The geography of the Körös/Criş[1] river system

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Introduction

The Körös/Criş river system consists of the following four main rivers: Berettyó/ Barcău, Sebes-Körös/Crişul Repede, Fekete-Körös/Crişul Negru and Fehér-Körös/ Crişul-Alb. After the junction of the Fekete-Körös and Fehér-Körös the river takes the name Kettős-Körös and after the confluence of this with the Sebes-Körös, the river is named Hármas-Körös. The Körös rivers represent one of the most developed river systems tributary of the Tisza River.

The drainage area of the Körös/Criş river system covers a surface area of 25,778 km^2 with an equal territorial distribution between Hungary (12,941 km^2) and Romania (12,837 km^2). The full length of the river system is 949 km.

River	Length of the main course km			Surface of drainage basin sq. km		
	On the territory of		Full length	On the territory of		Total
	Hungary	Romania		Hungary	Romania	
Berettyó/Barcău	78	118	198	4116	1979	6095
Sebes-Körös/Crişul Repede	59	148	207	6694	2425	9119
Fekete-Körös/Crişul Negru	24	144	168		4476	4645
Fehér-Körös/Crişul Alb	10	238	248	318	3957	4275
Kettős-Körös	37		37	1744		
Hármas-Körös	91		91	12941		
TOTAL			949	12941 + 12837 =		25778

Table 1. Morphometry of the Körös/Criş river system

1 The first name is Hungarian, and the second Romanian.

The hydrographic basin of the Körös/Criş rivers extends over three large landforms: highland (the Western part of Munţii Apuseni), hill-country and plateau (Western Piemontane Hills) and lowland (eastern part of the Hungarian Plain, named Plain of Körös/Criş rivers). The difference between the highest point (Vlădeasa Mt.1836 m) and the lowest one (the mouth of Hármas-Körös) is about 1750 metres.

Munţii Apuseni (Apuseni Mts.): Part of the Western Carpathians, the Apuseni Mts. stretch from Someş to Mureş river. Within the bounds of the Körös rivers hydrographic basin they consist of a central part -the Bihor Mts. which is the highest apart, and four lower ridges: Metalici-Zarand Mts., Codru Mts., Pădurea Craiului Mts.and Plopiş Mts, running more or less in an East-West direction.

Except for the central part — Bihor Mts. —, where the altitude reaches 1800 m above sea level, the ridges remain at about 1500 m.

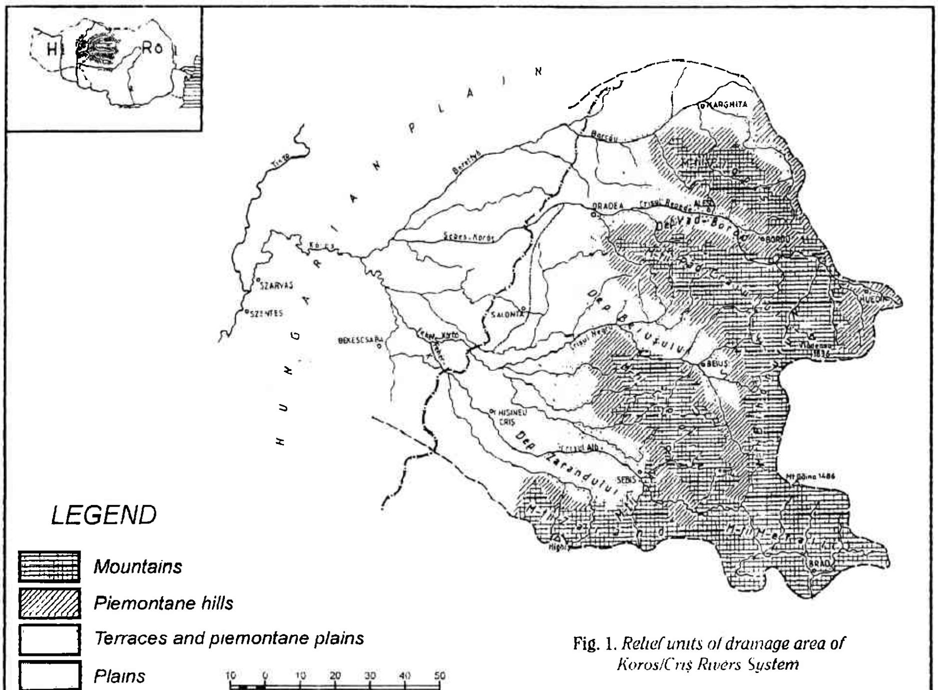

Fig. 1. *Relief units of drainage area of Koros/Criş Rivers System*

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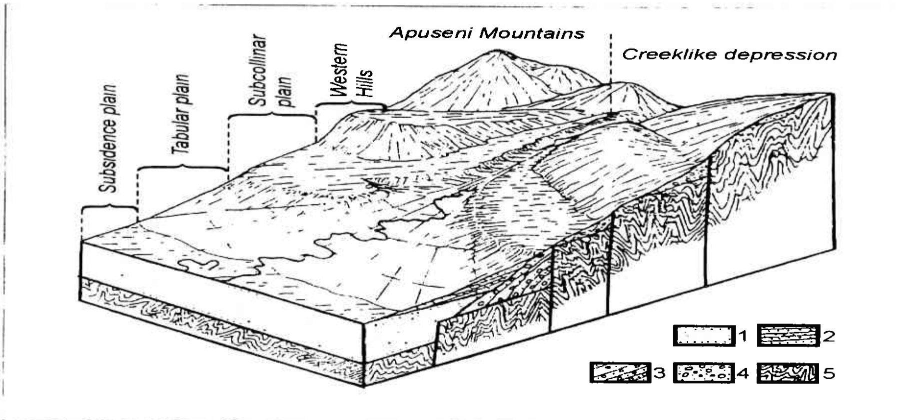

Fig. 2. *Sketchy block-diagram showing the stepped character of relief.*
1- Actual continental sediments; 2- Holocene fluviatile deposits; 3- Fossil fan-tallus; 4- Piemontane sedimentary formations; 5- Crystalline rocks.

Petrographically the Apuseni Mts. have a mosaic-like structure, with a hardly distinguishing disposition of the structural zones. On the whole, they have an insular position, underlined by several surrounding sedimentation basins. On the western border, these basins penetrate deeply towards the interior of mountains, taking a creek-like shape.

Another specific physiographic character of the Apuseni Mts. derives from a large development of karst relief, due to the widespread presence of limestone.

The Western and Southern slopes of the Apuseni Mts. are covered mostly by beech, the coniferous forests appearing only on the central high ridges of the Bihor Mts.

Due to their position, the Bihor Mts. play the role of a veritable climatic barrier against the humid currents of air from the West. This situation causes abundant precipitation on the western slopes of the Apuseni, the annual average value exceeding 1300 mm, while on the eastern border of the Hungarian Plain it is about 630 mm.

Several lower ridges branch off to the west from the central nucleus of the Apuseni Mts., and penetrate like tentacles towards the Hungarian Plain, separating the creek-like depressions of Zarand, Beiuş, Vad-Borod and Şimleu. In spite of their low altitude, these ridges receive a relatively high quantity of precipitation (700-900 mm). (Fig. 1., Fig. 2.)

The piemontane hills: Except for the western border of the Zarand Mts., the piemontane hills form almost a continuous belt between the mountains and the lowland. Only the Mountains of Zarand pass directly to the lowland. The piemontane hills display a stepped configuration with two levels, one at 500-600 m above sea level, the other at 300-400 m. As a rule, the upper one is well covered by deciduous forest, while the lower step has an agricultural character.

The limit between the hilly country and the lowland is vague, therefore the contour line of 200 metres is conventionally considered as being the limit between the two relief units.

The Körös/Criş Plain: Belonging to the Hungarian Plain, the Körös/Criş Plain genetically is a continuation of the hilly country, as a result of filling up of the Pannonian Sea with coarse alluvia carried by waters rushing down from the surrounding mountains. The torrential streams deposited a significant quantity of coarse alluvia on the shore of the former Pannonian Sea, the Hungarian Plain of today.

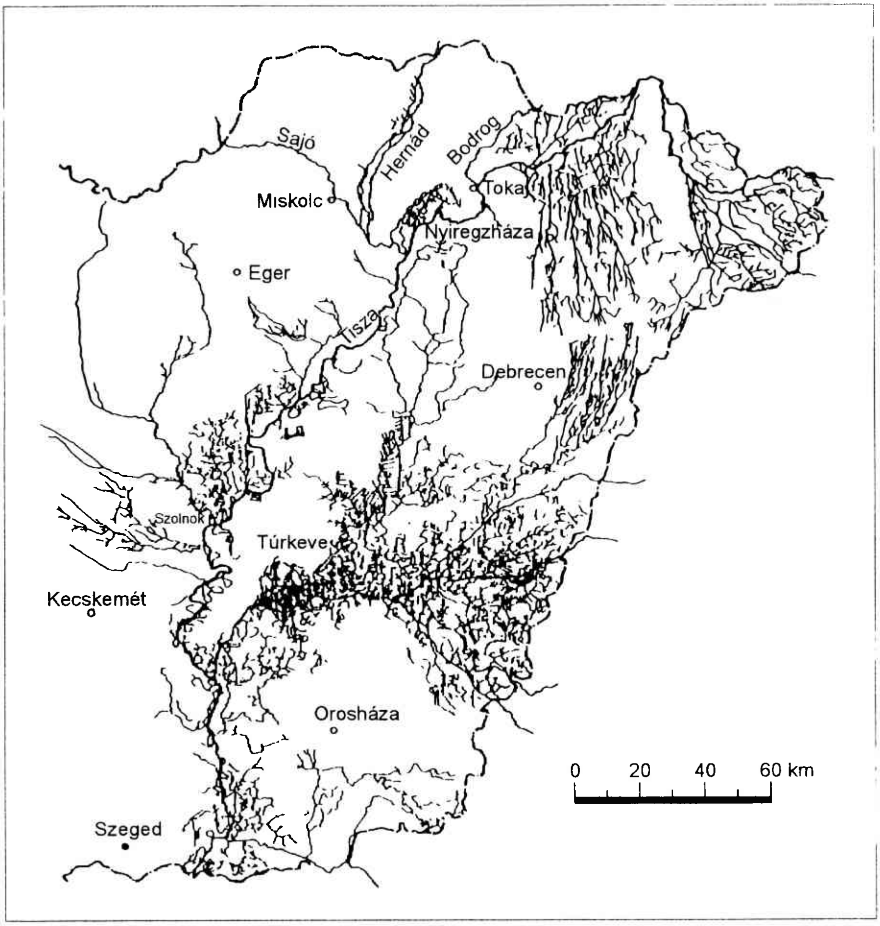

Fig. 3. *Canal network in the Hungarian Plain section of the Trans-Tisza Region*

The Hungarian Plain has been subsiding at the end of the Pliocene, and this process continued throughout the Pleistocene and even in the New Holocene. A westwards steeped inclination of the lowland can be observed, each step representing a stagnancy stage of the withdrawing sea. Two main levels of the Körös/Criş Plain can be slightly distinguished: the upper or tabular plain, and the lower or subsidence plain. The plain is deeply inserted into the creek-like depressions, along the rivers.

Resulting from the history of geological development, it is a characteristic feature of the Körös/Criş rivers pattern that it is a centripetal one. As a corollary to the recent sinking of the confluence area of rivers belonging to the Körös/Criş system, there were a lot of permanently and intermittently inundated areas, a fact to hinder the social and economic progress almost up to the present. This hydrographical situation was fundamentally changed by the large-scale water-regulations and the inland waters drainage completed mainly in the last century (Fig. 3.).

These, being so far the largest intervention into the natural environment, have resulted in various qualitative changes in the lives of rivers, in the local and microclimate of the affected area, in the composition of the flora and fauna as well as in the dynamics of soil formation. But there also have been changes in the living conditions of the population, and consequently changes in the nature of the economic life, the appearance of settlements and the transportation network.

In spite of their highly respectable scale and regional extent, these last century, social interventions cannot be considered final. Because of the transitional character of the climate in this steppe area it should not only provide protection against damages by water, but occasionally and even more frequently, against drought as well. The main target of this struggle is the permanent assurance of irrigation possibilities for as large agricultural areas.

A lot of natural land forms, such as abandoned river beds, levees, drainless areas, as well as anthropogeneous objects such as artificial levees, canals, cut-off branches and oxbows stand partially at the origin of excess water.

Soils of the drainage area of Körös/Criş rivers system

The soil cover in the study area is closely connected with the relief and altitudinal plant-belts respectively. The following main dominant soil groups have been distinguished (Fig. 5.).

Chernozems, gleyed chernozems and alkali-bazed chenozems soils, which appear for the most part on well-drained inter-river plains of the lowland, developed on medium loamy deposits with a permeability ranging between good-medium. These are the most fertile soils of the drainage area.

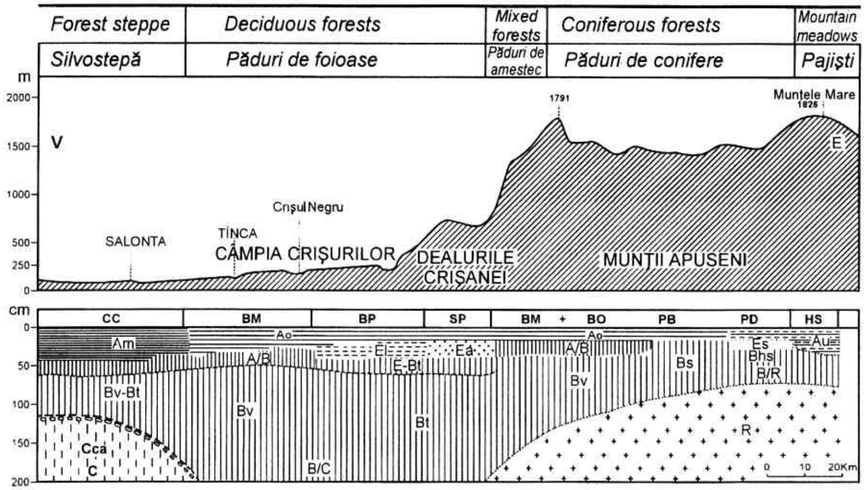

Fig. 4. *Relations between soils, relief and vegetations.* CC- chernozem; BM- brown earth; BP- argillic brown forest soil; SP- luvisol; BO- acid brown soil; PD- podzol, HS- histosol

Hydromorphic steppe soils (Humic Gley soil and Low-Humic Gley soil) are spread in the poorly drained, sinking convergence area of Körös/Criş Rivers Plain. They are developed on silt and clay with low permeability.

Halomorphic soils (Solonetz, Deep solonetz, intermixing of Solonetz and soda-rich Solonchak Alkali soils): They appear in the vicinity of hydromorphic soils in saucer-like micro depressions with superficial water table.

- Argillic Brown Forest soils and Luvisols represent the dominant soils of the hilly country and that of the lower part of the mountains under deciduous and mixed forests. On the plateaus they are frequently pseudogleyed, while on the steep slopes, especially when the natural plant cover is missing, they are strongly eroded
- Podzols and Acid Brown soils characterise the highest part of the drainage basin of Körös/Criş rivers. They are soils showing a shallow profile, developed on hard rocks (except limestone) under coniferous forests.
- Rendzina developed on limestone, widespread in the Bihor and Pădurea Craiului Mts.
- Soils of the flood plains comprise alluvial protosoils, alluvial soils, and Gley soils.

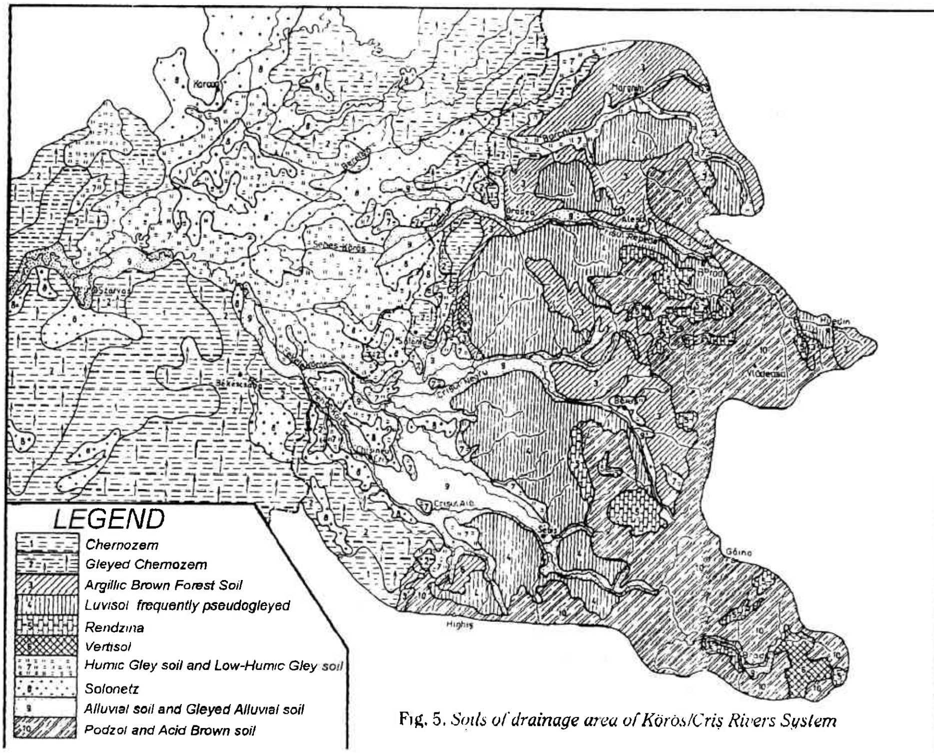

Fig. 5. *Soils of drainage area of Körös/Criș Rivers System*

The alluvial protosoils represent the young alluvia. In most cases the soil-forming processes are incipient or absent, because of more or less frequent flooding that hinder pedogenesis.The spreading of alluvial protosoils is limited to the active flood plain, or the flood-controlled stripe. Generally they are stratified, having a loose consistency and coarse texture (gravels, sands, loamy sands) especially in mountainous areas. However, they occasionally can be moderately coarse-textured (sandy loam) and medium-textured (loam and silt), mostly in the lowland region. These soils have a low organic matter and clay content, and consequently a weak cation exchange capacity, low retaining power and low buffering capacity.

Due to their particle-size distribution and the lack of an impermeable layer, even in the deeper levels, most of the alluvial protosoils are excessively permeable. Therefore, they cannot retain a great part of the substances which pollute the running waters. In this respect the storage of various wastes on the active flood plain can be harmful for the rivers. When the alluvial protosoils are covered with vegetation, their retaining and filtering power becomes more efficient.

The alluvial soils occur in various stages of development and fertility, on the flood water-free, or rarely flooded higher level of the rivers plain. Contrary to alluvial protosoils their upper — Ao or Am — horizon is deep, with a humus content exceeding 2—2,5%. The clay content is also higher, compared to that of alluvial prorosoils. In the area of creek-like depressions, the gley soils are spread mainly in the deep-lying marginal stripe of the flood plain. The important river regulation and floodwater prevention works that were performed in the lowland area led to significant changes in the position of the riverbeds. As a result, the actual flood plain is full of cut-off branches and oxbows, filled up with poor water-conducting, silty and clayey deposits, favourable for hydrogenic soil-forming processes (Fig. 4., Fig. 5.).

Conclusions

The Körös/Criş river system, with its 25,778 km^2 drainage basin, is one of the most important tributaries of Tisza River.

The abundant spring rain, frequently accompanied by a thaw, leads to floods almost every year, causing catastrophic inundation on the lower section of the rivers.

No natural pollution exists in the drainage area. The deterioration of the water quality is caused by anthropogenic pollution in the mining district of upper Fehér-Körös/Crişul Alb basin (Brad and its environs), and in the oil field of the Berettyó/Barcău river (Suplacu de Barcău) and the area west of Oradea (Borş). The industrial areas and agglomeration of human settlements, e.g. Oradea e.g., are to a large degree responsible for the water pollution.

The danger of water quality deterioration is the highest in the lowland area, where the permeable soils and deposits make possible the infiltration of different chemical materials, originating from industry and agriculture as well as from households.

It is to be noted that there is an important purification process carried out by the filtering and buffering power of those alluvial soils which have a relatively high content of organic matter and clay.

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