thickness greater than 4 m. It proves that deep holes in the former gravel surface provided enough room for repeatedly interrupted sediment deposition.

Distance GIS analysis showed that territories apart from the current meadow soil spots have less probability to accommodate buried soil layers. It seems that some actual depressions indicate their former persistence under the later sediment cover with the presence of buried humus layer.

Key words: Szigetköz, buried soils, sediment, GIS.

VORKOMMEN DER BEERDIGTEN HUMOS BODENSCHICHTEN IN SCHÜTTINSEL

Zusammenfassung: Während der großen Pausen der Ausgüssen können die auf Oberfläche gebildete humos Schichten neue Treibschichten bedecken auf der Hochgebiete der größeren Flüssen, worauf nochmal die Humisierung steigt. So bilden sich die beerdigte humos Gussbodenschichten. Die Eigenschaften, Tiefe der beerdigten humos Bodenschichten, können den Bodengebrauchswert modifizieren.

Der beerdigte Schicht ist selbst verwendungs- und ausförderungsbar.

Nach unseren Untersuchungen in Schüttinsel die beerdigte humos Bodenschichten oftmals vorkommen, wie wir das früher voraussetzten. Ihre Proportion kann 20% erreichen.

Die pünktliche Ortbestimmungen sind bei diesen Boden sehr bedeutend. Die beerdigten humos Bodenschichten Schüttinsels bilden keine große Zusammenhangsgebiete, sondern auf kleinen Flecken zergliedern sich.

Deshalb ist wichtig Koordinaten mit Hilfe von GPS pünktlich fixieren.

Wir können es nach unseren Prüfungen feststellen, dass die beerdigte humos Gussbodenschichten wir in der Schüttinsel oftmals und mit Sicherheit auf den dick bedeckten Gebieten, fern von den Flecken der Schotterten Oberflächen, und nähe der Wiesenbodenflecken finden werden.

Schlüsselworte: Schüttinsel, beerdigte Boden, Bodensatz, GIS

1. Introduction

Soils can be formed on the surface during long interruptions in sedimentation and then can be buried with new sediment layers when new flood periods come. That is the origin of buried soils with second or more humus layers. Properties of the buried layers and the depth of their location can modify the value of the present surface soil. In some circumstances the buried layers can be excavated and used for purposes other than agricultural. Usually the properties of these layers, preserving the photosynthetic energy of earlier times, are not enough known. Being not on the top of the soil, usual mapping procedure does not collect proper information about them. However, soil evaluation and environmental protection projects would need these data.

Geographical investigations (Göcsei, 1979) pointed out the presence of such soils in the Szigetköz area especially near village Vének. More detailed mapping estimated a 3,6% for their distribution in the whole area. There are opinions that the mapping has not paid enough effort for finding them. Sometimes the underlying buried layer was near the later surface soils and looked as their continuation.

The exact positioning technique is essential for mapping of these soils. They usually do not form large uniform territories, but small spots. When the position of the soil profile cannot be registered with high accuracy, the spots can be missed during a repeated tour of mapping.

It was supposed that some soil properties can be correlated with the presence or absence of buried humus layers. Our investigation aimed to find out these correlations, which could give some explanation for the distribution pattern of spots with buried humus layers.

2. Methods

For the investigation a 13000 ha territory was selected in the Mid-Szigetköz region, between Mosonmagyaróvár and Ásványráró, because of the availability of an uninterrupted soil map data there in a scale of 1:10000. Digitized point maps of soil properties, derived from more than 1000 investigated soil profiles, were converted into Thiessen polygons. The classified thematic map for every feature then was split into separate maps, holding the islands of unique feature classes over a zero background. Classified distance maps were created on the basis of the maps of unique feature classes of soil properties. Distance maps then were overlaid by the polygon maps of buried soil spots. Area calculations run on the overlaid distance maps provided the data for determination of a rate, shared by the buried soil spots inside the territory of each distance class of unique soil features.

The thickness data of fine sediment over the gravel layer were derived from a geomorphology layer map (Sharek, 1999), because usual soil profile investigations with their 150 cm depth cannot offer that kind of estimation.

Distance maps then were rated positively or negatively, according to the share of buried soil spots territory on them. A final overlay of all rated maps gave a summarised result, pointing out the areas where the probability to discover a spot with buried layer might be higher then average.

3. Discussion

A typical picture of buried soils of the Szigetköz area is shown in Fig. 1. The buried humus layer at different depth can be located in some fluvisols (alluvial soils) and very rarely in phaeosems or vertisols (meadow soils) or chernozems. There aren't any surface indications helping the spotting of buried layers.

A buried humus layer discovered in a soil profile represents only a point information. Enough frequent and systematic deep sampling permits to convert the point data into polygons. This procedure was made by tessellation, and the results are shown in Fig. 2. The dark spots indicate the territory occupied by buried soils, which make up about 20% of the selected area. There isn't any information about the territory near the Danube riverbed, because the fields under forests vegetation there was not included into investigation. There is a lack of information for the territories under residential areas as well.

Fig. 1. A soil profile with buried humus layer

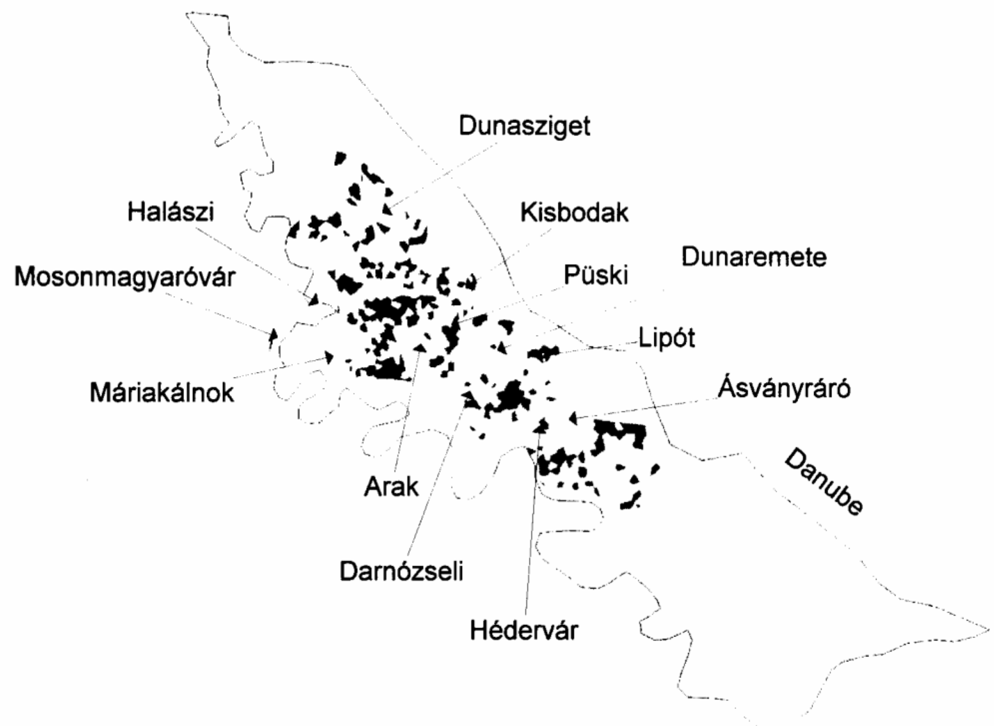

Fig. 2. Buried soil spots of the selected area

Classified point data of some other soil properties was converted into polygon maps also by tessellation. The maps are shown in figures 3-7, and the territory shared by different feature classes can be found in table 1.

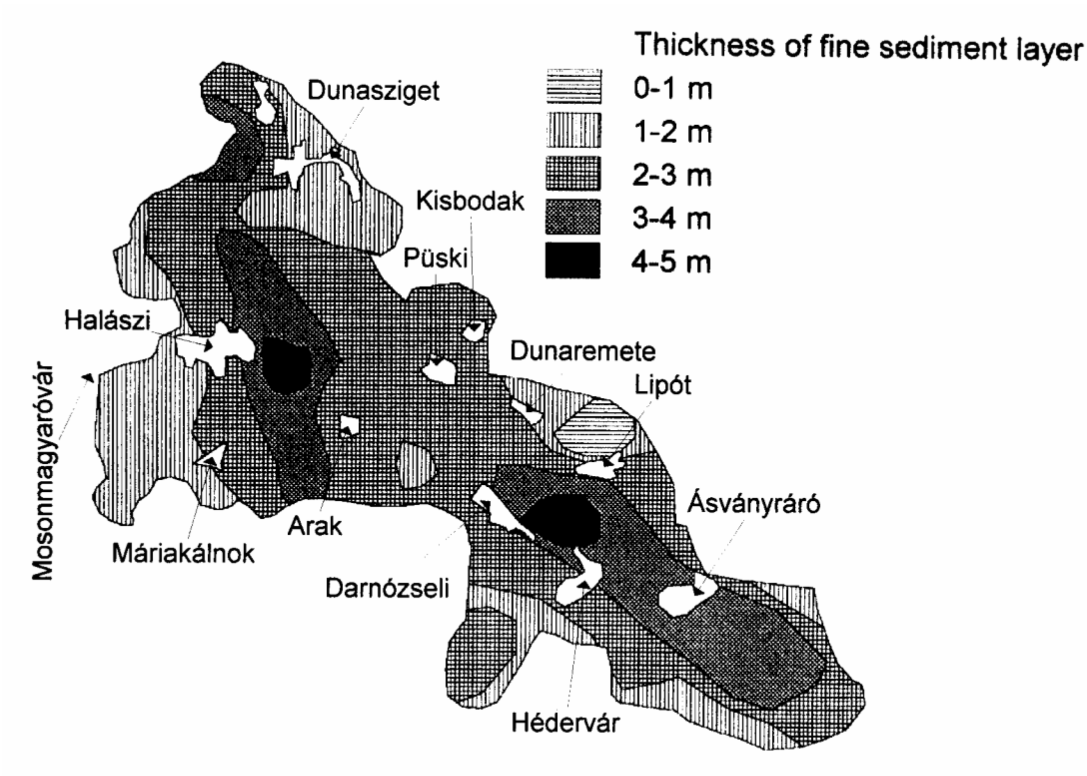

Fig. 3. The thickness of fine sediment layer

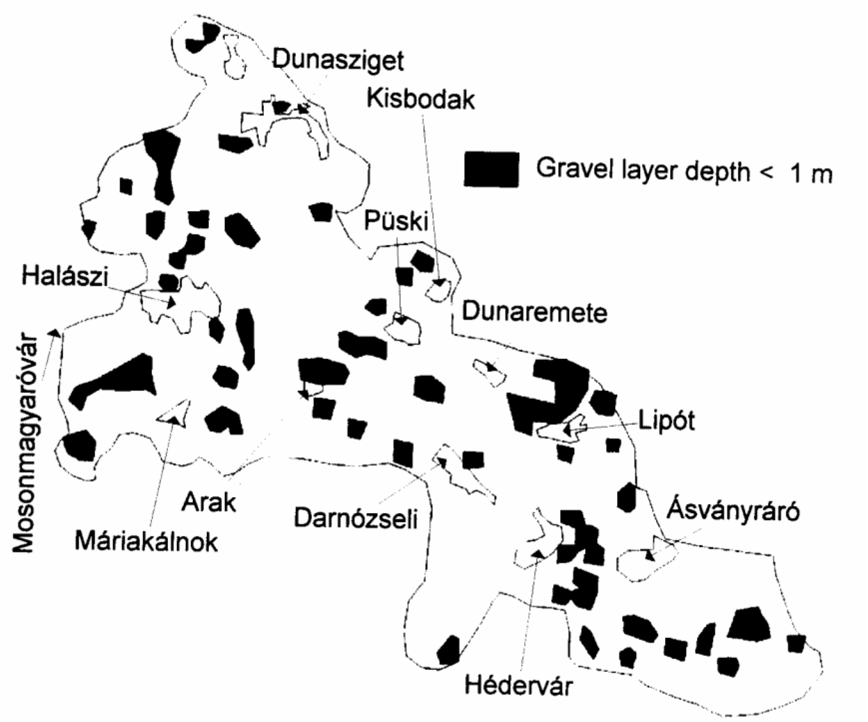

Fig. 4. Gravel layer distance from soil surface

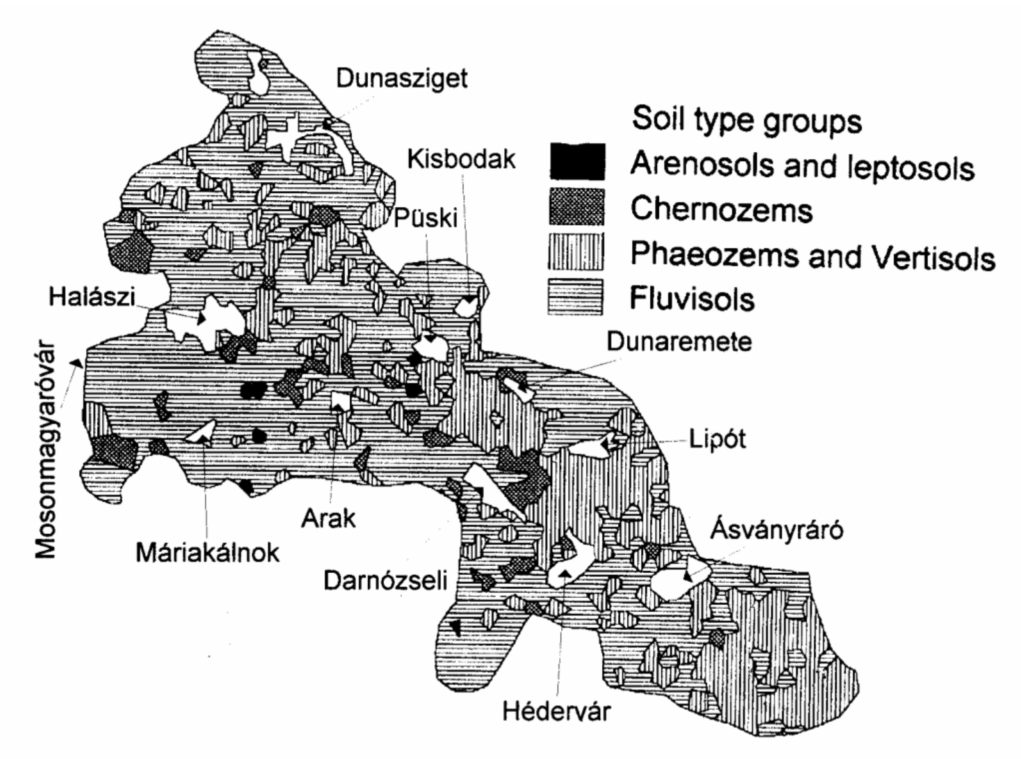

Fig. 5. Soil of the investigated area

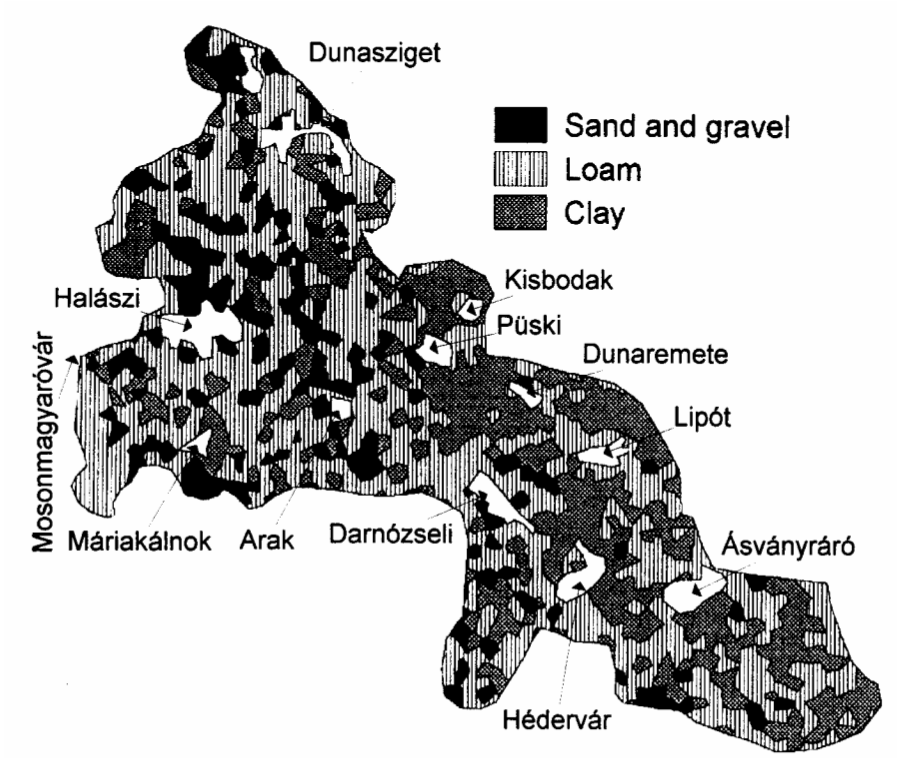

Fig. 6. Texture of the plough layer of the soils

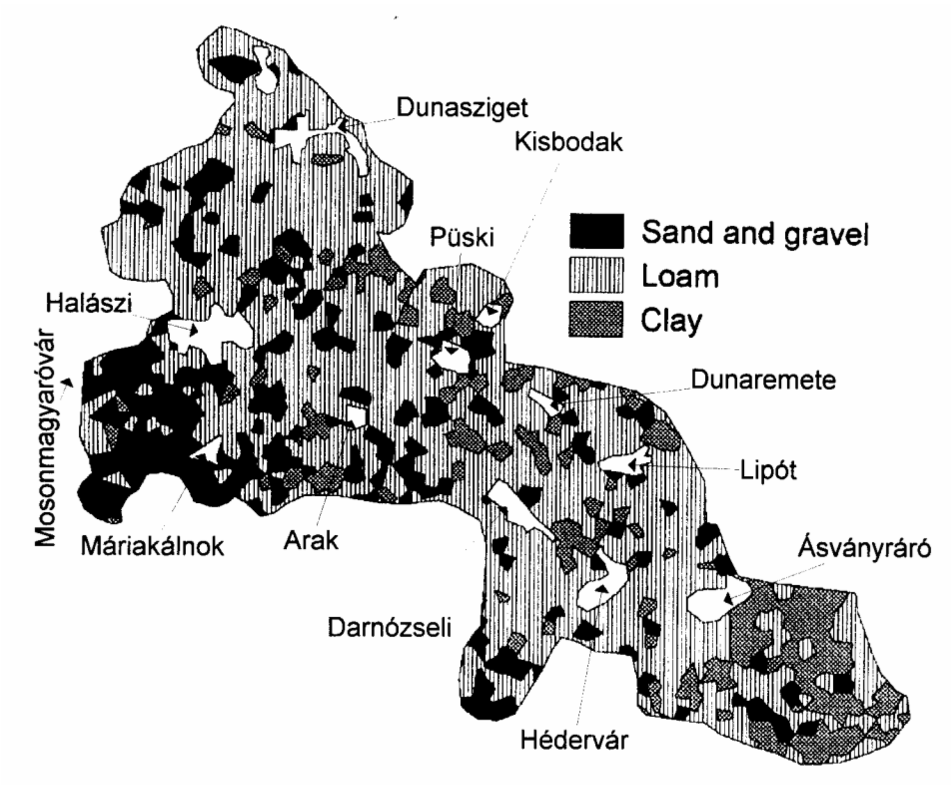

Fig. 7. Texture of the parent material of the soils

Table 1. The territory shared by different property classes

Feature class	Occupied % of the investigated area (13375 ha)
Thickness of fine sediment layer	
0-1 m	1.7
1-2 m	24.0
2-3 m	49.4
3-4 m	22.1
4-5 m	2.8
Distance of the gravel layer from soil surface	
< 1 m	13.5
Soil type groups	
Arenosols and Leptosols	0.5
Chernozems	5.6
Phaeozems and Vertisols	29.7
Fluvisols	64.2
Texture of the plough layer of the soils	
Sand	16.0
Loam	52.9
Clay	31.1
Texture of the parent material of the soils	
Sand	20.9
Loam	64.5
Clay	14.6

The most frequent fine sediment thickness over the gravel layer is 2-3 m (Fig. 3., table 1.). There are 4-5 m deep holes in the gravel surface. These holes were filled with fine sediment gradually, and during the pauses in sedimentation they make room for soil development buried by later floods. The proportion of buried soil spots in the area of 4-5 m thick fine sediment is the highest (table 2.), gradually decreasing towards shallow sediment territory.

Table 2. Occurrence of buried humus layers depending on the distance from the spots with certain feature classes

Feature class	Distance from the spots with certain feature classes, m				
	0	0-100	100-500	500-1000	> 1000
	Rate of the territory with second humus layer, %				
Thickness of the fine sediment cover layer = 4-5 m	56,86	36,74	31,12	25,10	18,86
Texture of the parent material of the soils = clay	41,16	21,54	18,24	15,34	16,25
Texture of the plough layer of the of the soils = sand	19,37	21,11	21,55	23,75	-
Texture of the plough layer of the of the soils = clay	18,82	23,33	21,86	24,21	-
Soil type = Phaeozems and Vertisols	14,10	32,78	28,19	13,39	2,38
Distance of the gravel layer from soil surface < 1 m	16,69	16,76	18,64	23,76	27,86
Water canals	-	18,59	19,21	23,45	28,90

There is a 13.5% of the investigated area, where the gravel layer is nearer then 1 m to the surface (Fig. 4., table 1.). That feature causes less then average frequency of the occurrence of buried layers (table 2.). In rare occasions, when the gravel layer is nearer to the surface then 60 cm, the buried layer, if any, cannot be differentiated from the surface soil.

64.2% of the territory is occupied by fluvisols (alluvial soils) (Fig. 5., table 1.). About 30% of these soils accommodates buried soil layer. In consequence, the identification of the soil type alone does not mean a complete guarantee for the location of the buried layers.

The territory proportion of buried layer spots is elevated in the near neighbourhood of phaeosems or vertisols, but rather decreased when moving far from them (table 2.). It suggests that the buried layers can be considered as continuation of phaeosems or vertisols under the cover latterly developed fluvisols.

In case of clay texture of the parent material of soils the share rate of buried soil spots will be increased (table 2.). Unfortunately that can be detected on the surface (Fig. 6-7.). The determination coefficient calculated between the texture of the parent material and the texture of the surface soils is equal to 0.12 only. However, the positive correlation existing between the clayey texture of the parent material and the territorial share of buried soils also supports the idea about the former phaeosem or vertisol origin of the buried layers, because these soils tend to have clay texture.

It seems that the present canals do not indicate the places with buried layers (Table 2.), perhaps they are not running through the former depressions.

By the way of overlaying the rated distance maps of unique soil features a map was created (Fig. 8.), pointing out the areas with elevated probability for locating buried layers.

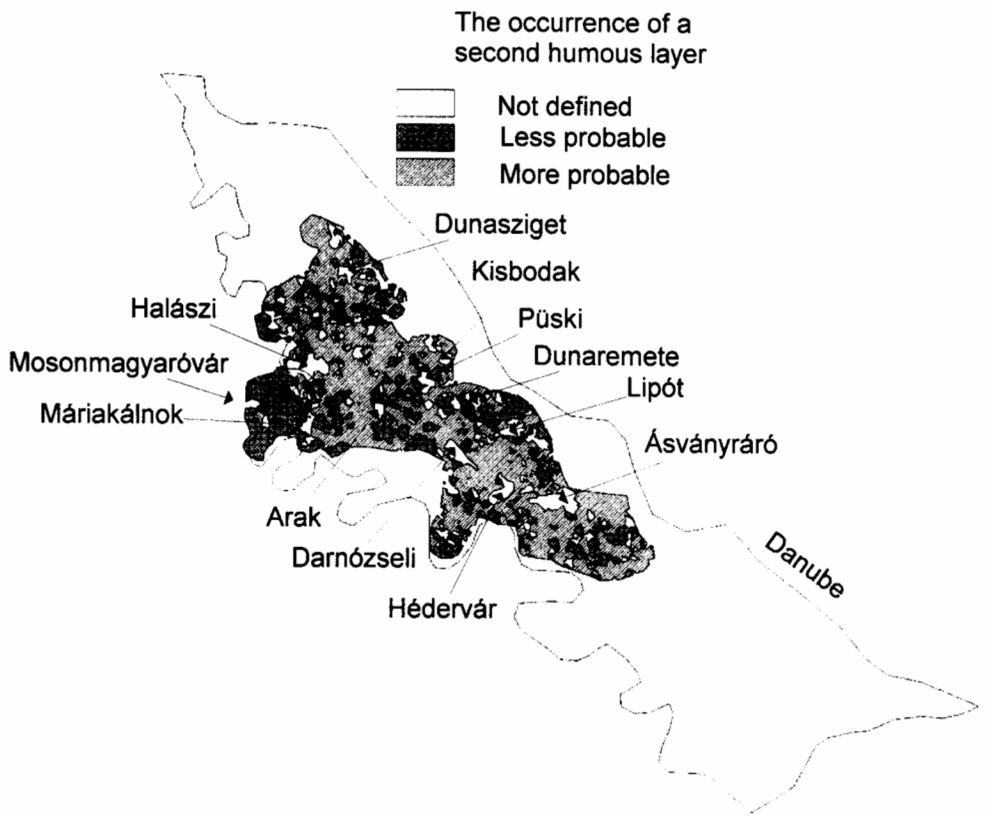

Fig. 8. The probable occurrence of second humus layers of soils in Mid-Szigetköz region

4. Conclusions

According to the investigation carried out, buried soil in the Szigetköz area may have territorial share about 20%. These soils can have more than average proportion on the territories with deep fine sediment layer, where the parent material of the soils is clay, on the spots neighbouring the places occupied by phaeosems or vertisols and not near the present canals.

5. Acknowledgement

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6. References

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