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RIVERS, MARSHES & FARMLANDS

RESEARCH PERSPECTIVES ON THE ECOLOGICAL HISTORY OF HUNGARY THROUGH EXAMPLES OF BODROGKÖZ (NE-HUNGARY)

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In the last millennium one of the most important changes in the natural environment of the Great Hungarian Plain was the process of river regulation. Although the Plain was formed by the alluvial deposits of two main rivers, the Danube and the Tisza, the former runs at the edge of the lowland, while the latter flows right through the middle of it. Consequently, the regulation of the Tisza and its tributaries had a much more widespread environmental impact. The process deserves a closer look from the point of view of historical ecology/environmental history. Regulation works initiated a dramatic change in the adaptation strategies of people living along the rivers.

Keywords: Danube, Tisza, Bodrogköz, regulation, drainage, channelization, environmental history, ecology, land use

From the foothills of the Carpathian Mountains up to its confluence with the Danube, on both sides of the river Tisza the key economic driver, even before regulation, was agriculture. However, this activity was accompanied by multi-purpose use of the flood areas (pasturing, fishing, gathering), and was influenced primarily by natural factors, mainly elevation and geomorphology. After channelization and drainage, soil-conditions became important, but these had only a restrictive role. The influence of the natural environment was decreasing, while that of the economic and the social environment was growing.

The paper investigates the steps and characteristics of this process, focusing on the changes in land use patterns of the area. Examples were chosen from the Bodrogköz, a region in the northeast part of the plain. As a conclusion, an attempt was made to underline some factors that should be taken into consideration in the sustainable development of the Tisza Valley in the 21st century.

Bodrogköz is a triangular flood-plain area of 940 km^2 in the northeast part of the Carpathian Basin. It is bordered by three rivers: Latorca in the north, Bodrog in the west, and Tisza in the south-east. It is an “island on the mainland.” It is connected to the other parts of the plain lands by a bottleneck less than two kilometers

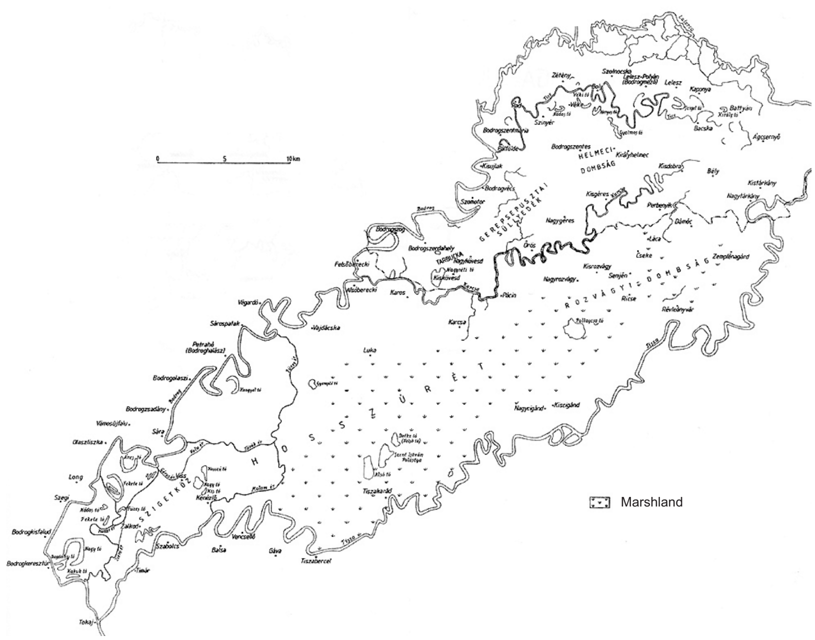


Figure 1. Surface waters of the Bodrogköz before the regulation of the rivers

wide. Two previous branches of the Tisza river meandering from east to west (and now nearly completely dried out) are found in it. Closer to the Latorca is the Tice and to the south of the Tice is the Karcsa. As a consequence of the peace treaties concluded in the wake of World War I, the Bodrogköz area was cut in two by an international border along the Karcsa, the northern part belonging to present-day Slovakia, the southern part to Hungary, although according to the census of 1910 more than 90 per cent of the population was Hungarian speaking.

The geographic boundary of the territory does not correspond to the historical-cultural-economic boundaries. Only fifty settlements had been part of the historical county of Zemplén since medieval times. Three villages (Kenézlő, Viss, Zalkod) in the southwest corner, also named Szigetköz ("Island between"), were part of county Szabolcs. There were no independent settlements on the left bank of the river Bodrog south of Vajdácska, and this area was used as meadow lands by communities on the right-bank. Some villages to the left of the river Tisza also have meadows in Bodrogköz. These differences were caused by the geography of the region. It was easier to communicate with the outside world by crossing the rivers than by crossing the surrounding marshlands.

Bodrogköz is a flood-plain at an elevation lower than 105 meters. There are two hilly regions above 150 meters, the Tarbucka and the Helmeci hills in the northern part. One also finds sandhills along the Tice and in the eastern corner between the Tisza and the Karcsa (the so-called Rozvágyi hills), but small sand dunes (4–10 meters high) can be found all over the area, even in the middle of the lowest areas. The three rivers and the two dried up branches run on a small ridge (natural levee) accumulated by the alluvium of the rivers. The deepest, and therefore in the last centuries most often flooded areas lie along the rivers (mainly the Bodrog and the Tisza, as the Latorca is much smaller) outside the ridge, and in the central area between the Karcsa and the Tisza, namely Hosszúrét ("long meadow") and Nagyrét ("large meadow"). A low lying area around Gerepsepuszta between the Tarbucka and the Helmeci hills was better sheltered by the surrounding hills.

There were a lot of small lakes and runlets among the hills and in the lowlands. Some of them were active only during periods of flooding. The flood waters usually could not flow back to the rivers, so they formed swamps and marshes fed by precipitation and water logging processes (Valter, 1974, 4–6). The main rivers were bordered by ox-bow lakes. Some runlets, especially in the south-west areas, had more importance. They separated the territory of the villages.

Resources[1]

In the Carpathian Basin the most dramatic changes in the environment in the 19th and 20th centuries, which were followed by dramatic changes in economy and land use, were river regulation projects and the channelization and drainage of floodplains and marshes. In Bodrogköz the Tisza and Bodrog rivers were regulated from the 1850s to the 1870s, and drainage was completed in the last decade of the 19th century and the first decade of the 20th, respectively. The Latorca river, which borders Bodrogköz in the north, was not regulated, and the southwest corner of Bodrogköz was not drained until the 1960s. The impacts of regulation and drainage on land use patterns can be tracked using various resources, mainly maps and statistical data.

Maps of farm land re-allotment in the different communities, dating mostly from the 1850–70s, are available in the county archives (for Bodrogköz, the Zemplén County Archive in Sátoraljaújhely) and in the National Széchényi Library. Maps of the temporary cadastrial survey in 1851–55 are kept in the National Archive. General maps can also be used for the purposes of following the changes in the environment and land use patterns. The county maps of the cadastrial survey of Hungary between 1875–85 are in the collection of the National Széchényi Library, too. Three military surveys (1782–85, 1819–69, 1872–84) were executed within the territory of Hungary. As their sheets are now available on DVD, they can easily be accessed.

The other data are statistical. From the first half of the 19th century the Statistical and Geographical Survey of Hungary by Elek Fényes (1836–40) can be used.

The printed material of the temporary cadastrial survey of 1851–55 was published on the order of the Governor in Council of Hungary in 1865. The most reliable sources are the printed surveys of the Hungarian Statistical Office. The most commonly used ones include the Cadastrial Survey of 1875–85, the Agricultural Statistics showing the situation of November 10th, 1895, and Cadastrial Correction, executed pursuant to Act No V, 1909. Geographic data can be processed by cartographic elaboration and statistical data by computing, while verbal and written textual data collected are subject to ethnographic interpretation. Changes in environment and the land use patterns can be summed up as follows.

Before River Regulation

At the beginning of the 18th century the settlement pattern of the area under investigation had already been developed (Valter, 1974, 11–33). Villages were formed at the natural boundary between flood-prone and flood-free areas in order to take advantage of both conditions (Réfi-Oszkó, 1987, 37–38). Adaptation to these environmental conditions resulted in the so-called flood-plain management that characterized peasant-economy along the major rivers in Hungary almost up to the 19th century.

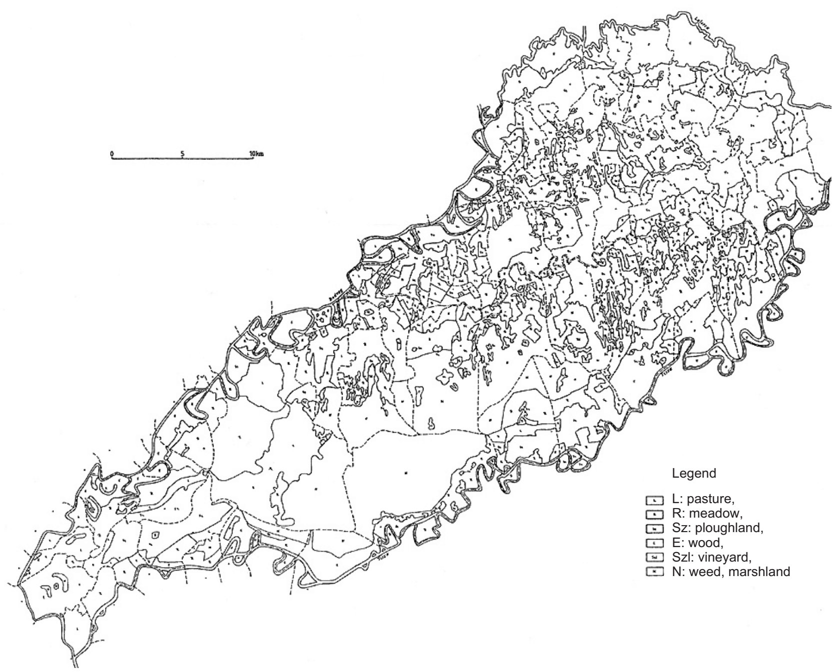


Figure 2. Land use patterns in 1855

Flood-plain management in Bodrogköz was based on agriculture, although farming was restricted to the flood-free areas, which in some villages were very small. Forests were cut and burnt to increase farmable land, and peasants, especially those from villages along the Tisza and the Bodrog, leased arable land in the neighboring county of Szabolcs (Vályi, 1799/2, 288; Pesty, 1864). Even on the more fertile lands, farming allowed only for self-subsistence. On the other hand, utilization of flood-plains and flood fringes had a far greater importance, in particular through animal husbandry complemented with bee keeping, fishing, hunting and gathering (Dankó, 1986, 22–23).

Various agricultural zones were formed in accordance with the elevation of the land. Open waters were used for fishing. Lakes and riversides covered by vegetation were subject to gathering. Gallery forests and temporarily inundated areas were exploited as orchards and grazing lands. When water was high, cattle grazed in the higher areas, in dry periods, in the lower areas. Hay was collected from the upper areas of marshlands and from meadows below cropland. Flood-free areas, in some cases very small, included sites for human settlement, woods suitable for masting (keeping free range pigs fed on acorns), and most important of all, arable land. In the small hills there were usually vineyards and forests,and they were also used for grazing.

Expansion of the various zones depended on the height of the flood in the given year, which also determined the main source of subsistence. However, considering that all kinds of cultivation were practised, there was always a chance to survive. Over the course of the 19th century farming became the key factor, and it also spread to the lowlands.

In the middle of the nineteenth century the two most important events in Hungary from an agricultural point of view were the abolition of serfdom and the effects of the corn-boom in the global economy. As the old and anachronistic agricultural structure and techniques did not change, the only way to increase agricultural production and to take advantage of the boom was to expand the size of land under crop. In Bodrogköz the only way to do so was to regulate the rivers and channelize and drain the marshlands (Szabad, 1979, 555–559; Réfi-Oszkó, 1987, 88).

River Regulation and Drainage

External factors motivating river regulation and subsequent channelization and drainage of marshlands could be summarized as follows:

1. The need to increase agricultural production.
    a. This could be achieved by the extension of arable land, but it was hindered by the marshlands along the rivers (Lászlóffy, 1982, 164–165).

b. According to the old laws, landlords owned marshlands, but peasants had the right to use them. By draining the marshlands the arable estate of landlords increased, so they urged channalization. Peasants were against it, as for them it entailed a loss of a source of income (Balassa, 1975, 225).

2. The increasing population (Lászlóffy, 1982, 194).
3. Forest clearing along the sources of the rivers caused increasing erosion and higher and more intensive floods.

The first comprehensive plans for regulating the rivers in the Tisza valley were completed in the middle of the 19th century, but political, financial and technical problems prevented implementation until the last decades of the century. In 1895 two of the three bordering rivers of Bodrogköz, the Tisza and the Bodrog, were controlled, and after the turn of the century drainage was also nearly completed.[2] (As mentioned before, the regulation of the smallest river, the Latorca, and drainage of the southwest corner of Bodrogköz took place only in the middle of the 20th century.)

Regulation and drainage had several geographic consequences. Water level fluctuations increased. The run of the floods was faster but higher. Accumulation of deposits in the floodway between the dikes became more intense, as silt could not spread over the flood plain. The previous flood plain became flood-free and subject to agriculture. There was very little and slow silting here. The original flora and fauna became extinct. The microclimate became drier. Wind-erosion increased. Soils changed. Some became drier and more alkaline, while soils previously in semi-flooded areas improved in quality (Somogyi, 1967, 153–56).

After the Regulation of the Rivers

As the main aim of channelization and drainage was to change the structure of land use patterns and to increase the size of land under crop, the changes were of course characterized by this process. Previous marshlands and swamps in the low lying areas became wet pastures in the first stage. After drainage, some of them were converted into arable land. Previous pastures and meadows of the semi-flooded areas were turned under the plough, too. The process was also characterized by the clearing of the remaining forests, converting the land to pastures and arable land, too. Thus the area of arable lands expanded from the hilltops to the hillsides, to the riverbanks and later even to the drier parts of the lowlands. Agriculture lost its special flood-plain character and became more general.

On the other hand, village sites suffered a different type and extent of change after the regulation and drainage. Based on the extent of the two main processes,

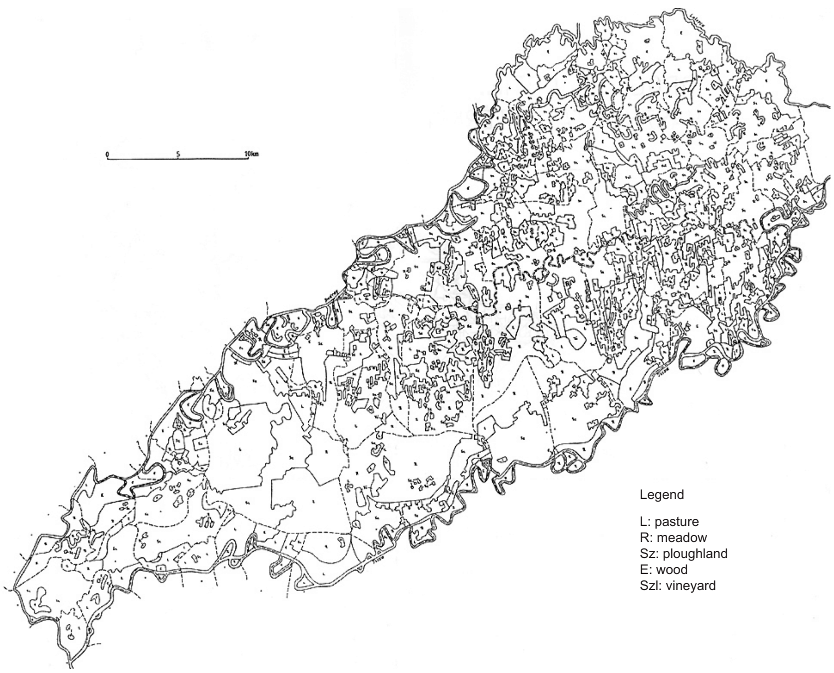


Figure 3. Land use patterns in 1880

extension of arable land and the disappearance of barren land, Bodrogköz settlements can be arranged in groups as shown on the following map.

The most intensive changes can be seen in the territory of the villages around Hosszúrét. Settlements in the east and middle part of Bodrogköz suffered fewer changes, and the territory of villages between the Latorca and the Tice and along the northern part of the Bodrog remained nearly untouched. This means that the most thorough changes took place in villages around the plains. Settlements along the Bodrog river and the villages that were further up from both the Tisza and the Bodrog were less affected. The land use structure of the settlements in Bodrogköz became more homogenous.

Computer Analysis

The natural and economic changes in the Bodrogköz after the regulation of rivers and drainage can also be investigated through a mathematical analysis of the body of data that characterizes the natural and economic environment of the settlements. Through an analysis of the connections between the various factors, internal correlations can be identified which cannot be detected in any other way. The study is based on a cluster-analysis that arranges the 53 settlements of

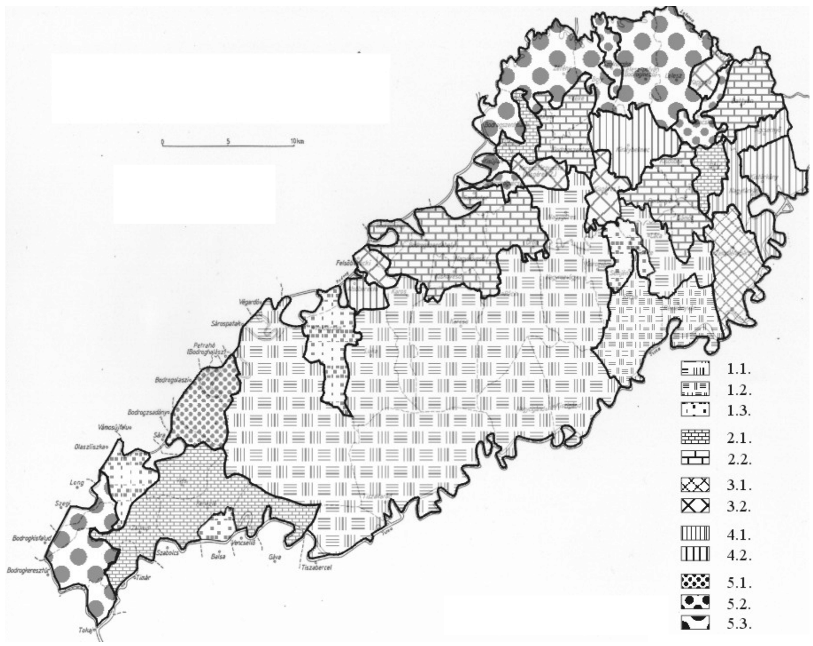


Figure 4. Various patterns of land use changes in different communities

Key:

1. After regulation there was no barren land;
1.1. After drainage (after 1895), arable land increased at the expense of meadows and pastures;
1.2. After drainage, arable land increased mainly at the expense of forests, in addition to meadows and pastures;
1.3. After drainage, arable land did not increase;
2. Barren land was small, after regulation arable land increased at the expense of meadows and pastures;
2.1. After 1880 increase of arable land was more than 10 per cent of the entire area;
2.2. After 1880 increase of arable land was less than 10 per cent of the entire area;
3. Barren land was small, after regulation arable land increased at the expense of forests;
3.1. After 1880 increase of arable land was more than 10 per cent of the entire area;
3.2. After 1880 increase of arable land was less than 10 per cent of the entire area;
4. Barren land was small, after regulation arable land increased at the expense of forests, pastures and meadows;
4.1. After 1880 increase of arable land was more than 10 per cent of the entire area;
4.2. After 1880 increase of arable land was less than 10 per cent of the entire area;
5. After regulation, land use did not change;
5.1. Arable land increased only after 1880 at the expense of forests;
5.2. Between 1855 and 1910 increase of arable land was not more than 10 per cent of the entire area, although periodically it was higher;
5.3. Between 1855 and 1910 increase of arable land was not more than 10 per cent of the entire area.

Bodrogköz in groups according to natural factors and land use factors during different periods in the second part of the last century. Subsystems, sub-areas and sub-regions within the area can be distinguished this way. The level of dependency of the economy on the natural environment and the process of change in land use can be characterized by analyzing the correlation of the different clusters.[3]

Altogether, eleven clusterization runs were carried out. The first clusterization was done according to the natural environment. Variables included the geographic sub-areas, the elevation of the settlement center, the relative relief (the highest difference in elevation within one square kilometer, the position and the geographic structure of the settlement, the average yearly temperature, and annual rainfall. The run yielded five clusters. The second clusterization was done according to distribution of soil-types. Values were given as percentage rates within the territory of the given settlement. This clusterization resulted ten clusters. The third run, a clusterization of all natural factors (runs one and two), yielded ten clusters. Runs four, five, six, and seven were done according to land use patterns in 1855, 1883, 1897 and 1910, respectively. Variables included the different land use types. The values were given as percentages within the territory of the given settlement. These runs resulted in seven, six, seven, and six clusters, respectively. The eighth clusterization, based on land use patterns between 1855–1913 (runs four, five, six and seven), resulted in nine clusters. Runs nine and ten were done according to land value in 1883 and in 1913. Variables included different types of land use. Values represented the value of different types of land per territorial units. The runs yielded six clusters in both years. The eleventh clusterization was done according to land value between 1883–1913 (runs nine and ten). The analysis provided eight clusters.

These groupings are comparable. Comparison can be done through visual analysis of the dendrograms, which are visual representations of the similarities of the data characterizing each settlement, and correlation analysis of the dendrograms carried out by computer. The conclusions are the following:

1. Land use patterns of villages between 1855 and 1910 became increasingly homogeneous, because the dispersion of the co-ordinates characterizing land use was decreasing, and in the year of 1910 already 40 of the 53 villages were grouped into two great clusters. The ones outside these clusters were mainly along the Tice, a dried-up branch of the Tisza.
2. Geographical features have more influence on land use in 1855 than later. Groups similar to the geographic sub-areas can be distinguished in clusters of land use patterns. This is especially typical in villages around Hosszúrét and in settlements between the Tice and the Latorca. The Hosszúrét group is almost completely disintegrated by 1910, whereas villages along the Tice are very different from other settlements, but are not really similar to each

other, either. In clusterization run eight a transitional dendrogram is obtained. This observation also confirms the increasingly homogenous nature of land use and the decreasing importance of natural features.

3. The correlation coefficients obtained by the correlation analysis of soil and land use clusterizations grew between 1855 and 1910. It seems that soil type has stronger influence on land use patterns after regulation than before. However, coefficient values are still very low, indicating that non-numerical soil-features also play a significant role. Numerical values of correlation coefficients in the correlation analysis of all natural features and land use clusterizations between 1855 and 1895 are higher than those found before. One can conclude that before regulation natural features had some influence on patterns of land use, but this influence was lost after drainage. The existence of this process is confirmed by the very low (or negative) numerical value of correlation coefficients between the clusterizations of natural features and land-value.
4. The most significant change in land use took place between 1855 and 1880, namely after the regulation of the rivers. Drainage caused a smaller change between 1895 and 1910. The difference between land use patterns of 1880 and 1895 is the slightest, as the highest numerical value of correlation coefficient is found here.

Conclusions of Computer and Cartographical Analysis

Farming was the most important economic sector in Bodrogköz, even before the regulation of the rivers. Additionally, fishing, gathering and animal husbandry had a very important role, especially in the middle and southern parts. Livestock management was based on meadows, marsh-pastures, and gallery forests. Although Bodrogköz was not any “wetter” than other regions in Hungary, and large marshlands were found only in Hosszúrét and in some lowlands, the chances of flooding were high. Consequently, the value of the land, mainly in the southern part, was low.

From a geographic and economic point of view, Bodrogköz was not a single entity. It can be divided into characteristic sub-areas and sub-regions. The change of land use patterns also differed from village to village, but the groups set up according to this do not correlate with geographic and economic regions. At the end of the process of the transformation of the natural landscape, land use in Bodrogköz was more uniform and simple than it had previously been.

Before channelization, considering only the natural features, land use patterns were influenced mainly by geomorphology, elevation and the sub-areas to which the settlements belonged. After drainage, soil-conditions became important.

However, these had only a restrictive role. They did not determine management, as elevation and geomorphology had before. This means that the influence of the natural environment itself was decreasing, as opposed to that of the economic and social environment. Briefly, channelization had reached its goal.

After regulation and drainage, the previously typical elevation-zones lost their importance. Barren lands and marshlands became pastures and meadows, while meadows, pastures, and woods became arable land. Patterns of land use showed very little change in the northern and eastern areas.

The transformation of the natural environment paved the way for the extension of arable land. This happened in two steps. After regulation (1860–80), areas that previously had been meadows and pastures were turned into arable land. After drainage (1895–1910), the rest of the meadows, forests, and pastures made of marshlands were fallowed. Barren land and marshland almost completely disappeared, and arable land was expanded at the cost of a less valued but more flexible method of cultivation. Nevertheless, the value of arable land converted from previous wetlands was also low. As the best meadows were fallowed, animal husbandry was transferred to pastures that were relatively scarce. So the number of animals decreased, affecting land use as well. Thus the paralyzed structure of land use and animal husbandry mutually limited each other's development.

From an economic point of view, the process was a late and ill-matched adaptation for several reasons. Because of political and economic difficulties the expansion of arable land was completed after the end of the corn-boom, in other words too late to have been of great value. Given the technical problems in drainage and lack of fertilization, the value of arable lands was low. Because of the paralyzed economic structure, newly broken land was cultivated in accordance with traditional practices, which prevented the development of more suitable agriculture. In other words, social and economic factors that prompted the natural and agricultural changes at the same time hindered the complete utilization of the new natural environment.

Outlook: Changes in Land Use in the 20th Century

In the 20th century the most important change from the perspective of agriculture was the organization of the cooperatives in the 1960s. From the first decade of the 1900s up to the 1960s no significant change in land use took place. The main effect of turning private plots into cooperatives was the re-allotment of arable land into larger sections, although the various patterns of the natural environment did not encourage this approach. Still, intensive farming methods were introduced with increasing use of machinery, artificial fertilizers, etc. The proportions of different types of land use underwent only a slight change in the second half of the century. The rate of arable land decreased by 5 per cent (it became woods and orchards), and meadows and pastures decreased by a smaller degree (2 per cent). On the other hand, the size of open water and built-up areas increased by 2 per cent and 0.4 per cent, respectively, and the rate of woods increased by 4 per cent. However, the latter process was dominated by invasive non-native species, such as poplar and honey locust. The surface of Bodrogköz is still dominated by intensive agriculture. At the turn of the millennium the rate of cultivated land was around 60 per cent (Nagy, 2008, 148–49). According to the most recent satellite images, the proportion of cropland in 2006 is 45 per cent, while the rate of orchards 6 per cent, vineyards 1–2 per cent, and hayfields 9 per cent. The rest is woods, pastures, marshlands, open waters and settlements. A high proportion of arable land, however, lies fallow (Dobos, Novák, 2008, 169, 171, 174).

Perspectives: Optimal and Actual Land Use

Whether natural conditions render certain kinds of land use impossible is a question open to analysis. This method was developed in Hungary by Éva Konkoly-Gyuró on the basis of the example of the Zemplén Mountains. Factors that exclude tillage include:

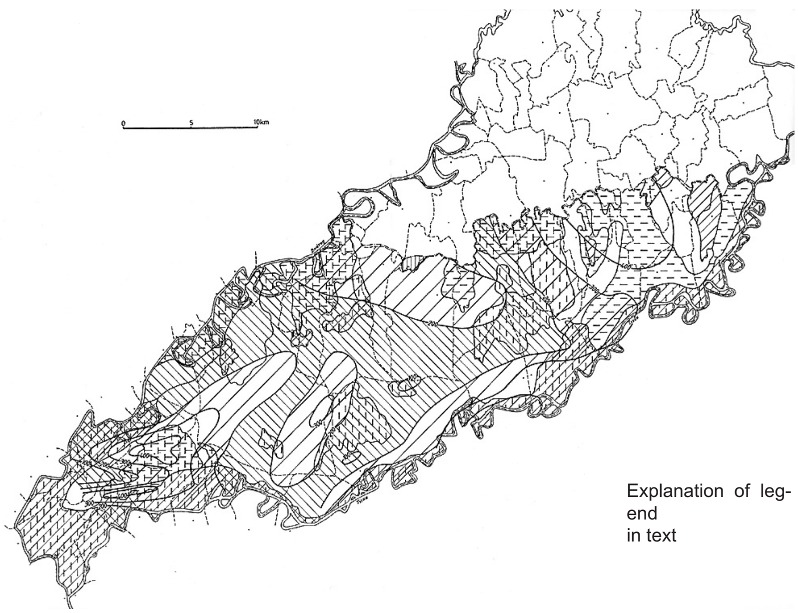
1.a. topsoil thickness is less than 40 centimeters;
1.b. organic matter is less than 100 t/hectare;
1.c. the groundwater table is closer than 200 centimeters to the surface;
1.d. there is an extremely poor water regime in the soil.

Similar values for these factors were determined when they only limit but do not exclude the possibility of cultivation:

2.a. relative soil fertility is less than 40 per cent of the most fertile soil;
2.b. organic matter is between 100–200 t/hectare;
2.c. the groundwater table is between 200–300 centimeters from the surface;
2.d. the soil has a poor water regime (Konkoly-Gyuró, 1989, 45).

This method could be adapted to the flood plain of Bodrogköz with some restrictions. The distinction in the flood plain can only be made between pastures, meadows and arable land. Furthermore, as soil properties are subject to rapid alterations when environmental conditions change, recent investigation is of only limited historical value. Finally, Konkoly-Gyuró based the soil valuation system on the work of Hungarian experts.[4] As Slovak soil scientists use a different approach, this method can only be adapted to the southern part of Bodrogköz within

Hungarian territory (Borsos, 2000: Optimal land use map). However, recent efforts to reconcile the two systems of soil valuation resulted in a map illustrating the cropland potential of the entire area (Molnár et al., 2008, 188–90, and Map XXII. 3).



Figures 5. Optimal land use map of South Bodrogköz

A closer look at the optimal land use map shows that there are very few areas in the southern region of Bodrogköz suitable for tillage (white spots). Most of the territory ought to be pasture or meadow. Comparison of this map with the maps of land use in 1855 and 1880 suggests the interesting conclusion that given the need for arable land to meet the needs of the local population, some areas were overused even before the channelization. After the regulation of rivers in the 1880s, overexploitation increased, and after the drainage at the turn of the 19th and 20th centuries, overuse became more intensive, remaining essentially unchanged up to the turn of the millennium. It is the main cause of the recent environmental and agricultural problems in the area (Viga, 1989, 116).

A recent examination of Bodrogköz by an international team of Hungarian and Slovak experts offers suggestions to solve those problems. Revitalization of the former Tisza branches (Tice, Karcsa) and some smaller creeks is considered necessary, as is the creation of lakes on the low laying areas for fishing. Reforestation should be done using local species, such as willow and alder, ash and elm, and oak and hornbeam, with due regard to the elevation and wetness of the area, instead of invasive species (locust, poplar). It is advisable to decrease the size of arable land to 35–40 per cent (Midriak et al., 2008, 192–95). They suggest establishing a mosaic-like structure of land use depending on soil and morphological conditions. Open waters (rivers, lakes, creeks) and wet marshes should remain biosphere reserves and are to be used for ecotourism and fishing. Flood areas are good for pastures, meadows, flood-woods and orchards, and high flood areas are optimal places for hardwoods, while the flood-free areas, hills and sand hills can host settlements, cropland and orchards-vineyards (Midriak et al., 2008, 195–97). Thus, the cycle of environmental changes comes to a close. When putting the traditional and the suggested optimal patterns of land use into neighboring columns of a table, as in *Table 1,* similarities become obvious.

Table 1

Traditional land use	Suggested optimal land use
– Open water: fishing – Lakes, lakesides, riversides with vegetation cover: gathering – Riparian forests: orchards and animal husbandry – Flood-free areas: human settlements, masting on acorns, arable land – Small (sand)hills: vineyards, forests, grazing	– Open water (rivers, lakes, creeks) and wet marshes: biosphere reserve, fishing, ecotourism – Flood areas: pastures, meadows, riparian forests, orchards – High flood areas: pastures, meadows, hardwoods – Flood-free areas, sand-hills, hills: settlements, cropland, orchards

Notes

1 Only resources actually used are listed here. References include papers of key importance and reviews. For a detailed list see Borsos, 2000, 199–201, 211–18.

2 For details see Révy, 1896 and Dóka, 1977.

3 For more information on the mathematical background of cluster analysis see Borsos, 2000, 22–23. The number of clusters depends on the process of clusterization. Such numbers are used where the characteristics of the clusters undergo a sudden change.

4 See mainly Várallyay 1985, Várallyay et al. 1979–80, 1981.

References

Balassa, I. (1975) *Lápok, falvak, emberek. Bodrogköz* (Marshes, villages, people. Bodrogköz). (Budapest: Gondolat).

Borsos, B. (2000) *Három folyó között. A bodrogközi gazdálkodás alkalmazkodása a természeti viszonyokhoz a folyószabályozási munkák előtt és után (1840–1910)* (Surrounded by three rivers. Adaptation of traditional husbandry to natural conditions in Bodrogköz before and after the regulation of rivers (1840–1910)) (Budapest: Akadémiai Kiadó).

Borsos, B. (1995) Ecosystem – Geographic Area – Economic Region: A Computer Analysis of the Environmental and Economic Changes in the Bodrogköz, NE Hungary in the Second Part of the 19th Century. *Acta Ethnographica Hungarica,* Vol. 40, Nos 1–2, 131–84.

Dankó, I. (1986) A Bodrogköz régi vízrajza és vízi élete (Historical hydrography and exploitation of waters in Bodrogköz). In Gy. Viga (ed.) *Fejezetek a Bodrogköz néprajzából* (Chapters from the ethnography of Bodrogköz). Néprajzi vidékek Borsod-Abaúj-Zemplén megyében V. (Miskolc) 21–28.

Dobos, E. and Novák P. (2008) Jelenkori tájhasználat (Recent land use) in E. Dobos and J. Terek (eds.) *Élet a folyók között. A Bodrogköz tájhasználati monográfiája* (Life among the rivers. The monography of land use in Bodrogköz) (Miskolc: Miskolci Egyetem) 169–76.

Dóka, K. (1987) A Bodrog szabályozása (The regulation of the River Bodrog). *Herman Ottó Múzeum Évkönyve* Vol. 16, 105–31.

Fényes, E. (1836–40) *Magyarországnak és a hozzákapcsolt tartományoknak mostani állapotja statistikai és geographiai tekintetben* (A statistical and geographical survey of Hungary and its attached provinces) (Pest: Trattner).

A kassai kataszteri kerület összes becslőjárásainak osztályozási vidékenkénti előleges tisztajövedelem fokozatai és sommás osztálykivonatainak összeállítása; az összes művelési ágakat illetőleg, 1883 (The cadastrial survey of Kassa district: land use types and income) (Budapest: KSH).

Konkolyné Gyuró, É. (1989) A területhasznosítás optimalizása a Zempléni-hegység térségében (Optimalising land use in the area of Zemplén Mountains). *Gazdálkodás,* Vol. 33, No. 11, 39–50.

Lászlóffy, W. (1982) *A Tisza. Vízi munkálatok és vízgazdálkodás a tiszai vízrendszerben* (The river Tisza. Water-regulation, drainage and economy of water-supplies in the river-system of the Tisza) (Budapest).

A Magyar Korona országainak mezőgazdasági statisztikája (1895) I. Főbb eredmények községenként, 1897 (The agricultural statistics of the countries of the Hungarian Crown /1895/ I. The main results by communities). *Magyar Statisztikai Közlemények Új Folyam,* Vol. 15.

Magyarország művelési ágak szerinti terjedelme és földjövedelme. A Helytartótanács rendeletéből kiadva, 1865 (The territory of Hungary regarding the land use types and land related income. Published upon the order of the Governor in Council of Hungary) (Buda).

Midriak, R. et al. Tájhasználati potenciál (Potentials in land use) in E. Dobos and J. Terek (eds.) (2008) *Élet a folyók között. A Bodrogköz tájhasználati monográfiája* (Life among the rivers. The monography of land use in Bodrogköz) (Miskolc: Miskolci Egyetem). 177–98.

Nagy, D. (2008) Történeti tájhasználat (Historical land use) in E. Dobos and J. Terek (eds.) (2009) *Élet a folyók között. A Bodrogköz tájhasználati monográfiája* (Life among the rivers. The monography of land use in Bodrogköz) (Miskolc: Miskolci Egyetem). 135–50.

Pesty, F. (1864) *Pesty Frigyes helynévtára* (Frigyes Pesty's collection of toponyms) (OSZK Kézirattár).

Réfi-Oszkó, M. (1987) *Gazdálkodás a Rétközben a XVIII–XIX. században* (The native economy of the Rétköz in the 18–19th century). Doctoral Dissertation. (Budapest: MTA Kézirattár).

Révy, G. V. (1896) A Bodrogközi Tiszaszabályozás története (The history of the regulation of the river Tisza in Bodrogköz) in J. Mailáth (ed.) *A Bodrogközi Tiszaszabályozó Társulat monographiája 1846–1896* (The monography of the Society for Regulation of the river Tisza in Bodrogköz 1846–1896) (Budapest). 19–44.

Somogyi, S. (1967) *Az ármentesítések és folyószabályozások (vázlatos) földrajzi hatásai hazánkban* (A sketch of the geographical effects of flood control and river-regulation in Hungary). *Földrajzi Közlemények* Vol. 15 (91), No. 2, 145–58.

Szabad, Gy. (1979) Az önkényuralom kora (1849–1867) (The age of absolutism (1849–1867)) in E. Kovács (ed.) *Magyarország története 1848–1890* (The history of Hungary 1848–1890) (Budapest). 435–768.

Szabolcs vármegye adóközségeinek területe és kataszteri tisztajövedelme művelési áganként és osztályonként, 1913 (The territory and cadestral net income of the communities of Szabolcs county by land use type and classes, 1913) (Budapest: KSH).

Valter, I. (1974) A Bodrogköz honfoglalás kori és középkori településtörténete (The history of the settlements in Bodrogköz in the era of the Hungarian conquest and in the Middle Ages). *Agrártörténeti Szemle,* Vol. 16, Nos 1–2, 1–55.

Vályi, A. (1796–99) *Magyar országnak leírása I–III* (A description of Hungary I–III) (Buda).

Várallyay, Gy. (1985) Magyarország 1:100.000-es méretarányú agrotopográfiai térképe (An agrotopographical map of Hungary on the scale of 1:100,000). *Agrokémia és talajtan,* Vol. 34, Nos 1–2, 243–48.

Várallyay, Gy. et al. (1979–80) Magyarország termőhelyi adottságait meghatározó talajtani tényezők 1:100.000-es méretarányú térképe (Map on the scale of 1:100,000 about the pedological features determining fertility potential in Hungary). *Agrokémia és talajtan,* Vol. 28, Nos 3–4, 363–384 and Vol. XXIX, Nos 1–2, 35–76.

Várallyay, Gy. et al. (1981) Magyarország agroökológia potenciálját meghatározó talajtani tényezők 1:100.000-es méretarányú térképe (Map on the scale of 1:100,000 about the pedological features determining agro-ecological potential in Hungary). *Földrajzi Értesítő,* Vol. 30 Nos 2–3, 235–50.

Viga, Gy. (1989) Néhány megjegyzés a néprajz és a kulturális ökológia kapcsolatához (Some remarks on the connection of ethnography and cultural ecology). *Herman Ottó Múzeum Közleményei,* Vol. 26, 115–19.

Zemplén vármegye adóközségeinek területe és kataszteri tisztajövedelme művelési áganként és osztályonként, 1913 (The territory and cadestral net income of the communities of Zemplén county by land use type and class, 1913) (Budapest: KSH).