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BOOK REVIEWS

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Weather Anomalies and Their Economic Consequences: Penury in Northeastern Hungary in the Late 1870s*

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This study investigates an episode of penury in 1879–1880 in Borsod and Zemplén Counties which occurred as one of the negative consequences of a short-term weather change which was experienced across Europe in the late 1870s and early 1880s. From the mid-1870s on, due to the wetter and cooler weather, the annual crop yields repeatedly fell below the usual and expected averages in Hungary. After a catastrophic harvest in the autumn of 1879, when the quantity of harvested cereals was sufficient neither for reserves nor for spring sowing, the situation became severe. 1878 had also been a bad year for agriculture: the severe floods in the second half of 1878 not only had washed the crops from the fields but had also covered them with thick sludge that made it impossible to sow in autumn.

Since the spring of 1879 was characterized by unfavorable conditions for agriculture (increased rainfall, widespread floods, low average spring temperatures), the local and national authorities continuously kept their eyes on the crops. Thanks to this preliminary attention, the administration was able to respond quickly and in an organized manner to the bad harvest in July and August and could avert catastrophe at national level. The leadership of the two counties responded more or less in the same way to the near-famine conditions. First, they asked the Treasury to suspend tax collection until the next harvest at least so that the farmers who were facing financial difficulties would not have to go into debt. Second, they appealed to the government for financial and crop relief to save the unemployed population from starvation. For those who were able to work, they asked for the approval of public works and major construction projects from the Ministry of Transport and Public Works. For many, such state-funded road construction or river regulation projects were the only way to make a living. Third, the county administrations also gave seeds for spring sowing to the farmers. While Borsod county survived the years of bad harvests without dire problems due to the higher proportion of better quality fields, in the more mountainous region of Zemplén, most landowners had smaller and lower quality lands, and they often chose to emigrate to avoid starvation. These difficult conditions may have provided the initial impetus for mass emigration to Western Europe and America.

Keywords: weather anomalies, penury, crisis management, Hungary, late nineteenth century

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Hungary, as a predominantly agricultural country, has always been highly vulnerable to weather conditions. Both extremes of the precipitation spectrum, meaning too much or too little precipitation accompanied by temperature fluctuations and complemented by theoretical and technical backwardness in farming, have often led to subsistence crises.

Several people have already dealt with the history of penuries and famines in Hungary caused by the droughts of the nineteenth century: the distress of 1814–17[1] and the famine of 1845–47,[2] and 1863–64.[3] However, wet and cool weather, especially during spring and summer months, can also badly damage crops, resulting in penury and, in the worst case, famine. This is especially true when there is unusually humid and cold weather for years in a row. This happened in Hungary beginning in 1875, and this caused distress in the northeastern parts of the country after the catastrophic harvest of 1879. Though our research does not cover other regions of Hungary, press products and economic sources suggest that the poverty caused by the weather extremes was not limited to the northeastern counties.

Neither the unfavorable weather nor the subsequent difficult economic situation were unique to Hungary. Rather, the crises caused by extreme weather was hit much of Europe.[4] The year 1879 marked a turning point in economic growth in many countries, with grain being imported in several places due to the high rate of crop losses (up to 50 percent) that generally occurred. The influx of cheap grain mostly from America and Russia led to a sharp drop in the price of the cereals produced in Europe. In England, for example, the 50-year recession, the so-called agrarian crisis, began in 1879.[5] As Hubert H. Lamb put it, "1879 turned the decline into a collapse."[6]

In the works written on the history of the Hungarian crisis,[7] which affected the agricultural sector as well, the focus of research has been on the inflow of cheap grain and the consequent fall in domestic grain prices, and the relationship between the crisis and the weather anomalies of the era has not

1 Hodgyai, "Ínséges évek."

2 Czoch, "A reformkori közigazgatás"; Rémiás, "Az 1847. évi éhínség"; Ungár, "Az 1845–47. évi."

3 Boa, "Az 1863–64. évi aszály"; Katus, "Az 1863–64. évi aszály."

4 Lamb, *Climate, History and the Modern World.*

5 On the agrarian crisis in Great Britain, see Perry, *British Farming.*

6 Lamb, *Climate, History and the Modern World*, 233; Bichet et als., "Enhanced Central European summer."

7 Sándor, *A XIX. századvégi agrárválság*; Kaposi, "A 19. századi agrárválság"; Kaposi, "Válság és alkalmazkodás"; Kaposi, „Agrarkrise in Ungarn"; Klement, "Die Agrarkrise"; Kiss, "Gabonaválság a 19. század végén."

been examined. There had been a decline in agricultural prices in the country before 1879, so the explanation is not primarily to be found in the weather conditions, but we nonetheless must take into account the possibility that food and feed shortages due to a series of bad harvests and the catastrophic harvest of 1879, accompanied by impoverishment, could certainly have contributed to and deepened the depression. Our research, the initial findings of which are included in the present paper, is intended to fill this lacuna in the secondary literature.

This paper is divided into three sections. In the first, we examine the weather conditions of the last third of the nineteenth century, highlighting anomalies in temperature and precipitation. Next, in our discussion of conditions in two northern counties, we show how adverse weather affected agricultural production at the regional level. According to the sources, a series of poor harvests led to distress in several districts in late 1879 and early 1880. In the third part of the paper, we present the extent of this need and the official measures taken to address it. Although our paper focuses on events and conditions in these two northeastern counties, we also briefly discuss the situation in the neighboring counties in order to provide a wider context.

Sources and Methods

Given the aim of the paper, we used statistical and descriptive sources in our research. To observe the weather anomalies, we used the yearbooks of the predecessor to the current Hungarian Meteorological Service, which began publication in 1873.[8] Collected under standardized conditions, these instrumental data are available from 1871 on for some settlements in the country. As the monitoring network expanded, weather data from other settlements were added to the yearbook over time. Consequently, we have data from different periods for the settlements in the northern region that we examined. The longest data series, dating back to 1871, are from Eger and Eperjes (today Prešov, Slovakia).

To examine the temperature, we used monthly averages calculated on the basis of the daily temperature averages recorded immediately after detection.[9] With regard to precipitation conditions, we examined the monthly precipitation data aggregated from the daily data.

8 *Meteorológiai Évkönyvek*.

9 The temperature was measured three times a day, at 7 a.m., 2 p.m., and 9 p.m.

The data in the yearbooks were theoretically recorded in a centrally regulated way and under conditions with state-approved means, so we can consider them more reliable than those recorded in previous periods, but we must nonetheless be careful, because improper recording techniques or various bias factors may have affected the accuracy of the data. One such factor is the change of the location of the measuring station over time, which for example occurred in the case of Kassa (today Košice, Slovakia). The homogenization of our data, which could increase its accuracy and reliability, would make it possible to eliminate problems like this. However, homogenization would also require the examination of additional metadata (measurement-related data), which we are unable to perform because we lack the professional meteorological knowledge. We hope that soon meteorologists will also homogenize the data from our period, as they have done for the data from the twentieth century.

In order to be able to examine the characteristics of our data over a longer period, we also included in our research the data from Budapest, the city with the oldest data series in Hungary. These homogenized data series are from the váraljamet.hu meteorological website. The homogenization and interpolation of the data to the meteorological station of Pestszentlőrinc are carried out by ZAMG *(Zentralanstalt für Meteorologie und Geodynamik)*.

In addition to the weather data series, the range of our statistical sources is expanded by the county yield results, which we collected from the relevant volumes of the Hungarian Statistical Yearbooks.[10] Regarding the accuracy of the data, it should be noted that they were recorded on the basis of the accounts and estimates provided by landowners, but more importantly, the landowners tended to underestimate the actual yield at the time of the surveys, as they feared a tax increase.[11] In addition, it is conceivable that farmers reported higher crop losses than the losses that they actually suffered in hopes of receiving state compensation. These are merely assumptions, but we can suspect that the situation may have been more favorable, if not necessarily by much, than the picture drawn by the data.

Descriptive sources were also included in the research in order to identify inaccuracies in the statistical data and the experiences behind the numbers. As our main goal was to present the official measures take to manage the crisis, we used the documents of the county administrations, which means the reports

10 *Magyar Statisztikai Évkönyvek*

11 Vörös, "A magyar mezőgazdaság."

issued by the so-called *szolgabíró* or, roughly, sheriff at the district level and the *alispán* or deputy lord lieutenant at the county level. The magistrates in charge of running the districts *(járás)* served law enforcement, administrative, and judicial functions, and the *szolgabíró*s normally submitted their reports on the conditions of their district every six months. However, due to the growing destitution, the *alispán* required monthly reports, and these reports enable us to present in detail the course and management of the crisis. After the *ispán* or lord lieutenant, the *alispán* was the second deputy in the county administration and also the figure who actually held control of the county. Reports from the *szolgabíró*s (district deputies) and the leaders of the settlements also went to the *alsipán*, who, on the basis of these reports, submitted an exhaustive report to the Ministry of Interior on the affairs of the county every six months. Almost all of the *szolgabíró*s' and *alispán*'s reports are found in the Borsod-Abaúj-Zemplén County Archives of the Hungarian National Archives. In addition to these sources, materials published in the *Borsod. Miskolczi Értesítő* [Borsod. Miskolcz Gazette], an organ of the local press, were also examined.

Weather Conditions in Northern Hungary, 1871–1900

Instrumental data collected with standardized tools and methods have been available for Hungary since 1871. The development of the network of meteorological stations took place gradually, beginning in the Transdanubian areas and spreading to the regions in the east and northeast. Each station was connected to the network at different times, so while we have data from some areas from the very beginning, other parts of the country only appeared on the "weather map" of the country 10 or 15 or 20 years later. Of the northeastern region examined in greater detail in our study, the data sets from only two cities, Eger (the seat of Heves County) and Eperjes (the seat of the former Szepes County, today Prešov, Slovakia), date back to 1871; in the other settlements, measurements began to be taken a few years later.

Temperature between 1871 and 1900

In the diagram showing the annual average temperature of the settlements belonging to the northeastern Hungarian and upland regions, apart from the differences due to the geographical location, the curves of the individual towns mostly follow one another in the same rhythm without significant jumps (Fig. 1).

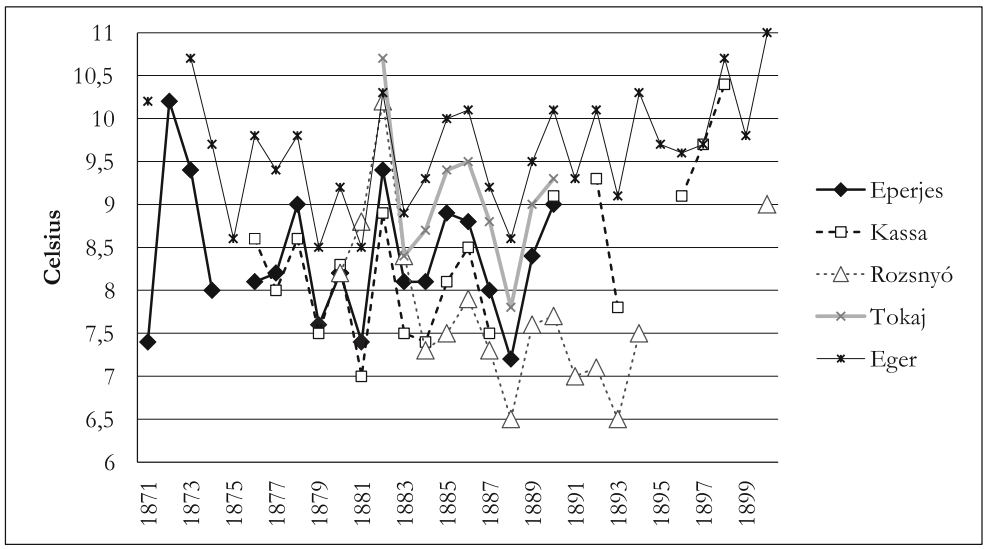

Figure 1. Annual average temperature of settlements in eastern and northeastern Hungary, 1871–1900.
Source: Meteorológiai Évkönyvek

We are best able to draw conclusions about the temperature conditions during the thirty-year period under examination on the basis of the data concerning Eperjes and Eger, which are supplemented by the partial data concerning the other towns. Between 1871 and 1900, several major declines in the average annual temperature were observed: a significant cooling was felt compared to the previous year or years in 1875, 1879, 1881, 1883, 1888, and 1893. The year 1875 is special because from that year on there was not any significant increase in the temperature until 1882. In other words, the period between 1875 and 1881 was the coldest for the entire time period. A similar cooling came only in 1888, but this was not followed by further cooler years. On the contrary, a slow warming began. The warmest years in the northern region were 1872, 1873, 1882, 1898, and 1900.

Although we do not have long-term data series for the settlements we studied, we can use Budapest's temperature data dating back to 1780 to examine the extent to which the cooling in the last decades of the nineteenth century was exceptional over a longer period of time (Fig. 2).

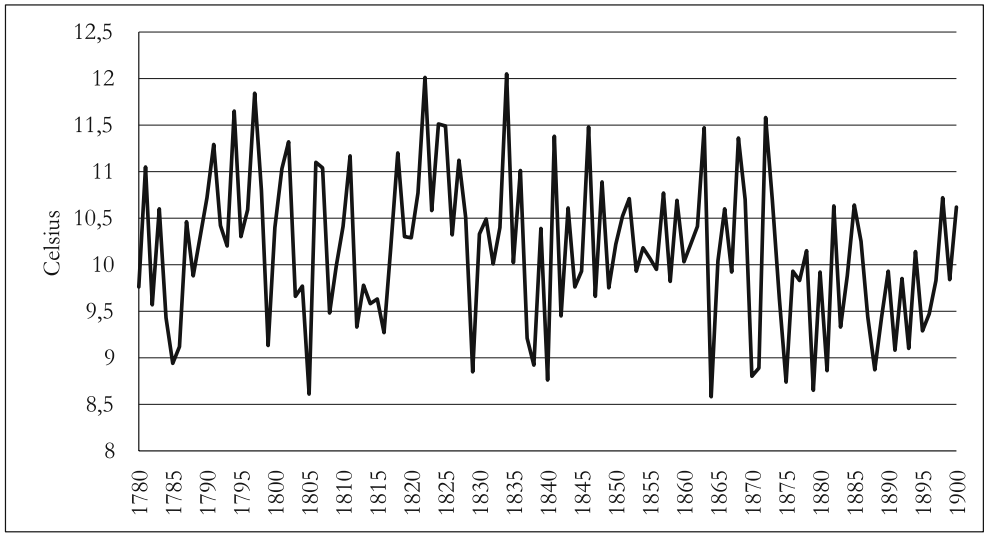

Figure 2. Budapest's annual average temperature, 1780–1900. Source: váraljamet.eoldal.hu

On the diagram showing the long-term temperature conditions in Budapest, the cooling experienced in our period, which began in 1875 after the warm years of the early 1870s, can be clearly seen. With the exception of 1882, 1885, and 1892, the average annual temperature in this period was around or below 9.7 °C, which differed significantly from the previous decades' average temperature, which was above 10 °C (Fig. 3).

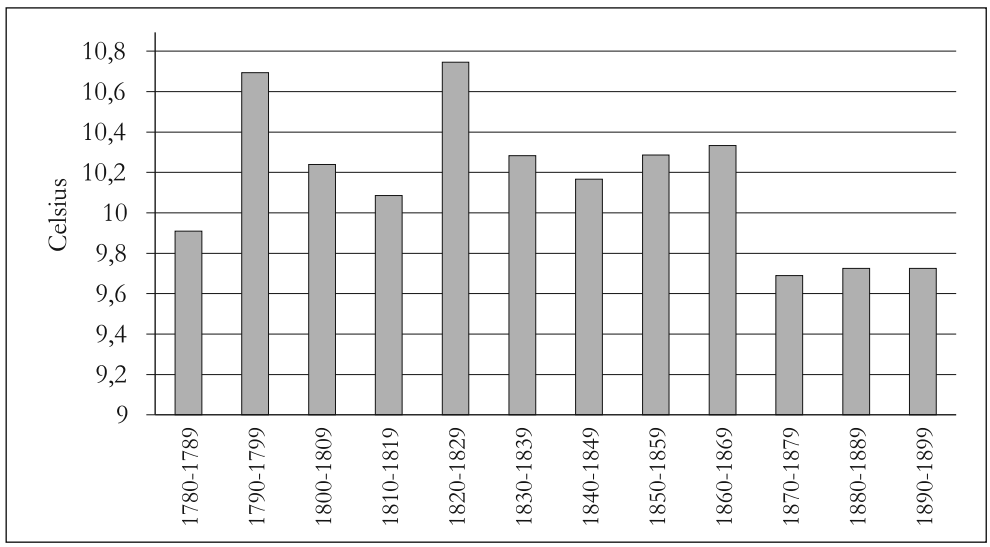

Figure 3. Budapest's average temperature by decades. Source: váraljamet.eoldal.hu

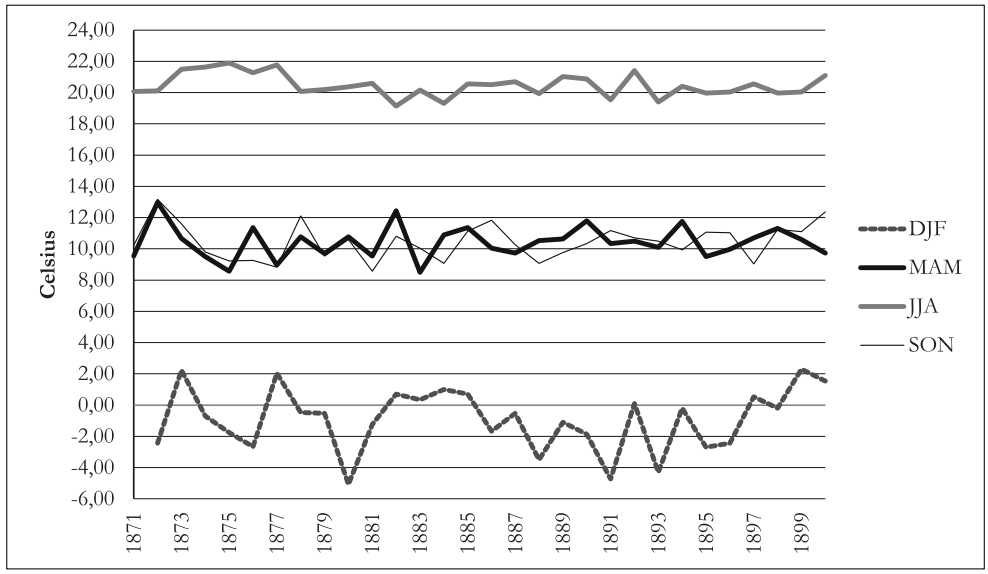

Figure 4. Budapest's annual average temperature by seasons. Source: Meteorológiai Évkönyvek

If we examine the temperature data by seasons, we see that this cooling occurred mainly in the summer and winter (Figs. 4 and 5). The temperature diagram for Budapest and Eger shows that during the period in question, the average temperature in the summer months (June, July, and August) decreased

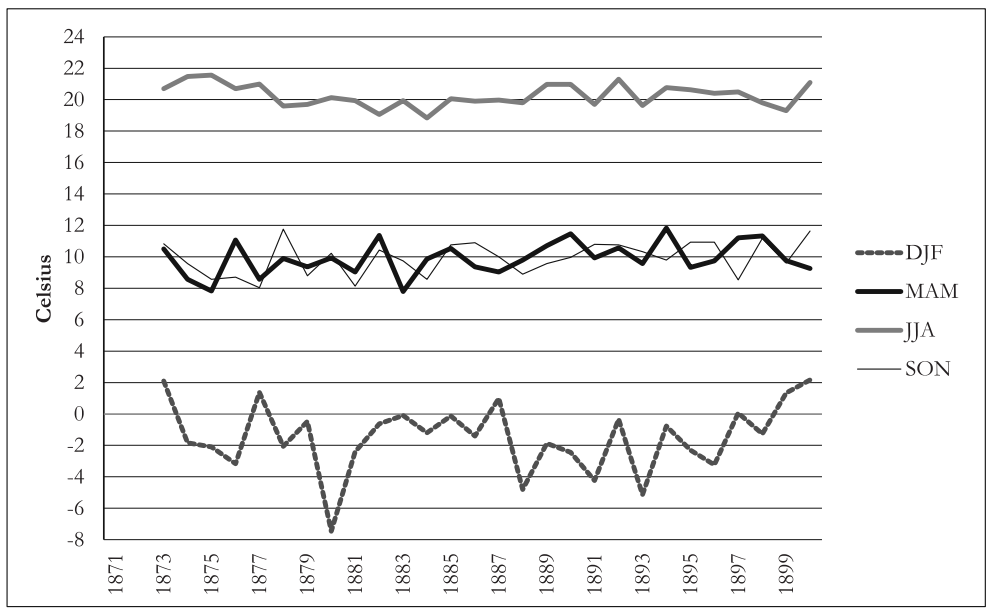

Figure 5. Eger's annual average temperature by seasons. Source: Meteorológiai Évkönyvek

by about 2 degrees after 1877. The average temperatures in the spring (March, April, and May) and autumn (September, October, and November) started to decrease after the remarkably high average temperature of 1872, and then, in the following years of the century, both were between 8 and 12 Celsius (with the exception of the spring of 1876 and 1882 and the autumn of 1878). During the period in question, the autumn months were also cooler, as the temperature went above 10 Celsius only once, in 1878. The average for the spring months was similar, except for 1876 and 1882.

Precipitation between 1871 and 1900

After analyzing the temperature conditions, we now turn to an examination of the amount of precipitation. In the figure showing the annual precipitation in the northern and upland towns, we observe a significant difference in the rhythm of the falling precipitation (Fig. 6). The changing geographical environment of each settlement was correlated with large differences in the yearly amount of precipitation. Therefore, in contrast to the temperature data, it is difficult to draw general conclusions concerning the period in question on the basis of the precipitation data. This task is further complicated by the fact that the data sets for the settlements are rather incomplete; with the exception of the partial data for Eger and Eperjes from the years before 1877, we do not have information on the precipitation conditions in the other settlements.

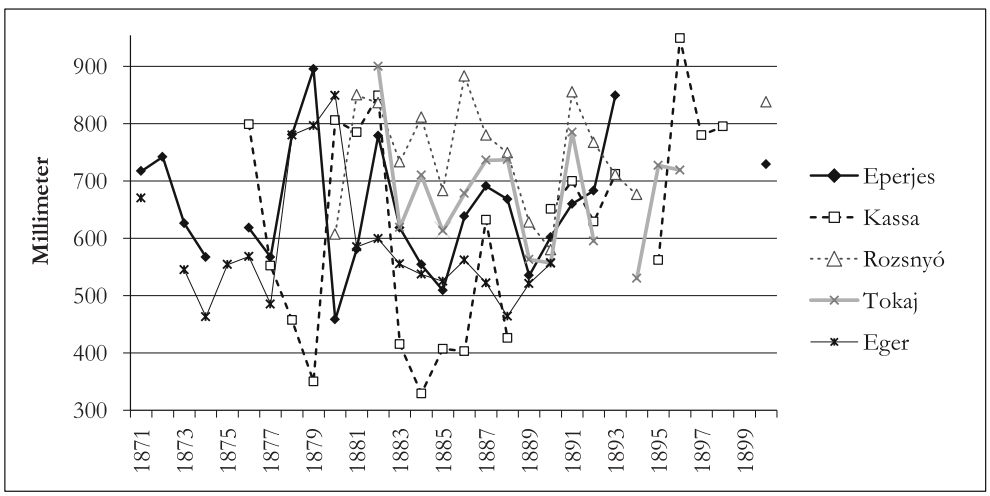

Figure 6. Annual average precipitation in settlements in eastern and northeastern Hungary. Source: Magyar Statisztikai Évkönyvek

Based on these data series, we can say that for most of the 1870s, drier conditions prevailed in the northern region year after year, and only in 1878 did rainfall begin to increase. We learned from the analysis of the temperature data that temperatures were significantly higher in the early 1870s than after 1875; and from our fragmentary data, it appears that this warmer weather may have been coupled with a period of low rainfall, though the amount of rainfall was not so low as to cause a drought, at least not in this area. Within the period in question, there were four more years in which there were significant decreases in the amount of precipitation: in 1880, 1883, 1885, and 1889. However, these decreases were only temporary and were not followed by a more prolonged drop in precipitation.

It is worth noting that the different geographical conditions of the settlements may have led to significant differences in our data. The datasets concerning Eperjes and Eger are good examples of this: while in 1880 the annual rainfall peaked in Eger, in Eperjes the precipitation dropped drastically in the same year to a level that was close to a drought. The wetter years in the second half of the 1880s did not affect the county seat of Heves either; so the precipitation seems to have been concentrated in the upland area. However, the differences observed in the data series from Eperjes and Kassa (seat of the former Abaúj County) can be explained less by geographical conditions than by erroneous data recording. This is because the two settlements are located only 35–40 km apart in the valley of the Hernád River, and there is no geological formation between them that would explain such a discrepancy in the data. That is why the data from Kassa should be handled with extreme caution.

Although there are considerable differences in the data sets from the settlements studied, the wettest years in all cases[12] occurred between 1878 and 1882.

As we did in the case of temperature, we can use the data concerning Budapest to see whether the precipitation between 1875 and 1882 was outstandingly above average from a long-term perspective (Fig. 7). In the diagram, the period in question clearly stands out from the other years with an average precipitation above 600 mm per year. There was no other period over the long run with such high precipitation values for every single year.

12 1886 was considered the wettest year in Rozsnyó (today Rožňava, Slovakia), but since we do not have data from the late 1870s, it is possible that precipitation in the missing years exceeded precipitation in 1886.

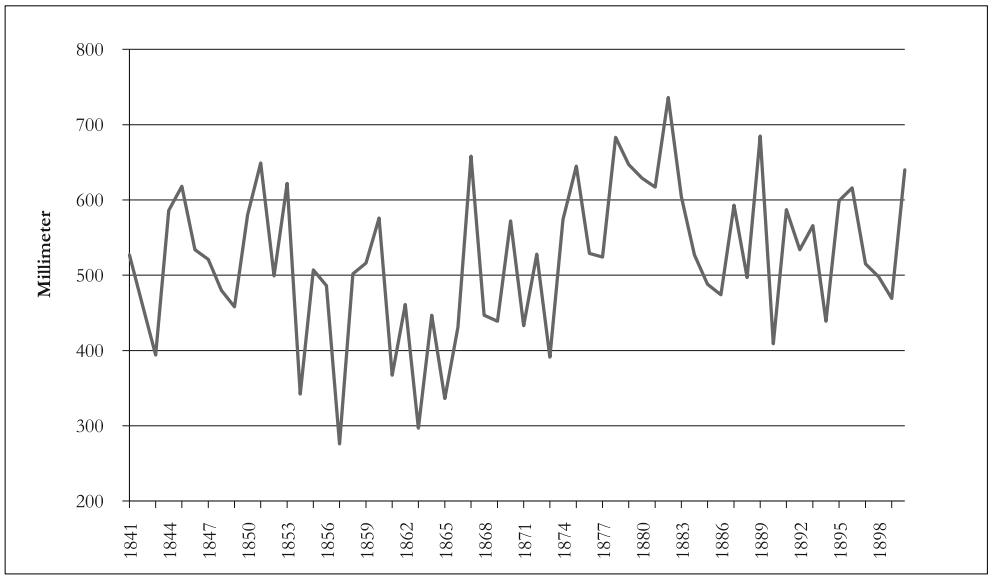

Figure 7. Budapest's annual average temperature, 1841–1900. Source: váraljamet.eoldal.hu

The Impact of Weather Anomalies on Agriculture

As made clear in the discussion above, the 1870s proved extraordinary from a climatic point of view for two reasons. On the one hand, on average, more precipitation fell each year than in the individual years of the decade before and the decade after, and in some years the levels of precipitation were outstandingly high. This high average rainfall was a result of the rainy summer and unusually wet autumn months. On the other hand, in addition to the extraordinary rainfall, the decade was cooler on average than the previous decade and the subsequent decade. Although extremely high or extremely low rainfall can cause a lot of damage to agriculture, unsuitable temperatures can have an even direr effect on crop yields. Due to the cold springs, farmers could expect fewer crops, which were further damaged by the cool and rainy summers and autumns. The crop was either unripe or rotten. Thus, over the course of the decade, there may have been several major and minor crises in agriculture.

In this section, we examine the results of harvests of grains (winter wheat, winter rye and meslin[13]), maize, and potatoes, which are the agricultural products which have the greatest impact on daily livelihoods. In the case of the northern

13 Meslin is a mixture of equal parts of wheat and rye that is sown and harvested together.

counties, potatoes were not simply an additional source of food. They were often the only option in higher settlements with cooler climates. And maize was often used as an important supplement when wheat and rye yields were unfavorable. In order to bring our quantitative data to life, we used many expressive narrative sources which offer impressions of the experiences people endured because of the poor harvests brought about by unfavorable weather.

Although the Hungarian Statistical Yearbooks provide data concerning various crops from the 1868 harvest onwards, due to the different methods of data collection, we were only able to use the series from 1877 onwards. In order to make the data easily interpretable, the development of each crop is shown in a separate figure. On the graph of wheat yields (Fig. 8), we see that there was a significant decline in three years (1879, 1883, and 1889), with the most severe decline coming in 1879, when the yield per hectare decreased by half or one third compared to the previous year. This low point can clearly be attributed to the extremely rainy and cold weather of the second half of 1878 and the beginning of 1879. Although there was already significantly more rain in 1878 than there had been in the previous years, this is not yet reflected in the average yield in 1878 because the excess rainfall only came in the autumn months. By this time, however, the wheat had been harvested. After 1879, we see a different degree of rise, after which the wheat crop stagnated in 1881–1882 and then fell again in 1883. This decline is presumably due to the lower rainfall in 1883. The period between 1883 and 1887 was a time of stagnation again, and then the yield

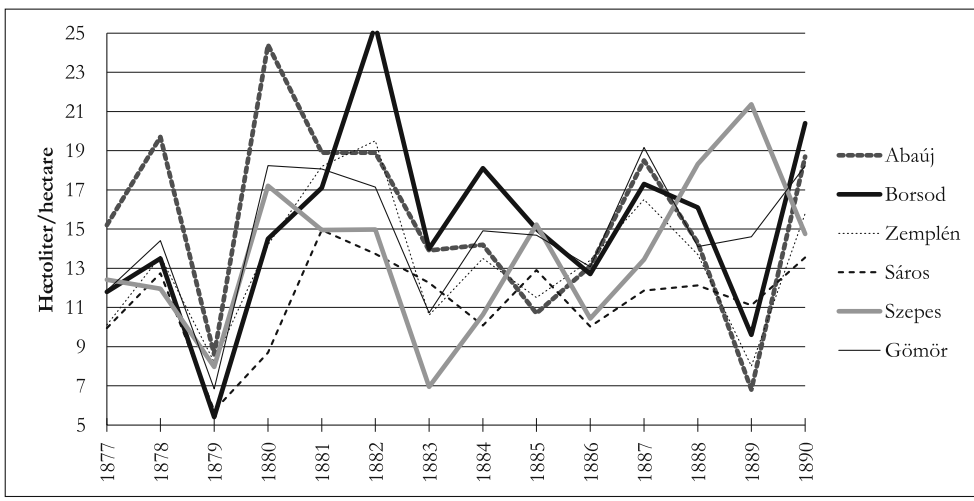

Figure 8. Annual wheat crop by counties, 1877–90. Source: Magyar Statisztikai Évkönyvek

average began to drop slightly at first and dramatically after 1888. The low point of 1889 is similar to that of 1879, though it was not as dramatic a drop.

In the case of rye, we see a pattern similar to the case of wheat, despite the fact that rye is better able to withstand cooler and wetter climates (Fig. 9). 1878 was a relatively good year for this crop, but the rainy weather that began towards the end of July was simply too much for the rye as well. Thus, in 1879, like wheat, the rye crop dropped by half or two thirds. However, 1883 cannot be considered such a bad year for rye, and in Szepes County, the average yield even increased. While in the case of wheat, the second low point came in 1883, in the case of rye it occurred somewhat later, in 1885–86, and it was not as severe. The weather in 1888 and especially in 1889, however, significantly reduced rye production, much as it reduced production of wheat.

Figure 9. Annual rye crop by counties, 1877–1890. Source: Magyar Statisztikai Évkönyvek

Since it is a one-to-one mixture of wheat and rye, meslin unsurprisingly followed the trend described for wheat and rye (Fig. 10). In other words, in the case of meslin, 1879, 1883, and 1889 were also considered the worst, but the years between 1883 and 1889 were also generally considered bad. On the other hand, the harvest in 1882 ended with a relatively favorable result in several counties.

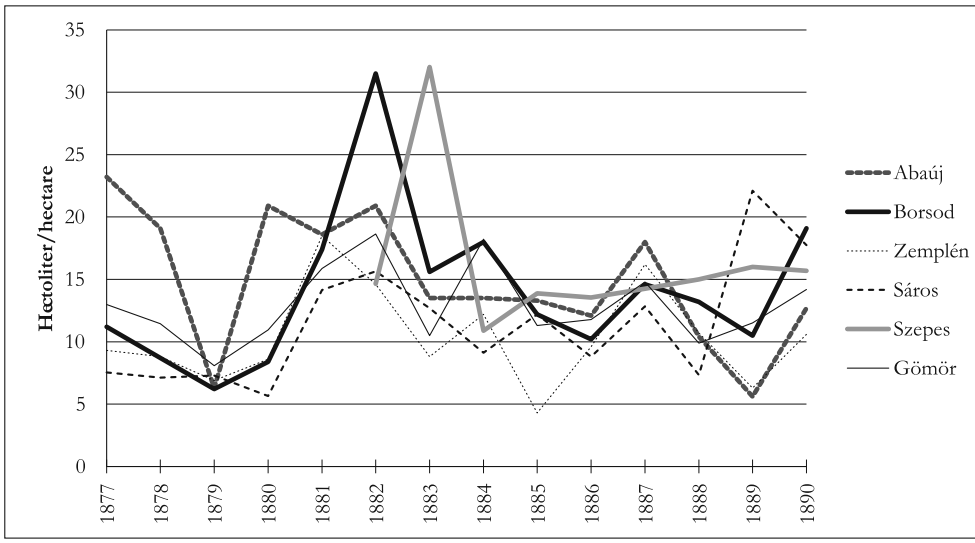

Figure 10. Annual meslin crop by counties, 1877–1890.
Source: Magyar Statisztikai Évkönyvek

Turning to the potato and maize yields, the graphs clearly illustrate that these two crops were much more sensitive to weather changes than cereals (Figs. 11 and 12). However, it was not simply temperature and precipitation conditions that had a perceptible effect on the average yield per hectare, but also geographical differences, as we can see that the yields in the different counties show a very different picture. Nevertheless, the figures do indicate that there were common points, for instance the worst years. As shown in the figure below, in addition to 1879, which was also a low point for potatoes, in 1882, 1884, 1888, and 1890 the weather was not favorable for potatoes either. However, while in the last years the potato yield developed well in some of the counties (e.g. Abaúj and Borsod), in 1879, the statistics recorded an extremely low average yield in all the counties in question. In other words, from a practical point of view, this meant that, due to the generally poor harvest, it was not possible to compensate for the shortfall by importing from the neighboring counties. If we look at the average yield of the two counties, Borsod and Zemplén, which are the focus of our study, in Zemplén, where the climate was usually colder and therefore potatoes were the dominant food source, the average yield remained below 70 hectoliters/hectare for most of the period in question. This amount/quantity not only lagged behind the average yields in Borsod, it also lagged behind the yields in all the counties in the north. Moreover, not only were the yields low, but the size of the area cultivated also decreased significantly over the years: while

in 1877, potatoes were grown on just over 22,000 Viennese acres,[14] in 1890 the area on which they were grown came to only 11,720 Viennese acres. The biggest decline occurred in 1880, when potatoes were planted on only 8,400 acres, in sharp contrast with the previous year, when the area on which they were planted came to 15,000 Viennese acres. In Borsod, where potatoes were not a dominant crop,[15] compared to the data from Zemplén, the potato crop developed relatively well from 1882: it produced a yield of over 100 hectoliters/hectare until 1889.

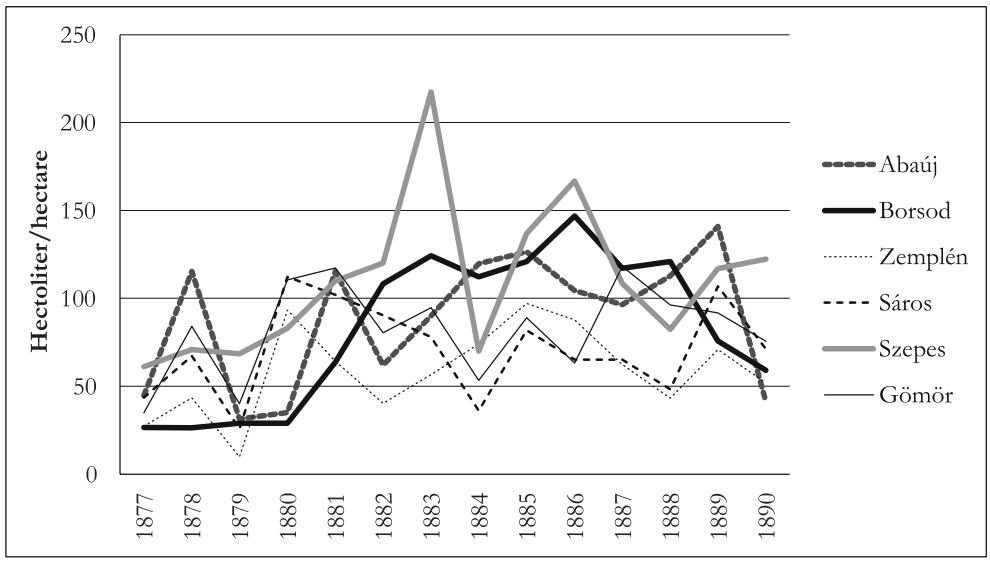

Figure 11. Annual potato crop by counties, 1877–1890.
Source: Magyar Statisztikai Évkönyvek

In the case of maize, which prefers warmer temperatures, our diagram offers a relatively more uniform picture.[16] With the exception of the remarkably high value in Abaúj, a more significant decline can be observed which began as early as 1878 and continued in 1879. Despite the fact that 1882 proved a very good year for cereals, this cannot be said for maize, as the average yield started to decrease again this year, and in 1883 it reached another low point. The next unfavorable year came in 1890, when the average yield fell in all counties except Borsod, which was the southernmost.

14 One Viennese acre is 5,755 square meters.

15 Between 1877 and 1890, the size of the sown areas varied between 2,300 and 3,000 hectares.

16 From Szepes County, there were maize data for only three years in the Statistical Yearbooks, so we did not include them in our analysis.

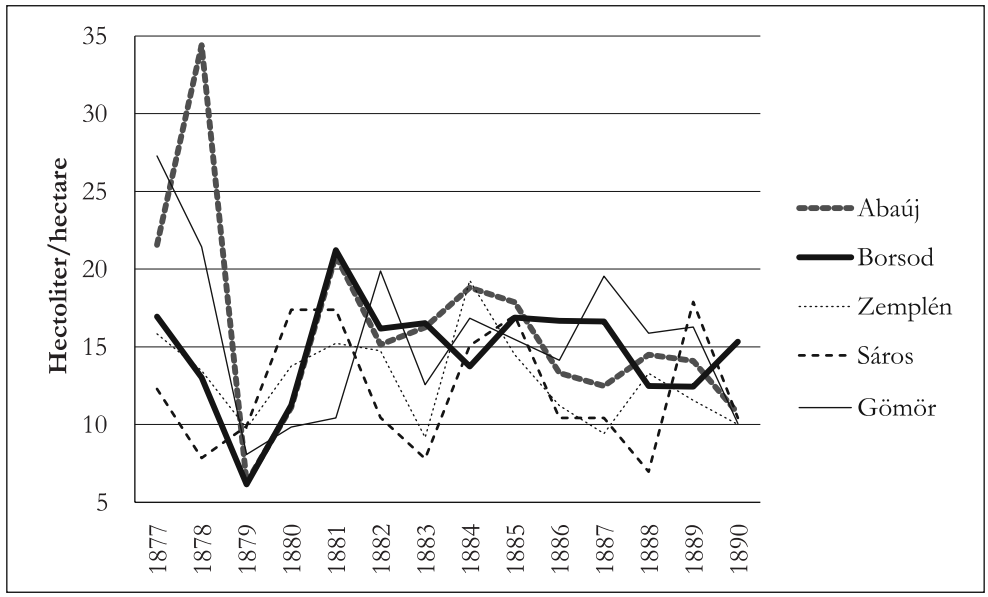

Figure 12. Annual maize crop by counties, 1877–1890.
Source: Magyar Statisztikai Évkönyvek

Of the northern counties, only in the case of Sáros we can compare the average grain, potato, and maize yields with the precipitation values (Figs. 13 and 14). The figure clearly shows the strong correlation between precipitation and average yield: in the period with high precipitation (above 600 mm/year), grain yields declined, such as after 1879, 1882, and 1887, whereas in moderately rainy

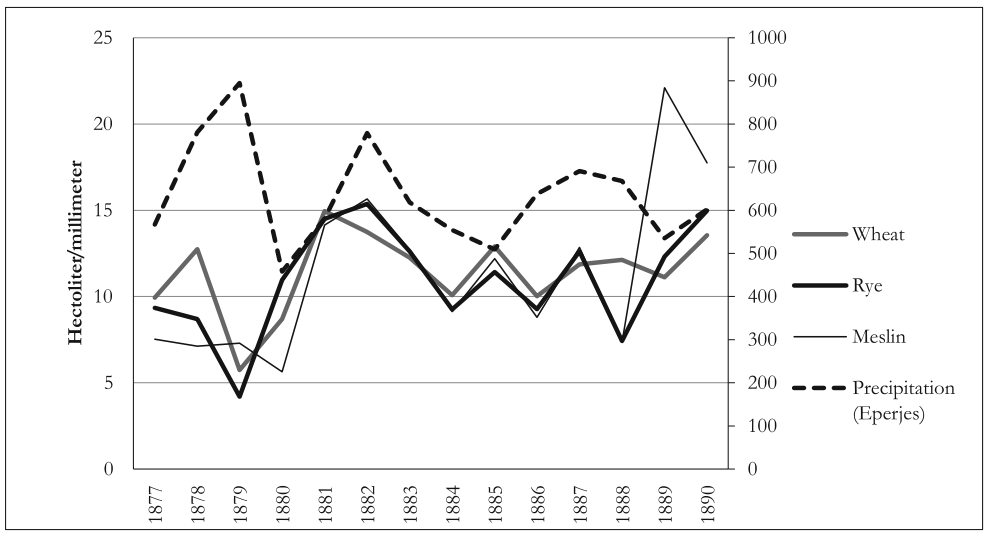

Figure 13. Annual cereal crops in Szepes County in relation to the annual average precipitation in Eperjes. Sources: Meteorológiai Évkönyv, Magyar Statisztikai Évkönyvek

years, grain yields rose. Although each cereal responds differently to precipitation, there was not too much difference in yield. Similarly, in the case of potatoes, a close relationship can be observed between yields and changes in precipitation: too much rain clearly resulted in a drastic decline in yield, while in drier years the average yield improved somewhat. As for maize, the correlation can also be seen, though it is less spectacular way: declining rainfall led to higher crop yields.

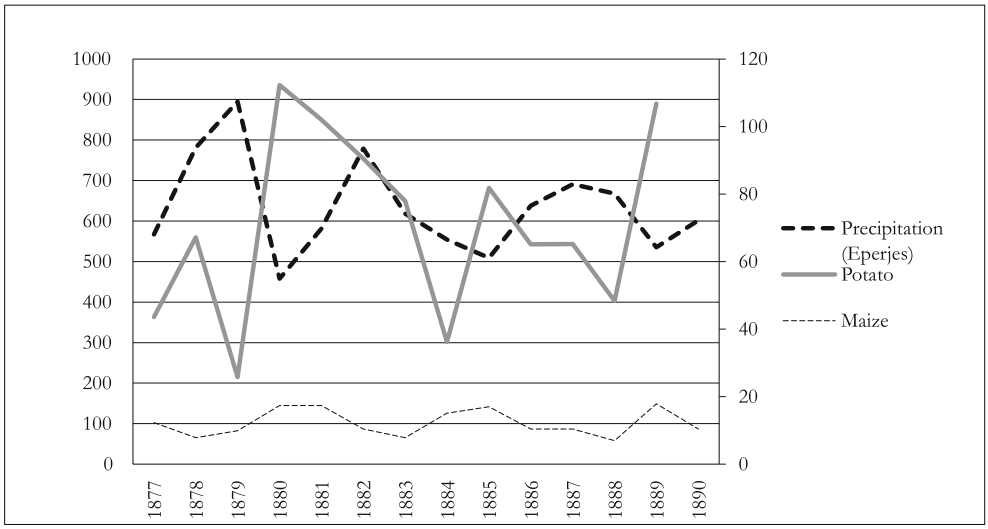

Figure 14. Annual potato and maize crops in Szepes County in relation to the annual average precipitation in Eperjes. Sources: Meteorológiai Évkönyv, Magyar Statisztikai Évkönyvek

Subsistence Crisis and Its County-level Management

Although our data show that 1879 was the worst year for the crops we are studying, the harvest results of 1878 also lagged behind results from the previous years. Our qualitative sources show that this was due to the unfavorable weather typical of the whole of 1878. The year began with a huge amount of snow in January, followed by a rainy and cool spring. Continuous rainfall made it impossible to start spring work in the fields and the vineyards.

With the arrival of summer, the situation did not improve; due to the low average temperature and the amount of rain, the crop showed an increasingly depressing picture as harvest time neared. Articles in which locals expressed their frustrations were published in organs of the press, including for instance the following description:

> The weather is still desperate, it doesn't want to clear up, and the rain, if not every day, falls every other day. Grape rot is common on all the hillsides, and if the weather does not get warmer or windy soon, our hope for a rich harvest will be dashed. Good, high-quality wine can no longer be expected as very warm weather has not arrived and the soil is so full of moisture that its absorption can only be somewhat balanced by extremely windy, dry, warm days. The weather not only affects us winegrowers, but also the grain producers; in the counties of Abaúj, Zemplén, Ung, and Gömör, but also in the upper parts of our [Borsod] county, the grain is still out in the field, and the blackened and even greening bundles offer a sad sight.[17]

As our graphs show, the 1878 harvest was not overly plentiful, and although rainy weather continued throughout the autumnal months, at least the grape harvest turned out relatively well due to the higher temperatures in September and October. Plenty of wine was also reported from Sopron and Budaörs, although the quality was uneven.[18] The reports submitted by the *alispán* of the county indicate that many grapes were harvested in Borsod as well, but where it was not possible to finish the harvest in time (and this was usually the case for better quality grapes), the grapes burst and rot due to the high quantity of rain. As a result, the quality fell short of expectations and the price of wine fell sharply.[19]

Excessive rainfall caused serious problems from other perspectives as well, in addition to disappointing yields. Due to frequent floods and inland water caused by high groundwater levels, a significant part of the arable land was covered with either water or a thick layer of mud. This made it difficult to plow and sow the lands in the autumn for the following year. Thus, the farmers had to begin the next year (1879) with harvests which were far more modest than they had hoped for large swathes of land that went unsown.

The climate of 1879 put people's tolerance to the test. Although the winter was not too harsh, it was all the wetter, so when spring arrived and the huge amount of winter snow started to melt, this caused severe flooding across the country. Floods of several small and large rivers were reported from the area on which our research focuses, but most of the problems were caused by the flooding of the Tisza River, which affected both counties. The river broke the surrounding embankment between Zemplénagárd and Leányvár on December

17 *Borsod. Miskolczi Értesítő*, August 29, 1878, 3.

18 Réthly, *Időjárási események*, vol. 2, 548.

19 MNL BAZML, IV. 809. b. 868/1881.

27, 1878, flooding the surrounding arable lands.[20] Although the embankment had been repaired, the *szolgabíró* of the Bodrogköz District reported on the July 4 that one fourth of Bodrogköz was still covered with water. As he noted in his report, the constant rains completely destroyed the few autumn sowings that the flood had spared and thus also the spring crop. Furthermore, after pastures had been broken up and turned into arable land in the previous dry years, now, when the remaining pastures were under water, people were driving their cattle to other counties to graze or simply selling them at cheap prices.[21] The *szolgabíró* of the Szerencs District also highlighted in his report that places which where normally waterless in the middle of summer were also covered with water due to the high levels of rain.[22]

By July, it had become increasingly certain that the year's harvest would be well below even the yields of 1878. Heavy rains and severe frosts had destroyed not only the cereals but also the potatoes and the maize, which were the staple food of the poor. The situation near harvest time was summarized by the *szolgabíró* of the Szinna District in July as follows:

> This year in my district, because of the heavy and continuous rainfall, the field crops are showing a worrying picture. Wheat and rye are poorer than average, harvesting is very slow due to the continuous rainfall, barley is practically missing, oats are mediocre, maize, beans are very deficient, potatoes, which are indispensable to the Highlanders, have already rotted. This is compounded by the depressing circumstance that citizens who moved to the lowlands for the harvest are returning with half the income they earn in other years […]. Fodder crops, if they are successfully harvested, can be said to be pretty good this year. I note that we had quite high hopes for spring crops, in particular, at the end of last month, but they have been severely damaged by the continuous rainfalls since the 5 of this month [July].[23]

In early September, after the start of the harvest, he briefly reported that "the result can be said to be the worst possible" and that the proliferation of wild boars and bears was causing considerable damage to the already shoddy crop and among the cattle.[24] Cereals produced so few seeds that they were considered

20 MNL BAZML IV. 2402. b. 2/2020/1879.
21 Ibid.
22 Ibid.
23 Ibid.
24 Ibid.

not only insufficient for sale and food, but also as seeds. It was feared that great parts of both counties would soon face famine.

Finally, we must also talk briefly about the development of fruit crops, especially grapes, which were a major source of income in Zemplén County. As noted earlier, in 1878, despite the rainy autumn, there was a relatively large amount of wine, although the quality of the wine was not very good, and this led to a significant reduction in its price per barrel. In 1879, however, the vineyard owners' prospects deteriorated further after hailstorms in late spring and summer severely battered not only the orchards but also the vineyards.[25] In addition, in the settlements of Tokaj-Hegyalja (Mezőzombor, Mád, and Tarcal), a leafroller moth called *Tortix pilleriana* appeared, and the worms of this moth caused enormous damage in the vineyards.[26] Presumably, the locals managed to curb the spread of the insect, because in the subsequent reports submitted by the *szolgabíró*s, it was noted that traces of neither the *tortrix pilleriana* nor the *phylloxera* appeared in the vineyards.[27] Unfortunately, the situation was much worse for the other fruits, as in 1879 and 1882 the crop failed due to frost and premature fruit loss.[28]

Heavy rainfalls and floods contributed indirectly to general impoverishment as well, since people could not get to the fairs and markets due because of the damaged roads and bridges, so they had to do without the incomes they usually made from selling their goods. In addition, repairs to the roads were made only slowly, as due to the high water levels, it was difficult to remove the gravel needed for paving from the rivers.[29] It is thus hardly surprising that the *szolgabíró* have reported stagnation in tax collections in all the districts.

Penury in Zemplén County

It did not take long for the first signs of crisis to appear. In September, the *alispán* of Zemplén County informed the Minister of Interior about the worrying situation:

25 MNL BAZML IV. 2402. b. 107/1880.
26 MNL BAZML IV. 2402. b. 6559/1879.
27 MNL BAZML IV. 2402. b. 127/8758/1880; 9340/1881; 2216/1882.
28 MNL BAZML IV. 2402. b. 189/6559/1879; 162/9479/1882.
29 MNL BAZML IV. 803. b. 185/1879.

> Your Honourable, the Hungarian Royal Ministry of Interior!
> From the reports of some of our *szolgabírós* and the public statements based on the experiences of committee members gathered at this general assembly from different parts of the county, we have sadly made sure that most of the county's people will struggle with poverty and hunger as a result of current year's general infertility.—And the middle and smaller landowners, in addition to their already shaken credit, have found themselves in such a dire situation that they are on the verge of death without the help of a cheap state loan to be lended as soon as possible.[30]

The *alispán* ordered reports on the annual yields for each parish covering the possessions and the supplies of foodstuffs and seeds of the landowners. In addition, a so-called "poverty committee" was set up to compile the incoming data and take the necessary measures. In order to remedy the situation, the Minister of Finance was asked to suspend the collection of state taxes among the already struggling population for a year, beginning on October 1, 1879,[31] and the Minister of Transport and Public Works was instructed to provide a source of income for the needy through public works.[32] In response to the request, the Minister of Interior was willing to grant the requested government loan, but not for the number of people requested by the county. The financial support was limited to people of two categories: the destitute who were able to work and the destitute who were not able to work or could not support themselves on their own. Furthermore, seeds were also given to those who were unable to obtain them even through private credit. The Minister of Interior asked the county leadership to review the range of people who needed support based on the conditions mentioned above. Until the exact data was available, however, he sent 8,000 forints as financial aid, "so that where the risk of starvation really threatens, the necessary aid can be provided from this amount."[33]

Despite the fact that the Minister of Finance was asked in November to suspend the collection of state taxes, reports from the county said there was no response to the request, and tax collectors continued to seize the last food items of those in need with the utmost rigor. Given the gravity of the situation, the Zemplén County General Assembly decided to take immediate action. Instead

30 MNL BAZML IV. 803. b. 434/1879.

31 After the moratorium expired, they asked to pay the one-year tax in interest-free instalments. MNL BAZML IV. 2402. a. 188/1879.

32 MNL BAZML IV. 803. b. 434/1879; MNL BAZML IV. 2402. a. 188/1879.

33 MNL BAZML IV. 2402. a. 321/1879.

of sending petitions *(felirat)* to the Minister, which was the normal way of lodging a complaint or request, the Assembly requested the immediate suspension of tax collection by telegram:

> Because of the famine, our assembly asks to stop tax enforcement against farmers in all our districts through telegraphs; otherwise there will be distress in districts where it otherwise would not have been.
> Tax enforcement has a very bad effect in times of need.
> More explanation in representations.
> We are asking for taking actions through telegrams because there will be auctions tomorrow.[34]

The general county assembly decided on the following measures. First, it was resolved to purchase maize to feed the destitute who were incapable of working. It was estimated that the supply of maize to feed roughly 5,000 people in need, though the concession was made that "their number will be much higher," counting one liter per person per day, would require 9,100 hectoliters of maize in total at a cost of 91,000 forints (10 forints per liter). The Minister of Interior was therefore asked to issue the necessary amount in the form of state aid.[35]

Steps were also take to provide help for the destitute who were able to work by offering public employment opportunities. The number of people belonging to this category was put at 7,891 in Zemplén County. For each person, 120 working days were calculated with a wage of 40 kreuzers per day, which comes to a total cost of 384,000 forints.[36] The county assembly listed by district the public works in the county "the construction of which was in the best interests of the public" and then submitted the planned works and the estimates of costs to the Ministry of Public Works and Transport for approval.[37] The minister may have found the costs of the planned public works too high, because he asked the county to select only those work projects which were essential to the public interests and then resubmit the proposal to the Ministry. Until authorization was given, he sent 50,000 forints to start the approved works.[38]

Fortunately, with the help of the sources, we can also get an idea of how the aid process took place. In each district, a district relief committee was set

34 MNL BAZML IV. 2402. a. 321/1879.
35 Ibid.
36 MNL BAZML IV. 2402. a. 9522/1879.
37 MNL BAZML IV. 2402. a. 321/1879.
38 MNL BAZML IV. 2402. a. 9522/1879.

up to distribute food, which was procured by a subcommittee of the Poverty Committee (Central Subcommittee). The minutes of a meeting of the General Assembly offer the following description of this committee:

> The District Relief Committee, composed of two, possibly three trusted, intelligent individuals living in the district and the *szolgabíró*, is led by the *szolgabíró*, who takes over the food sent by the Central Subcommittee and executes the distribution in agreement with the Committee members, and in due time he submits to the county *alispán* a certificate of the use of the food or financial aid that have been sent. In addition, he is required to report weekly to the *alispán* on the condition of those in need.[39]

The allocation and implementation of public works was organized in a similar way to relief management. First, the individuals responsible for oversight wanted to ensure that only county residents were involved in public works. It was the task of the *szolgabíró*s to prove this, and they gave a certificate (ballet) to the individual who applied for employment. The needy were divided into two groups. The first group included strong men who would be given a daily wage of 40 kreuzers, while the second group included weaker men and women, who would only be given a daily wage of 30 kreuzers. Workers could claim their wages in cash or half in cash and half in crop. In addition to wages, workers also received food for the duration of the work. This was coordinated by the s*zolgabíró*s through contractors.[40]

Relief, however, came slowly, and many people decided to look elsewhere for their livelihoods. Some headed south towards the Great Plain, while others went to north and sometimes even as far as England or America. As the *szolgabíró* of Nagymihály wrote in November 1879,

> In my district, this year's poor harvest and the fact that state aid has not arrived yet are forcing the poorest people to migrate to America and England. I am aware that it is the working men, young and old, who leave their homes in hordes to emigrate, among them countless men of military age and off-duty soldiers. They make their way through Kassa to Eperjes, and there are agents in the latter town who give advice to those who want to emigrate.[41]

39 MNL BAZML IV. 2402. a. 321/1879.

40 MNL BAZML IV. 2402. a. 9522/1879.

41 MNL BAZML IV. 2405. b. 9958/1879.

As the *szolgabíró*'s report shows, the authorities were aware of the possible consequences of emigration even before it took on a mass character, but they did not know what they could do to slow it. On what grounds could they hold people back, and how could they restrict an individual's personal freedom if he or she wanted to leave? In addition to legal issues, moral questions also had to be taken into consideration. Etele Matolay, the *alispán* of Zemplén County, also addresses this problem in a letter to the Minister of Interior:

> Another question, however, is whether it is possible or, in such a time of need, advisable to act with rigor in such a case if the person is not liable to military service when we are not even able to give the jobseeker a job at home. […] Then when they have to deal with poverty at home: I would consider it an unjustified restriction of personal freedom to prevent them from emigrating.[42]

When emigration began to take place on a larger scale, the authorities did not even know where people were going, and this also hampered official efforts to slow it. It was rumored that people were being taken to dig the Panama Canal, but they did not know exactly where they would end up or what kind of work they would be given or whether, for that matter, they would be paid properly, given care in the case of illness, or be transported back to their homeland.[43]

Although the abovementioned measures helped improve the conditions under which the destitute lived their everyday lives somewhat, the climate still did not improve, and 1880 ended with poor harvests (making it the third year in a row to end with a disappointing harvests). Seeing the increasingly dire impoverishment of the population, the *alispán* sent another petition to the Minister of Finance:

> Considering that this year's harvest was far less substantial than what was hoped for, and considering that most of those involved in agriculture have been burdened with considerable debts as a result of the spring crisis and repayment for these debts is due this year, and taxes of the last two years will also be payable this year, please be so kind as to extend the deadline for repayment of the state loan by one year and to modify the payment dates to October 1, 1881, 1882, and 1883. On October 1 of the current year, interest shall be payable only on the due date.[44]

42 MNL BAZML IV. 2405. b. 10717/1879.

43 Ibid.

44 MNL BAZML IV. 2402. a. 127/1880.

Despite all hopes, the following year did not bring the long-awaited abundant yield. A heavy downpour came with hail in July, affecting almost all the districts in Zemplén County. It hit autumn and spring crops so hard that the *szolgabíró*s saw little chance of the grains developing by harvest time.[45] The district reports indicate that, in general, few grains were produced,[46] and mice, who had multiplied in the highlands, caused significant damage to autumn grain.[47] In his semi-annual report, the *alispán* ranked the 1881 harvest as one of the worst,[48] and he noted that it had caused further impoverishment and an increase in emigration.

The year 1882 brought mixed results. Both the data and the narrative sources show that rainfall was abundant again, causing flooding along several rivers. Fortunately, the heavy rains came mostly in late summer, and by that time, the "truly beautiful crop" had been harvested in many places, but there were areas (e.g. in the middle of the county) where rains did great damage to the crops that had already been harvested. At the same time, the wet weather was beneficial to root and fodder crops and also to pastures and meadows, which had become dry in the long droughts during the first half of the summer.[49] The diverse geographical conditions of Zemplén are well illustrated by the fact that, while in some areas the harvest was abundant, in other districts, such as the Homonna and Szinna districts to the north, a situation of destitution or near-destitution developed. The s*zolgabíró* of the Szinna district, fearing a crisis as dire as the crisis faced in 1880, requested the cessation of tax collection.[50] The sources, however, suggest that the s*zolgabíró's* fears may have been an overreaction, as there was no cause for distress.

Given the abundant crop, tax collection began with renewed vigor, and efforts were made to recover debts accumulated in the previous years. Several s*zolgabíró*s indicated that tax collection was progressing well, so there was no need to use bailiffs to collect arrears. It seems, then that the harvest of 1882 was abundant enough in several places to help the population begin to recover from the trials they had suffered in the previous years.

45 MNL BAZML IV. 2402. b. 7135/1881.
46 MNL BAZML IV. 2402. b. 7135/1881, 9286/1881, 9340/1881.
47 MNL BAZML IV. 2402. b. 9340/1881.
48 MNL BAZML IV. 2402. b. 5/2534/1882.
49 MNL BAZML IV. 2402. b. 162/9479/1882.
50 Ibid.

Penury in Borsod County

Although the first official report on impoverishment in Borsod County was written in December 1879[51] (months after the first official report on Zemplén), it can be assumed that the first signs of the crisis appeared earlier. At the beginning of November, the weekly journal *Borsod. Miskolczi Értesítő* reported on the unfavorable weather and poor harvests in the county,[52] and soon after this, it wrote of needy job-seekers from the highlands: "There are already signs of acute need in the highlands, for every day we see the highlanders marching through the county with nothing to eat, migrating to the lower part of the country in groups, looking for work; […]."[53] Presumably, by November, the leadership of the county was confronted with the extent of impoverishment, which found clear form in the sight of people coming from the highlands, and the people of Borsod also had to suffer increasingly dire penury. This is indicated by the fact that in November the General Assembly of Borsod County asked the Minister of Finance to suspend tax collection "given the impoverishment."[54]

One month later, Bertalan Bay, the *alispán* of Borsod, reported to the Ministry of Interior on the situation in the county as it follows:

> On the basis of the official reports I have received, I have stated that in this county there are generally alarming phenomena concerning the livelihoods of the lower classes; that in the town of Miskolc the number of the poor is very high, and the extreme cold, which arrived with unusual suddenness, aggravates the situation, so that the town authority is taking measures on a case-by-case basis to provide aid for the needy.

I also noted with regret that in the lower part of the district of Miskolc the working class has no income, and the small amount of food they have purchased is almost completely exhausted, and in particular that the town of Mező-Csát is facing a crisis; finally, in the upper section of the Szentpéter district, especially in Alacska, and in the upper section of the Eger district, in Tibold Darócz and Kács, several families depend on the mercy of the better-off. In both parts of

51 MNL BAZML IV. 803. b. 577/1879.

52 *Borsod. Miskolczi Értesítő*, November 6, 1879.

53 *Borsod. Miskolczi Értesítő*, November 20, 1879.

54 MNL BAZML IV. 803. b. 420/1879; MNL BAZML IV. 803. b. 569/1879.

the Szentpéter district, however, it was indicated that official aid measures would have to be taken soon.

Given these unfavorable circumstances, it is to be feared that the distress at the beginning of next year will be so great in many places that, in order to alleviate it and to secure the financial survival of some, it is necessary to resort to state aid. For this reason, I have the honor to request the respectable Hungarian Royal Ministry to lend a certain amount—at least one thousand forints—as state aid as soon as possible.[55]

Given that according to the *alispán* the most state aid would be needed at the beginning of the following year, we can conclude that the situation in Borsod was less serious than in Zemplén, where the county *alispán* applied for state aid in the autumn. This seems to be supported by the annual report of the Borsod *alispán*, dated February 1880, according to which

> conditions are generally depressing, and the poorer class, especially because of the prolonged harsh winter, suffers from a sensitive shortage of already depleted foods and firewood in particular. However, with contributions by wealthier benefactors and using municipal funds in some places, the absolute need for state aid has not yet arisen to a greater extent—families struggling in need were only reported in the upper parts of the Miskolc and Eger districts, for whose relief I sent the amount corresponding to the need indicated [...].

At that time, only 300 forints had to be allocated from the 1,000 forints that had been previously sent by the Minister of Interior. At the end of the report, he summarizes the previous year as follows:

> But it should also be emphasized that despite the generally unfavorable conditions last year and the extremely severe winter, the likes of which has not been experienced for decades, there has been no phenomenon in the county that would prove the depletion of people's resources and means of subsistence. Even the poorest class, exposed in many ways to the most cramped way of life and the suffering and misery of life, bears its fate with silent surrender, and while people hope that difficult conditions will take a turn for the better, they calmly tolerate their circumstances, try to earn an income, and hope that their fates will improve in time.[56]

55 MNL BAZML IV. 803. b. 577/1879.

56 MNL BAZML IV. 803. b. 1/1880.

Impoverishment hit Borsod in the early 1880s. The *szolgabíró* of the Sajószentpéter district reported that a hungry person was transported to the hospital in Miskolc from Sajószentpéter, and a starving sick family was aided with funds from the town's treasury. However, he added that the people, considering their livelihoods, were not in a position to be seriously worried, or state aid would have to be required.[57] Not long after, however, he made the following report: "As a result of the fruitless harvest of the current year, the population of my district, with the decline of transport and manual labor, is already suffering a heavy burden of subsistence. In general, I can point out that not only manual day laborers, but also some of the landowners, are struggling with their livelihoods."[58]

In Miskolc, the seat of Borsod County, the situation deteriorated considerably with the arrival of the extremely cold winter, but fortunately it did not turn into a crisis thanks to the quick measures taken by the town authorities. Having already created a list of the needy in the town in a forward-looking manner, they were able to alleviate poverty more easily and quickly with the distribution of food, firewood, and money as the need arose.[59] As a result, in January 1880, the mayor of Miskolc, Kálmán Soltész Nagy, submitted a reassuring report to the county deputy:

> Based on the reports made to me and on my own experience, I officially declare that the poverty of the poor in the town of Miskolc does not appear to be of such magnitude at this time that it would require legal or state measures.
> It is undeniable that in the winter, the poverty of the population is greater than it has been in other years; however, the authorities, in accordance with the order of the town council, shall provide those who are incapable of working with the most essential foods and save them from starvation.[60]

Considering the deprivation suffered by the population and conditions close to famine, it could be feared that public safety would deteriorate. In 1879, the Borsod *alispán* asked the Ministry of Interior for eight more cavalries and eight

57 MNL BAZML IV. 809. b. 488/1880.
58 MNL BAZML IV. 809. b. 519/1880.
59 MNL BAZML IV. 803. b. 1/1880.
60 MNL BAZML IV. 809. b. 107/1880.

infantry gendarmes, in addition to the existing ones, due to an increasing number of cases of violence.[61]

There were similar fears of an increase in acts of violence in Zemplén, but according to the semi-annual report of the *alispán* in 1880, "public safety, considering the given impoverishment and need, cannot be called worrying."[62]

As in Zemplén, the provision of public works for the poorest was discussed in Borsod County. It would have been especially helpful for the needy in and around Miskolc if the riverbed regulation planned after the great flood in Miskolc in August 1878 had finally been given the green light from the Ministry. As Kálmán Soltész Nagy, the mayor of Miskolc, wrote in his report, "If the city had already approved the regulatory plan, it could not only help the poor by giving them work, but could also save the significant amount of money it has to spend on relief for the poor relief."[63] He then asked the *alispán* to try to get the Ministry of Public Works and Transport to approve the draft regulation as soon as possible "so that the work can begin to provide the poor of our town with a source of income at the beginning of spring."[64]

Fortunately, the improving weather also alleviated the misery. As the Borsod County *alispán* wrote, "In the area of the town of Miskólcz, with the onset of milder days, the shortage begins to end, so much so that by the 15 of the current month [March], the supply of foodstuffs will be ceased. Residents in need of public aid can get work in the vineyards and gardens, and the need for further aid, thanks to providence, will disappear."[65]

After the unfavorable harvests of the previous years, people rightly hoped that as the weather improved, the harvest would finally provide, if not abundant, at least a sufficient yield. However, the spring frosts dashed some of these hopes. In a report on the state of the crops in April 1880, Kálmán Soltész Nagy wrote,

> I am convinced after questioning several farming and viticulture individuals that wheat sowing is generally good, while rye sowing, especially the rye which was sown last, under the cold and heavy snow, is almost completely lost. The buds of the fruit trees are almost completely lost as a result of the extraordinary frost, which recurred at the beginning of spring, and there is no prospect of fruit production

61 MNL BAZML IV. 803. b. 418/1879.
62 MNL BAZML IV. 2402. a. 6/1880.
63 MNL BAZML IV. 809. b. 463/1880.
64 Ibid.
65 MNL BAZML IV. 809. b. 901/1880.

> at all. The buds on the vines are usually blackened, so they are infertile; however, the quality of the lower buds is still impossible to determine at this time.[66]

Nevertheless, the county managed to avoid the worst, and in July, the county *alispán* reported reassuringly to the Minister of Interior that

> Anyway—thanks be to providence! Famine has not devastated our county in a large and scary way. The sympathy and compassion of individuals, municipalities, and our authorities have alleviated the problem everywhere. And now, during the summer, we no longer have a reason to talk about poverty. Works assuring subsistence are underway everywhere, and there is hope that the year will not be one of the worst from the perspective of the harvests.[67]

The yields of the next years were similar in Borsod and Zemplén. The floods of 1881 caused considerable damage in both counties (as they did in other parts of the country), but the harvest ended with a mediocre yield.[68] A year later, in the spring of 1882, the *alispán* of Borsod saw the agricultural situation of the county more optimistically. But from mid-July through August, that is, during the harvest, many crops suffered due to torrential rains,[69] and their quality fell short of expectations. But in several districts, they were still "good mediocre," "completely satisfactory," or, as the *szolgabíró* of the Eger district wrote, "The fruit in the whole district is definitely good. In some places, it has exceeded the farmers' hopes."[70] Thus, the harvest of 1882, which can generally be said to have been plentiful and of good quality, brought the crisis in Borsod to an end, as it did in the neighboring Zemplén County.

Conclusions

The aim of our research was to examine the impact of the weather anomalies of the 1870–80s on agriculture in order to shed light on the decisive roles of weather conditions in the deepening of the agricultural crisis which took place in Europe in the last third of the nineteenth century. In the course of our research,

66 MNL BAZML IV. 809. b. 1246/1880.
67 MNL BAZML IV. 809. b. 2226/1880.
68 MNL BAZML IV. 809. b. 1/1882.
69 MNL BAZML IV. 809. b. 344/1882.
70 MNL BAZML IV. 809. b. 2638/1882.

by examining the climate and yield data of two Hungarian counties, Borsod and Zemplén, we observed a series of years of poor yields, as well as a catastrophic harvest in 1879, which led to a period of distress which lasted until 1882. During this period, the agricultural population, while avoiding the worst (as there was no famines), suffered material losses to a degree that led to mass impoverishment in the long run.

Our research does not show a clear link between unfavorable weather and the agricultural crisis, but we nonetheless maintain our contention that impoverishment caused by a series of bad harvests certainly exacerbated the inflow of foreign grain. Moreover, efforts to cope with the crisis were hampered by the fact that many farmers had been ruined and masses of people, including many farmers, emigrated. There are still many questions to be answered. Although we have only superficially examined the relationship between impoverishment and emigration, which took on massive proportions in 1879, it is very likely that the difficult economic situation in Hungary, which was a consequence of the unfavorable weather, gave a greater impetus to emigration. At this point, our research suggests a clear parallel between events and experiences in Hungary and the European experience, which included an ever larger wave of emigration in several countries beginning in the early 1880s.[71] Our results also show similarities with the duration of impoverishment in Europe as well, as the worst period in Hungary was also between 1879 and 1882, from which the relatively good yields of 1882 were the way out. [72]

Our research also revealed that even in the case of two neighboring counties, Borsod and Zemplén, needs were quite different, although we did not discern any significant differences in the ways in which these needs were addressed. Borsod was less sensitive to hardship, which was presumably the consequence of differences in farming (size and quality of cultivated land, varieties and proportions of cultivated crops, etc.) due to geographical differences. Our findings certainly make clear that if we wish to determine the extent to which we can speak of a national agricultural crisis in 1879–80, further studies at the regional level are needed.

71 Lamb, *Climate, History and the Modern World*, 234.

72 Ibid., 275; Perry, *British Farming*, 54–60.

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Evaluation of the Floodplain Farming of the Settlements of Nagykunság Based on the First Cadastral Survey*

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River control was perhaps the most significant form of anthropogenic environmental intervention in the Carpathian Basin, and in recent decades it has been the focus of considerable attention in the scientific community. However, in order to be able to evaluate this intervention, we need to know more about the floodplain management before the river regulations. In this essay, I provide data concerning the eighteenth-century floodplain management, on the basis of the first cadastral survey documents. According to Klára Dóka and other researchers, the settlements of the region along the Tisza River were in crisis in the early nineteenth century because the floodplain farming system was not adequate to sustain the growing population. However, they based this conclusion on sources concerning population growth, and they did not substantiate their essential contention concerning overpopulation with accurate data on production and consumption. I have sought to determine whether there really was an overpopulation crisis in Nagykunság at the end of the eighteenth century. The main question concerns the relationship between production and needs. The next question is whether the farmers had excess grain which they could take to markets. In other words, was the floodplain farming system profitable? My research constitutes a contribution to the debate between Bertalan Andrásfalvy and Miklós Szilágyi on floodplain management. The first cadastral survey documents contain detailed and reliable data on the management of the settlements, and I contend that they are more accurate and useful than the tax censuses which were compiled at the same time. The first step in the research was to establish the average annual consumption of the population. According to the data of the cadastral survey, production exceeded the needs of the population in each settlement, and the value of the production surplus covered the tax burdens. Wheat had a marketable share of the yield, come to 30–40 percent of the total. Assuming that livestock breeding was even more advantageous, one could contend that the floodplain farming system was profitable. However, natural resources are distributed disproportionately as a result of property relations. In Nagykunság, this found its most dramatic embodiment in the redemptus-irredemptus contrast. There were several events in the late eighteenth century, such as the construction of the Mirhó dam and migration to Bácska, on the basis of which researchers have inferred that the floodplain farming system was in crisis, but the cadastral survey suggests otherwise.

Keywords: floodplain farming system, carrying capacity, overpopulation, production statistics

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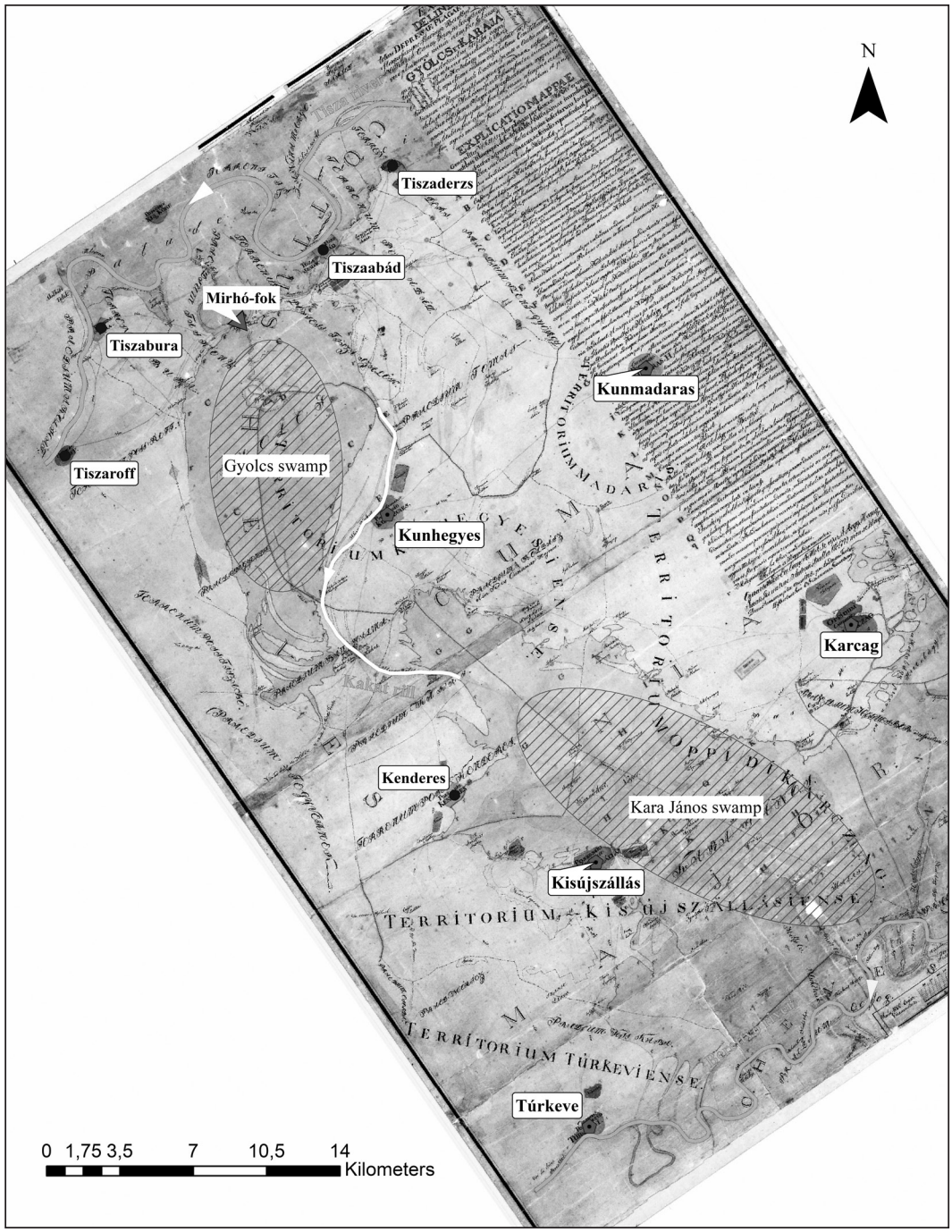
My research seeks to determine whether (and to what extent) floodplain farming was differentiated in the eighteenth century, whether it was able to satisfy the needs of the settlements, and how much marketable produce surplus was available to sell. In my study, by Nagykunság I do not mean the geographical landscape delimited on the basis of natural geographical aspects. I refer more narrowly to the Nagykun District, a political-administrative entity of eighteenth-century Hungary which formed part of the present-day Jászkun-District. I examined the water management of the six settlements which constituted Nagykunság at the end of the eighteenth century: Karcag, Kisújszállás, Túrkeve, Kunhegyes, Kunmadaras and Kunszentmárton.

The study of floodplain farming in Nagykunság is mainly justified by the fact that the population of the area carried out the first significant water regulation works in the Central Tisza Region in Hungary (well before the great river regulations of the nineteenth century took place), the so-called Mirhó Dam. The scour channel *(fok)*[1] was first closed in the middle of the eighteenth century, but the rudimentary rampart erected at that time could not withstand major floods, despite frequent repairs. In 1776, the owners of Heves County demolished the rampart. They claimed that due to a decrease in the floodplain reservoir capacity, they were experiencing higher levels of flooding on the right bank of the Tisza. The settlements of the Nagykun district submitted a complaint about this almost immediately, but the permission required to reconstruct the dam was obtained only in 1785, and the rampart was rebuilt only in 1787, and even the owners of Heves County helped with the works.[2] The flood relief work carried out by the settlements of the Nagykun district is considered in the secondary literature, primarily works on water history, one of the antecedents of the periodic regulations of the nineteenth century, and it is mostly treated as an indicator of the crisis faced by the farming system.[3] Klára Dóka strove to reveal the origins of the elimination of floodplain farming by examining the farming of the settlements along the Tisza at the beginning of the nineteenth century. In her view, extensive floodplain farming faced a crisis by the turn of eighteenth and nineteenth centuries, as it could no longer meet the needs of an increasing population, which prompted the communities to

1 *Fok*: scour channel, stream bed, channelixing water flow from the river onto floodplain during floods and draining it back during the falling stage.

2 On the history of the construction, see: Sugár, *A Közép-Tiszavidék két kéziratos térképe*, 53–57; Szabó, "A 'Mirhó-gáttyának' építése."

3 Károlyi, "A magyar vízi munkálatok rövid története," 59; Fejér, *A vízitársulatok 200 éve*, 17.



Map 1. Hydrographic conditions of Grand Cumania (Nagykunság) at the end of the eighteenth century. Map drawn by the author using the following map: JNSZML T30.

transform the previous system and intervene in the environment.[4] However, based on my research carried out in recent years, I have considerable doubts about the need to eliminate floodplain farming behind the construction of the Mirhó Dam.[5] The construction of the dam in 1786 alone cannot be considered evidence of overpopulation,[6] it is necessary to assess the economic condition of the settlements, i.e. to carry out a production-need-based study.

An Outstanding Source: The First Cadastral Survey

During the period of enlightened absolutism, many valuable sources were created in connection with the economic, social, and environmental conditions of the country, of which, from the perspective of the questions at hand in this essay, the census and the military and cadastral survey should be highlighted. Of these, the cadastral survey is a lesser-known source, which is mainly due to the territorial mosaic character of the preservation of documents, as most of the documents created in preparation for the sharing of public burdens fell victim to the resistance of the estates after the emperor's death.

The documents are valuable in part because they strove for completeness (i.e. they recorded all lands, regardless of whether the owner had tax exemption) and in part because they are based on cutting-edge statistical methods (homogeneous data structure, averaged data, etc.) and the survey was conducted professionally (through a well-established institutional system and by qualified engineers). We are well acquainted with the process according to which the survey was conducted, as the survey instructions[7] survived and through the thorough exploratory work of statistician Zoltán Dávid.[8] These are a great help in assessments of the reliability of the data.[9]

In the area under examination, a complete survey document survived only in connection with Kunszentmárton.[10] As for the other five settlements, only the so-called summary sheets are available.[11] However, such sheets also survived

4 Dóka, "Gazdálkodás a Tisza árterein."

5 Rózsa, "A 18. századi árvízmentesítések vizsgálata."

6 The needs of the population exceed production.

7 MNL OL P. 6. 1. 21.

8 Dávid, "Magyarország első kataszteri felmérése."

9 For a source-critical analysis of the first military survey, see: Rózsa, "Az első kataszteri felmérés környezettörténeti forrásértéke."

10 JNSZML V. 1900. 792.

11 JNSZML IV. 2. 76.

in the case of all the settlements in Kiskunság and Jászság, which thus make possible a comparative analysis. In the second half of the twentieth century, Dávid attempted to map the surviving documents of the cadastral survey, and he published some of the data (183 settlements) in a study, along with his analysis of the data.[12] The data provided by Dávid provided an opportunity for me to compare the floodplain farming used by the settlements of Nagykunság with the farming used in the settlements in other regions.

Indicators of Agricultural Cultivation in Nagykunság at the End of the Eighteenth Century

The settlements of Nagykunság were characterized by differentiated farming after repopulation in the eighteenth century. The leading sector was livestock farming, as livestock enjoyed better market sales opportunities and optimal environmental conditions. Grains were grown mainly for subsistence purposes, the sale of surpluses at the market was typical in the middle of the century. In the nineteenth century, as a result of the grain boom, the importance of arable crop production increased steadily, and self-sufficiency was replaced by commodity production. Tibor Bellon has thoroughly examined the farming in the settlements of Nagykunság in the eighteenth and nineteenth centuries.[13] However, as an ethnographer, he ignored in-depth statistical analyses and did not explore the process of structural change in detail. If one examines floodplain farming, the relative weight of crop and livestock production compared to each other is by no means a marginal issue. Most researchers assume there was a grain boom at the focal point of water regulations. As grain production can be carried out only at high risk in a floodplain environment, it was necessary for the area to be free from floods.[14]

In the cadastral records, the data on meadows and pastures are the most uncertain, as the extents of utilization in floodplain environments varied depending on the intensity and duration of floods, which also provided a good opportunity for farmers to make the *határ*[15] areas (the peasants' individual plots along, with the buildings of the village and, often, areas of communal meadow, woodland, vineyards and/or pasture) used for grazing appear to be useless

12 Dávid, "Adatok a mezőgazdasági termelés nagyságáról."

13 Bellon, *Karcag város gazdálkodása*, 24; Bellon, *Nagykunság*, 90.

14 Károlyi, "A magyar vízi munkálatok rövid története," 83–84, Somogyi, "A vízrajzi viszonyok szükségszerű átalakításának felismerése," 150.

15 Outskirts, agrarian area around the settlement.

at certain times of the year. In terms of meadows and pastures, Karcag and Kisújszállás were in the worst situation. The average of 2.5 *katasztrális hold*[16] per capita calculated here is particularly low compared to Túrkeve (5.13 *katasztrális hold*/capita) and Kunhegyes (4.84 *katasztrális hold*/capita). This is due to the hydro-geomorphological conditions, as the former two settlements lie deeper[17] and they directly border the Berettyó River. The average in the settlements of Nagykunság (3.71 *katasztrális hold*/capita) is higher than the average in the settlements of Jászság (2.80 *katasztrális hold*/capita), but it lags far behind the average of nearly 10 *katasztrális hold*/capita of the settlements in Kiskunság, with a large *határ* area and typically low population density. However, it is worth drawing a comparison with the areas outside Jászkunság as well. Most settlements in Nagykunság had a lower average than the average of 4.22 *katasztrális hold*/capita in Heves County and Külső-Szolnok County, but they were in a better position than Győr County, which had an average of 2.23 *katasztrális hold*/capita, Moson County (2.5 *katasztrális hold*/capita), and Sopron County, with an average of 0.58 *katasztrális hold*/capita (except for Kisújszállás and Karcag).[18] Although a land size/person similar to or worse than that of the control areas was observed in Nagykunság, and the highest yielding meadows and pastures were found here. In Nagykunság, the average hay yield was 10 quintals (1,000 kilograms) per *katasztrális hold* while in Jászság it was only 7.3 quintals (730 kilograms) and in Kiskunság it was 3.5 quintals (350 kilograms).

Much more reliable conclusions can be drawn on the basis of the data on ploughland than the aforementioned data. In the settlements of Nagykunság, the average ploughland per person was 1.55 *katasztrális hold*, which is significantly less than the average in the settlements of Jászság (2.94 *katasztrális hold*/capita) and Kiskunság (4.14 *katasztrális hold*/capita). The average in the settlements of Nagykunság lags behind the average in the settlements of Heves- and Külső-Szolnok (1.96 *katasztrális hold*/capita), Moson- (1.74 *katasztrális hold*/capita) and Győr County (1.68 *katasztrális hold*/capita), but it far exceeds the average in those of Sopron County (1.03 *katasztrális hold*/capita). However, if we subtract the *demesne* lands from all the ploughlands, it is 0.90 *katasztrális hold*

16 *Hold* was used as a unit of measurement in the cadastral survey. A *katasztrális hold* contained 1600 *négyszögöl* this was recorded in the survey documents. 1 *katasztrális hold* = 1600 *négyszögöl,* 1 *négyszögöl* = *3,5966 m*^{2} (SI) so 1 *katasztrális hold* = 5755 m^2

17 71 percent of the area of Kunhegyes is above 87 m B.a (B.a: Its height above the Baltic Sea), while 56 percent of the area of Túrkeve is below 85 m B.a.

18 For the data on which the calculation is based see, Dávid, "Adatok a mezőgazdasági termelés nagyságáról."

per capita in Heves- and Külső-Szolnok County, 1 in Győr, 1.74 in Moson, and 0.92 in Sopron County.

The 1.55 *kataszrális hold* per capita does not seem low compared to the data from the four counties, but it is depressingly low compared to Jászság and Kiskunság. Looking at the area size per capita in Nagykunság alone, we should assume a serious growth constraint or overpopulation, but it sheds a different light on the data if we also take into account the quality of the lands, i.e. their yield averages. The yield average in Nagykunság was 9.1 *pozsonyi mérő (p. m.)* (1 *pozsonyi mérő* = between 53.72 and 62.08 liters) per cadastral acre, which is well above the 3.83 *p. m.* per cadastral acre in Jászság and the 2.45 p. m. per cadastral acre in Kiskunság. In the 183 settlements surveyed by Dávid, the ploughlands produced an average grain yield of 7.7 p. m. Of course, I also had the suspicion that there might be some statistical error behind the exceptionally high yield averages or inaccurate or false yield data from Kiskunság and Jászság. There are no indications that the data on the settlements of Jászság and Kiskunság would be skewed downwards or the data on Nagykunság upwards. Only a comparison with the grain production potential[19] can be considered a resource-critical tool. The average wheat production potential of the settlements of Nagykunság is four points better than that of Jászság and seven points better than the average in the settlements of Kiskunság. The average yield per settlement calculated on the basis of the cadastral survey shows a strong correlation with the wheat production potential, and thus the cadastral data seem reliable. The high yield average in the settlements of Nagykunság and the low ploughland area per capita suggest that, at the time, only the high-quality lands optimal for arable crop production were utilized on the *határ* of the settlements. Thus, low ploughland per capita should not itself be considered a sign of overpopulation. Rather, it may indicate a lower preponderance of crop production compared to livestock production.

Most researchers agree that in the eighteenth century, pastoral farming was the most important agricultural sector in Nagykunság, and arable crop production was carried out only for self-sufficiency.[20] However, we have data on the market

19 Grain production potential is calculated by taking into account the parameters determining the crop production of the *határ* of the given settlement, i.e. climate, soil conditions, etc. The data are for the present, but the extent of soil and climate change is supposed not to reach the critical level which would prevent applying the data to the eighteenth century with some uncertainty. Many thanks to László Pásztor, an employee of the Institute for Soil Science and Agricultural Chemistry, Centre for Agricultural Research, the Hungarian Academy of Sciences for the data related to the wheat production potential of the settlements' *határ*s (outskirts, agrarian area around the settlement). See for details: Fodor and Pásztor, "The agro-ecological potential"; Fodor et al., "Coupling the 4M crop model."

20 Györffy*, Nagykunsági krónika;* Bellon, *Nagykunság*.

sales of grain from the middle of the eighteenth century as well. In 1750, palatine Miklós Pálffy ordered a survey of the economic strength of the settlements of Jászkunság to be conducted in order to levy taxes more proportionally. According to this census, the landholders of Nagykunság mostly sold their grain on the markets in Miskolc and Debrecen,[21] but we have no data on the volume of the grain trade. For example, the landholders of Kunszentmárton mentioned that some landholders did not sell any *mérő* of grain in 10 years. Thus, the information concerning which markets the farmers s old their grains on does not suggest in itself that grain production was determined by production for marketing. Examining the cadastral data, we can clearly see that the ploughland per capita shows a small variance in the settlements of Nagykunság (1.1–2 cadastral acres per capita), i.e. the extent of ploughland was relatively closely related to the population, which indicates self-sufficiency in the sector. If we assume that crop production was under extensive compulsion to grow, whether due to market conditions or unsatisfied domestic need, the amount of ploughland would be determined not by the population but by the amount of potentially suitable areas. All this, of course, is only true if we rule out the possibility that the ploughland had already reached its maximum possible extent and the small standard deviation of the ploughland per capita was purely coincidental. We have already seen that the hydro-geomorphological features of the *határ*s of the Nagykun settlements are different, and consequently their agricultural potential is also different. It therefore hardly seems likely that the ploughland reached its maximum extent, and thus the relationship between the extent of ploughland and the size of the population is not a statistical coincidence but an indication of self-sufficiency in crop production. Of course, this does not exclude the possibility that in years of high yields the surplus that was produced over the domestic consumption needs of the population was sold on the market. However, we can only venture conclusions concerning how much this amount may have been (and this is an important question of this study) if we also have estimates for consumption.

Calculation of Population Needs

Determining the grain needs of the peasant farms in Nagykunság is a very difficult task, as we have to take into account a number of variables (proportion of meat and cereal consumption, dietary habits, differences in nutrient requirements

21 Bagi, "A Jászkun Kerület," 254–66.

by gender and age groups, the impact of work activities, etc.) on which we have only sporadic data. However, as the relationship between production and consumption is a key issue in evaluating farming, despite these difficulties, we find a relatively large number of estimates in the literature and in contemporary statistical sources. In the present study, given the absence of adequate resources, I neither intend to estimate the contemporary needs of individuals, families, or peasant farms nor do I wish to contribute directly to the debates in this regard. I tried to bridge the problem of uncertainty by using estimates offered by several researchers and contemporary sources together, and since the sources so far provide little support, I assess their relevance to Nagykunság and the conditions of the relatively short period (the end of the eighteenth century) only to the extent needed.

The following estimates have been used for the annual grain need per person/family/household:

- Géza Perjés' estimate for the eighteenth century: 3.5 q = 7.51 p. m./capita/year,[22]
- István Orosz' estimate: 5 kila = 5 p. m./capita/year,[23]
- The average consumption used in the 1868 harvest statistics: 5 p. m./capita/year,[24]
- According to István N. Kiss' estimate, a family's minimum need for bread grain is: 6 q = 13 p. m./family/year,[25]
- In 1782, based on the aggregation of the Miskolc city council on grain need: 18 p. m./family/year,[26]
- Based on the censuses conducted in the Triple Districts during the Napoleonic Wars: 6 kila/capita/year,[27]
- Based on the 1816 Triple District Census: 1 kila barley/capita/year, 1 kila wheat/capita/year.[28]

Three of the data are estimates made after the fact and four were arrived at by contemporary public administrations. In order to make the calculations easier, I converted the needs to p. m., i.e. the unit of measurement that was also used in the cadastral survey. I did not consider the use of metric measurement units appropriate, because during conversion, *pozsonyi mérő*, which is one of the

22 Perjés, "Mezőgazdasági termelés," 240–42.
23 Quote by: Bagi, "Adatok a növénytermesztés nagyságához," 38.
24 Keleti, "Az 1868. évi aratás kenyérterményekben," 160–61.
25 Quote by: Gyimesi, "Adalékok Miskolc gabonaellátáshoz," 482.
26 Ibid.
27 Quote by: Bagi, "Adatok a növénytermesztés nagyságához," 38.
28 Ibid., 41.

liquid measurement units, has to be converted to a weight measure, which can only be done with significant uncertainty.[29]

The lowest average need comes from the 1816 census, but these data are related to the "poverty census" and thus they should be interpreted as the minimum need of the population, and if the total grain production of any settlement did not reach the total population need calculated according to this, it indicates severe overpopulation. István N. Kiss' estimate of 6 q/family, i.e. converted and rounded to 13 p. m./family/year, divided by the average family size of 5 people calculated on the basis of József's census data, means an average consumption of 2.6 p. m./person/year. The consumption of 18 p. m./family/year, determined by the Miskolc City Council in 1782, corresponds to an average consumption of 3.6 p. m. per person, and thus, together with the former, it is one of the lower estimates. The average value is consumption used in the 1868 harvest statistics and the census made during the Napoleonic Wars, and István Orosz also assumed a similar annual need per person. The most well-founded estimate seems to be that of Géza Perjés, who estimated the main annual need at 3.5 quintals, (7.51 p. m.) based on calorie needs and taking into account a whole range of variables (work intensity, age and gender-related differences, the calorific value and milling characteristics of grains, etc.). In connection with his estimation, the biggest question is how livestock farming can be adapted to the population of the central settlements of the Great Plain; he himself drew attention to this uncertainty factor as well.[30] However, in the communities of the Great Plain, which were mainly engaged in livestock farming, the proportion of grains in the average diet may have been lower, and this may have been especially true for floodplain settlements, where fish, game, and fruit (with regard to floodplain orchards) may have been been a proportionally larger part of the average diet. Another question is the extent to which the average daily consumption of 4,000 calories per an adult man, calculated by Perjés (and this seems high even seen from the perspective of today), can be generalized in the eighteenth century. In view of all this, Perjés' data can be considered a kind of "upper" estimate.

29 In the eighteenth-nineteenth centuries, liquid measures were used instead of weight measures to measure cereals. In the 18-nineteenth centuries, the size of *pozsonyi mérő* changed from 74 *icce*s to 64 *icce*s, i.e. between 62.08 and 53.72 liters. *Pozsonyi mérő*, therefore, corresponds to 46.5 or 40.29 kilograms of grain. This uncertainty can no longer be accepted in the order of tens of thousands of *pozsonyi mérő*. For conversions, see Bogdán, *Magyarországi űr-, térfogat-, súly- és darabmértékek,* 345.

30 Perjés, "Mezőgazdasági termelés," 236–37.

The issue is further complicated by the question of what we exactly mean by food or bread grain in the era. During the cadastral survey, the yields of four cereals (wheat, rye, barley, and oats) were recorded. In peasant culture, of these, wheat and rye clearly appeared as food grains, while oats appeared essentially as fodder crops. However, barley can be classified in either category only with reservations. According to Miklós Szilágyi, little care was taken to store the barley in the eighteenth century, so it was probably considered a lower value grain.[31] However, cereal porridge was the daily food of the people of Nagykunság, and according to sources, barley porridge, which was called gerslin, was also consumed.[32] The population clearly sought mainly to consume bread grains, but after the depletion of these stocks, the consumption of barley as porridge could also have been considered. I tried to bridge the uncertainty about the general use of grains by comparing the needs with three basic categories, namely bread grains (wheat and rye), food grains in the broad sense (wheat, rye and barley), and the total grain yields (wheat + rye + barley + oat).

Need / Production

If we calculate using the lowest average consumption (2 p. m./person/year), we see that the settlements of Nagykunság addressed many of the food needs of the population with wheat, and if we take bread grain and food grain into account, 5–6 fold overproduction occurs. The total settlement need calculated in this way should clearly be considered a minimum need for survival, and if the yield per cadastre calculated on the basis of the averages over the course of several years were close to or below this value, it would indicate severe overpopulation. In the settlements of Nagykunság, however, even the wheat yield exceeded this multiple times, and there was no settlement in Jászkunság where the production would remain below this value. (Table 1).

31 Szilágyi, *Az árpa vermelése.*

32 Elek, " 'Értünk kunság mezején'," 103.

Table 1. Production and need based on the highest and lowest average consumption. Source: JNSZML IV. 2. 76.

Calculated with the estimate from the 1816 census (in p.m.)						
	Wheat			Barley		
	Net production[1]	Need[2]	Difference (percent)[3]	Net production	Need	Difference (percent)
Karcag	38,645	7,580	410	41,555	7,580	448
Kisújszállás	24,365	5,266	363	27,359	5,266	420
Kunhegyes	16,206	3,666	342	14,386	3,666	292
Kunmadaras	12,648	3,966	219	18,782	3,966	374
Kunszentmárton	20,169	2,985	576	20,355	2,985	582
Túrkeve	18,604	3,934	373	26,846	3,934	582
Calculated with a consumption of 5 p. m/person/year						
	Grain bread (wheat and rye)			Edible cereals		
	Net production	Need	Difference (percent)	Net production	Need	Difference (percent)
Karcag	48,192	37,900	27	89,747	37,900	137
Kisújszállás	29,965	26,330	14	57,324	26,330	118
Kunhegyes	20,187	18,330	10	34,573	18,330	89
Kunmadaras	24,493	19,830	24	43,275	19,830	118
Kunszentmárton	26,564	14,925	78	46,919	14,925	214
Túrkeve	31,558	19,670	60	58,404	19,670	197
Calculated with the estimate made by Perjés						
	Grain bread (wheat and rye)			Edible cereals		
	Net production	Need	Difference (percent)	Net production	Need	Difference (percent)
Karcag	48,192	56,980	-15	89,969	56,980	58
Kisújszállás	29,965	39,585	-24	57,924	39,585	46
Kunhegyes	20,187	27,558	-27	35,564	27,558	29
Kunmadaras	24,493	29,813	-18	45,436	29,813	52
Kunszentmárton	26,564	22,439	18	47,094	22,439	110
Túrkeve	31,558	29,573	7	58,737	29,573	99

1 Without the need for seeds. In the cadastral survey, seed was deducted from the crop and this net yield was also recorded. I used this in all my calculations.

2 Only in terms of human consumption.

3 As a percentage of need.

The mean value of the average consumption estimate is given by the 3–5 p. m./person/year calculations. The total population needs calculated on the basis of this were met by the wheat yield only in Karcag and Kunszentmárton, but in the latter, 35 percent of the wheat yield (a relatively high proportion) was overproduction. If we also add the rye yield to this, there is no longer any settlement in Nagykunság where there was underproduction, and in the case of Kunszentmárton and Túrkeve, there was even a surplus of 60–70 percent. If we add barley to this, a 100–200 percent overproduction arises in Nagykunság.

However, the situation is less favorable if we calculate with the average annual consumption of 6 and 7.51 p. m., which form the upper estimates. Wheat production alone does not meet the entire needs in any of the settlements, and an underproduction of 10–30 percent can be observed in terms of bread grain. Exceptions are Kunszentmárton and Túrkeve, where bread grain met the needs and there was even an overproduction of 6–18 percent. However, if we consider food grain, a more favorable picture emerges, as production exceeded the needs in all settlements and, moreover, Kunszentmárton and Túrkeve produced 100 percent more than they needed.

As we can see, due to the uncertainty on the consumption side, it is difficult to accurately assess the relationship between production and consumption; however, some important conclusions can be drawn from the data. Production exceeded the minimum need by several times in all settlements, which makes it clear that there was no serious overpopulation. However, according to Géza Perjés' estimate, the production of the settlements only slightly exceeded consumption. It is, however, important to note that Perjés' calculations assume an extremely ideal consumption even for later periods. Thus, in the years of average yields, the population could have had plenty of grain to sell, not to mention the years of good yields. As production exceeded 4–5 times the minimum need, the worse-than-average years could not have caused more serious disturbances; at most the complete crop yield might have been consumed. Of course, it would be misleading to assess the relationship of production and consumption solely on the basis of physiological needs, to which we must certainly add the various types of tax burdens as well.

In the case of the settlements of Nagykun, the tax books *(Conscriptio facultatum)* of four settlements, Karcag, Kisújszállás, Túrkeve and Kunszentmárton, remained for the years of 1780, but in the case of the latter two, the column of the paid amount remained unfilled. In the year of 1784/85 the population of

Karcag paid a tax of RFT (Rhine Forint) 4,958,[33] and that of Kisújszállás RFT 2,856.[34] The amounts include both the war tax *(contributio)* and the habitation tax *(domestica)*. The amount of taxes did not exceed 7 percent of the total cadastral income for a settlement. Taking into account the assumed highest grain need per capita in the two settlements of Nagykun (Perjés), we can calculate with 32,829 p. m. surpluses in Karcag and 18,339 p. m. in Kisújszállás, considering the whole grain crop together. Calculated on the basis of the average prices of wheat, rye, barley and oats (based on market prices reported in the cadastral survey), this is about 13,470 and 7,029 RFT.[35] It follows that, in principle, the full amount of taxes could be paid merely from the sale of surplus grain. Considering the presumably higher benefits of livestock farming, the amount of war and habitation taxes alone did not impose an unbearably high burden on the population. This is, of course, a theoretical calculation as we do not know what proportion of the crop was actually marketable. Unfortunately, I did not find any summary data on the in-kind part of the war tax, but I assume that its burden might not have been greater than that of the part paid in money. I did not find any data on the exact distribution of the annual 12,600 RFT palatine census, either; however, based on the value calculations of the surplus crops in Karcag and Kisújszállás, it could hardly have been an unbearable burden. In 1837, Márton Bartsik, the archivist of Jászkunság, made a summary of the benefits in money and extraordinary in kind ones provided by the Jászkun District between 1735 and 1837.[36] According to this, the largest produce delivery for military purposes for the period of 1750 and 1800 took place in 1760, when the three districts delivered 60,000 p. m. of grain. This was 5.91 percent of the total annual grain production of the districts. It is also a clear indication that a total of 573,471p. m. of grain collected on extraordinary occasions amounted to 56 percent of the annual average production of the district during hundred years.

In the above calculation of grain surplus only the physiological need and tax burdens were considered however, it is important to take into account feed requirements and and storage losses too. József Glósz examined the balance of grain production throughout the country, calculating with 9 p.m/capita/years of needs, of which 5 liters of physiological needs and 4 liters of other

33 JNSZML, V. 100. 145.

34 JNSZML, V. 200. 1. a./2

35 *Rajnai forint,* taxes were paid in that currency.

36 Papp, "A Jászkunok száz éves áldozatai."

needs, which include tax burdens, animal feed and storage losses.[37] Assuming an average consumption of 9 liters, there was an overproduction of 52 percent[38] in Nagykun District, Túrkeve (103 percent) was in the best position and Kunhegyes (17 percent) was in the worst. It should be noted, however, that farmers in the Nagykun district did not pay the landlord's tax, and compared to other landscapes, there was probably less grain used for fodder here, because grazing was typical and pastures were rich, so the average consumption of 9 p.m/capita/years seems a lot. However, indicated the good situation of cereal production is by the fact that even with this high average demand, a significant surplus of cereals can be observed.

According to Glósz's calculations, there was a small underproduction in Nagykunság in the first half of the nineteenth century.[39] However, according to the cadastral survey, with the same average demand that Glósz used, there was a 26 percent overproduction in the Jászkun District at the end of the eighteenth century. This can be explained by the fact that between 1780 and 1840 the population increased by 74 percent, but the arable land by only 29 percent. Given that the comprehensive river regulation that allowed for greater extensive development of crop production only began in the mid-nineteenth century, this does not seem unrealistic. This study confirms Glósz's remark that county-level statistics may mask significant regional differences. The overproduction was 26 percent in the Jászkun District, but there were significant regional differences: the overproduction was 52 percent in the Nagykun District, 11 percent in the Jász District and 22 percent in the Kiskun District.

Distribution of Resources

The analysis of production and need presented so far is a highly theoretical calculation, as I have compared the total needs of the settlements with the total production, but relative overpopulation can also result from a large inequality in the distribution of resources. In principle, it can be assumed, for example, that the grain crop, which supplies the entire population of the settlement, is concentrated in the hands of a few landowners who constitute a small part of society, and thus the majority of the population faces food insecurity. The social

37 Glósz, "Területi hiány és felesleg," 125.

38 In this calculation I have already taken into account oats, which I have omitted so far because they were feed.

39 Glósz, "Területi hiány és felesleg," 126.

division created by redemption[40] (landowner redeemers/irredeemers displaced from land ownership) brought with it the possibility of such a situation. Fortunately, the individual sheets[41] of the cadastral survey also provide an opportunity to examine the estate structure, but such a document has survived only in connection with Kunszentmárton. However, there is no indication that my findings regarding Kunszentmárton cannot be generalized to the other five settlements with due caution.

In Kunszentmárton, 473 landholders were registered during the cadastral survey, i.e. persons with at least an internal plot (with a house, a garden), 17 of whom did not have any ploughland, meadows, pastures, or vineyards. According to other sources, 269 redeemer landowners lived in the settlement, and thus it seems that even irredeemer landholders obtained access to land cultivated in the system of the land community during the cadastral survey period. In the landed estate structure of Kunszentmárton, however, the marked social response line formed by redemption emerges clearly. At first glance, the structure of the landed estate (Table 2) gives a strongly negative picture, as 26 landless and 183 (38 percent of all landholders) family heads with less than one cadastral acre was recorded. From the point of view of overpopulation, it can undoubtedly be considered negative that almost 46 percent of the population had little or no ploughland or meadow that could be cultivated, as this clearly resulted in a continuously intense demand for land. However, it is also important to point out that a favorable structure of landed estate emerges within the stratum of the redeemers (practically the landholders with land of more than 1 cadastral acre in the table). Among redeemers, especially in the case of ploughland, the landholders in each category and the total cultivated area in that category are

40 The population of Jászság and Nagy- and Kiskunság redeemed themselves for the landlord's jurisdiction in 1745, and in exchange for the money paid at that time, the districts gained administrative, judicial, and economic autonomy, an event called redemption, which derives from the Latin word *redemptio*. The right of redemption, which came into force after 1745, divided society into two large groups, the full-fledged redeemers, who contributed to the costs of redemption, and the irredeemers, who were left out of it. Redeemers, in proportion to their contribution to redemption, acquired so-called capital land, which they freely possessed, and the holdings could be inherited and sold. Irredeemers were in principle not excluded from land ownership, but in practice the right of pre-emption of redeemers significantly limited their access to land. Even irredeemers could obtain access to pastures, meadows, and unallocated, so-called redistributed lands (melon, tobacco, and maize, etc.) at redemption in the eighteenth century, but at the end of the century, irredeemers began to be displaced from the common lands. See for details: Bánkiné, *A Jászkun Kerület közigazgatása*, 23–34.

41 A sheet listing all the owners of each settlement one by one, in which all the holdings cultivated by certain farmers were recorded.

Table 2. Structure of the landed estate in Kunszentmárton based on first cadastral survey

Distribution of ploughland				
(cadastral acre *katasztrális hold*)	Number of landowners in category	percent	Total area of the category	percent
No arable land	39	*8*	-	-
– 0.99	182	*38*	27	*0.46*
1 – 4.99	31	*7*	94	*1.59*
5 – 9.99	39	*8*	293	*4.95*
10 – 19.99	64	*14*	983	*16.59*
20 – 39.99	85	*18*	2,344	*39.57*
40 – 79.99	30	*6*	1,638	*27.65*
80 – 159.99	2	*0*	190	*3.21*
160 –	1	*0*	355	*5.99*
Distribution of meadow				
No meadow	167	*35*	-	-
– 0.99	78	*16*	20	*0.45*
1 – 4.99	41	*8*	116	*2.59*
5 – 9.99	56	*11*	428	*9.55*
10 – 19.99	62	*13*	847	*18.89*
20 – 39.99	47	*9*	1,311	*29.24*
40 – 79.99	17	*3*	963	*21.48*
80 – 159.99	5	*1*	519	*11.57*
160 –	1	*0.2*	280	*6.24*

relatively proportional.[42] Accordingly, in this social stratum, i.e. in the actual landholders, land subdivision was not yet so widespread; this stratum could be less characterized by internal tension. Undoubtedly, the pressure of the stratum of irredeemers gradually became more severe on that of the redeemers, but the key question in judging overpopulation is how great this pressure could have been and whether it could be managed under the given conditions.

In 1786, hundreds of mostly irredeemer families migrated to Bácska as part of the chamber's efforts to relocate sectors of the population. Relocation is interpreted by most researchers as a symptom of a crisis in the community when internal tensions have reached a level so critical that they trigger emigration.

42 This can be contrasted with the national situation at the end of the nineteenth century, when smallholders with less than 5 acres, representing 53.47 percent of the landholders owning 7.52 percent of the total, cultivated land. Katus, *A modern Magyarország születése,* 450.

In connection with this, however, I would like to mention my hypothesis that emigration was motivated more by the benefits of the chamber's relocation efforts than by internal social tension. This seems to prove that the councils of the Nagykun settlements initially strove to impede[43] the organization related to emigration, and the landlords of Külső-Szolnok County wanted to allow emigration from their villages only on condition that the families moving away find new landholders to take their place.[44] This behavior seems illogical if we assume that the settlements were facing an overpopulation crisis.

As the statistics show, the relatively large number (38 percent) of Kunszentmárton's heads of families were landless peasants or smallholders, and consequently landholders with lower levels of wealth and property. However, the stratum of irredeemers was also highly differentiated. On the one hand, there were landholders who had significant numbers of livestock, and on the other, there were herdsmen, horse herdsmen, shepherds, etc.,[45] who played an important role in livestock farming and otherwise enjoyed relatively high social prestige. It is very important that smallholders in the land statistics who cultivated less than one cadastral acre not be clearly considered social outcasts living at the poverty line, as most of them were servants and laborers in the service of redeemer landowners who had an income above the subsistence level. In the eighteenth century, the lord-peasant relationship was strictly regulated centrally by district administrations and at the local level by settlement councils: they prevented lords from luring contracted peasants away, sanctioned unilateral breaches of contract by the lord or peasant, and also set wages.[46] The initial impediment to the organization of emigration was clearly motivated by the fear of losing a labor force. At the agrotechnical level of the eighteenth century, the existence of this stratum providing a labor force was a normal condition for the operation of the farm, as the labor force of a family alone may mostly not have been sufficient to cultivate the estates of redeemer landlords with medium and large lands.[47]

According to the cadastral survey, 209 landless farm peasants or dwarf holders lived in Kunszentmárton, and they accounted for 38 percent of all

43 Szabó, *Kunhegyesi "földtelen emberek Feketitsre" költözése*, 43.

44 Bagi, "Egy bácskai kirajzás," 133.

45 See this for more details: Györffy, *Nagykunság,* 7–28.

46 On the wages of employees and the employment system, see: Szabó, "Megélhetőség Kisújszálláson."

47 According to Imre Wellmann, a serf who had more land than half a serf plot had to hire or use a day-laborer. See: Wellmann, *A magyar mezőgazdaság*, 147. In Kunszentmárton, at the end of the eighteenth century, 18 percent of the owners had more land than 11 *katasztrális hold* (on a country average, this is half a serf plot).

landholders. It is worth comparing this ratio with regional and national averages, but this is difficult to do. Of the surrounding settlements, the individual sheets survived only in Tiszaszalók (it is a part of Abádszalók today). The settlements of Jászkunság cannot be compared with one another due to lack of sources. In Tiszaszalók, the ratio of cottars with less than one cadastral acre was quite high, 61 percent. Of course, the socage settlement can only be compared with the privileged Kunszentmárton with certain reservations, as the landholders classified as cottars in the former may have had access to the allodial land of the landlords. Accordingly, the data for Tiszaszalók are likely to be skewed upwards in terms of the ratio of landless peasants or dwarf holders. Furthermore, the question may arise whether the very high ratio of cottars can be attributed to some peculiarity of the settlement. However, the ratio of socage and allodial lands and the ploughland per person is close to the averages in the settlements of Heves and Külső-Szolnok Counties,[48] and on the basis of its urbarium, it does not differ from the settlements along the river Tisza, either.[49]

According to the census in Nagykunság, the ratio of male cottars was 36 percent of all adult men. This ratio was 39 percent for the whole of Jászkunság, 48.5 in Heves and Külső-Szolnok Counties, 51 percent in Pest County, 32 percent in Győr County, and 51 percent for the whole of the Kingdom of Hungary.[50] In Nagykunság, therefore, the ratio of the landless peasants does not seem striking. At the time of the socage settlement, 27.12 percent of the cottars in the Kingdom of Hungary belonged to the category of housed cottars and 6.23 percent to the category of houseless cottars. By 1791, this proportion rose to 29.64 and 9.25 percent, respectively. Also in 1791, the ratio of housed and houseless cottars was 33.16 percent and 11.66 percent respectively in the counties of the Great Plain.[51] Based on these, on the other hand, the ratio of irredeemers of 38 percent with no land or little land but with a house in Kunszentmárton seems a bit high.

An important issue associated with overpopulation is the standard of living of the lower social strata. Fortunately, the individual sheets of the cadastral survey indicated not only the extent of the land cultivated by certain landholders, but also their yield. In Kunszentmárton, only 39 landholders (7 percent) were listed who did not produce any kind of grain, and 30 percent of them produced less than 5

48 The data on the settlements were published: Dávid, "Adatok a mezőgazdasági termelés nagyságáról," 123–24.

49 The urbariums are bublished: Soós, *A jobbágyföld helyzete*, 25–42.

50 For the data based on the calculation see: Danyi and Dávid, *Az első magyarországi népszámlálás*.

51 Quotes the data: Wellmann, *A magyar mezőgazdaság*, 69–70.

p. m., which was the lower annual need of a person. 53 percent of landholders produced 13 p. m. meeting one family's minimum annual need on their own land, and 46 percent of landholders harvested more than 37.5 p. m.[52] regarded as the upper estimate (Perjés). Thus, in terms of the distribution of production (Table 3), and thus 30 percent of landholders produced below the subsistence level, roughly 7 percent of them produced 13–40 p. m. needed only to provide for the family, and 46 percent also produced a surplus. Thus, a significant part of families produced a marketable surplus. However, I have to nuance the picture that emerges from the survey data at two points. My calculations refer to food grain, which also includes barley, the consumption of which as porridge may have been a stop-gap solution. A further criticism of the calculation may be that it records the average yield. Landholders with an average production of roughly 40 p. m. may have been the ones who were able to ensure their own crop supply even in poorer crop years. This applies to 54 percent of all landholders.

Table 3. Distribution of cereal production among individual landholders in Kunszentmárton based on first cadastral survey

Distribution of cereal production*				
(*pozsonyi méró*)	Number of landholders	percent	All cereals produced in category	percent
Less than 1	66	*13.95*	48	*0.03*
1 – 4	78	*16.49*	1.076	*0.6*
5 – 9	70	*14.80*	1.626	*0.91*
10 – 19	17	*3.59*	852	*0.48*
20 – 39	23	*4.86*	2.363	*1.33*
40 – 79	36	*7.61*	7.945	*4.46*
80 – 159	65	*13.74*	29.654	*16.65*
160 – 319	81	*17.12*	65.559	*36.81*
320 – 639	32	*6.77*	51.309	*28.81*
640 –	5	*1.06*	17.646	*9.91*

* The cadastral data of Kunszentmárton coincide with the estimation of József Glósz of the average yield of the categories of serf plots. See: Glósz, "A birtokviszonyok hatása," 206. The average yield of the estates belonging to the 40–50 Hungarian lunar category was 267 p. m. (According to Glósz, this category had a yield of 280 p. m.), 25–30 *magyar hold* – 176 p. m. (Ibid., 185), 20–21 *magyar hold* – 133 p. m. (Ibid., 140), 13–15 *magyar hold* – 90 p. m. (Ibid., 90), 5–10 *magyar hold* – 42 p. m. (Ibid., 46), 3–5 *magyar hold* – 22 p. m. (Ibid., 23). 1 *magyar hold* = 0,76 *kataszrális hold.*

52 The 37.5 p. m. presumably covered ample the needs of a family, if we calculate average consumption of 7.5 p. m./capita/year and a family size of 5 people.

Based on the above, it seems that at the end of the eighteenth century, the structure of landed estate in Kunszentmárton did not yet show significant fragmentation of the estate, which contradicts the hypothesis according to which the settlement was largely overpopulated. However, the optimal condition observed in the settlement cannot necessarily be considered valid for the whole of Nagykunság. In the other settlements of Nagykunság, the ratio of irredeemers was lower, which, however, does not only mean that there were fewer social tensions and, consequently, less hunger for land, but also that there may have been a less favorable structure of landed estate within the stratum of landowners, as all the cultivable land was shared between several owners. This could have been somewhat offset by the fact that the land available was proportionally larger, but this was not the case, as the utilized area per capita in Kunszentmárton (5.71 cadastral acres/person) exceeded the average in the settlements in Nagykunság (5.31 cadastral acres/person). However, these uncertainties are not greater than the uncertainties in the analyses that have been conducted by researchers so far. Based on the data of the cadastral survey, it can be stated that the amount of natural resources in relation to the population and the distribution of resources at the turn of the century were still relatively optimal, at least compared to other areas.

Assessment of the Economic Condition: Conclusions

The main question of the present study was whether the settlements of Nagykunság were afflicted by overpopulation due to failing to meet basic food needs and thus to what extent the anthropogenic interventions in the ecosystems (the construction of Mirhó Dam) could have been motivated by a kind of extensive growth compulsion. Due to the limited sources which were produced during and survive from the time, the question cannot be answered with certainty, but from the data of the first cadastral survey, which has been undeservedly neglected in environmental history research so far, many conclusions can be drawn which are new compared to assessments carried out by researchers previously.

According to the data of the cadastral survey, the grain production of the settlements of Nagykunság met the domestic consumption needs of the population, and taxes as well as the feed needs of animals too, and the population also had a surplus that could be sold on the market in normal and good crop years. The population of the settlements grew arable crops mainly for self-sufficiency, which is indicated by the relatively close relationship between the size

of the ploughland and the population. The structure of the landed estate, i.e. the most important natural resource and the distribution of agricultural land, was still optimal at the end of the eighteenth century, both at national and regional levels.[53] The overpopulation which, according to Klára Dóka, was an issue in the case of the settlements along the Tisza and the resulting growth compulsion can be detected only to a small extent in the case of the settlements of Nagykunság, along with the social tensions resulting mostly from redemption. The farming of the settlements of Nagykunság was characterized by the optimal utilization of environmental resources, and thus by high average yields (especially in the case of grain production).

The construction of the Mirhó Dam can undoubtedly be attributed to the confrontation between nature and man, but this is probably not due to the need to change the existing land use system, but to changes in the system due to external factors, in our case to the periodic changes in climatic conditions. This is indicated by the fact that the complaint letters written before the construction of the dam mention disturbances arising in the use of areas already under cultivation (flooded meadows all year round, ploughlands and vineyards protected by dykes, etc.) and do not formulate the need to involve new areas.[54] The grain boom which emerged later and which forced the floodplain communities of the Carpathian Basin to change to dryland farming can't have been behind the construction of the Mirhó Dam in chronological terms, either. If we accept the picture which emerges on the basis of the cadastral data, i.e. that the farming system at the end of the eighteenth century was relatively optimal, it is also unlikely that the goal of the farming communities involved in dam construction would have been to eliminate the farming system which had been in use until then. With regard to the construction, it is also worth noting that the dam was erected in the first half of the eighteenth century (i.e. in the initial period of reorganization), which suggests the possibility that the existence of the dam was a normal condition for floodplain farming. The intervention was rather the only active element of the basically passive floodplain farming carried out by the settlements of Nagykunság, similar to the way in which the settlements of Sárköz selected the scour channels *(fok)* that were unfavorable to them. Thus, the aim of building the Mirhó Dam could not have been to drain the area, but to create a more regulated water system. Based on the above, I agree with Zsolt Pinke, who suggests that

53 Dóka, "Gazdálkodás a Tisza árterein."

54 JNSZML V. 200. 1. a./a.

water management work was caused by the environmental challenges caused by intermittent climate change, and I also agree that the conflict among settlements stems from differences in hydro-geomorphological conditions.[55] However, given that floodplain management appears to have been statistically profitable and that significant quantities of marketable grain were available, in my opinion pressures from population growth may have played little role in dam construction in the eighteenth century.

My results are an adjunct to floodplain management debates too. The opinions of two significant researchers on the topic, Bertalan Andrásfalvy[56] and Miklós Szilágyi,[57] differed mainly on the question as to whether floodplain management was profitable and well-planned. My results are closer to Andrásfalvy's opinion on efficiency, as floodplain farming was profitable even in terms of field crop production, despite the fact that in the Nagykun District this sector was secondary. The study I have done does not in itself provide an opportunity to assess the other side, the planning of floodplain management, so I cannot contribute to the discussion in this respect.

However, the validity of my findings is limited by certain source-critical considerations, three of which are worth highlighting. In the case of the cadastral data, despite the fact that they provide much more reliable and less indirect information compared to the dical tax censuses of the period, there are a number of uncertainties. The uncertainties are rooted, on the one hand, in the fundamental problems of statistics and, on the other, in the much-mentioned interests of farmers in data distortion. The basic statistical problems include, for example, how much variance we have to reckon with in the case of the average yield, and the extent to which the pressure system caused fluctuations in production. The second major uncertainty factor is the determination of need. We have very little information on contemporary consumption patterns, especially at a given time and place, and the relatively large standard deviation of the estimates can be attributed to this. Moreover, need, like overpopulation, must be regarded as a relative concept. The third factor of uncertainty is the livestock farming sector as the cadastral survey provides data only indirectly

55 Pinke, "Alkalmazkodás és felemelkedés," 258.

56 Bertalan Andrásfalvy examined farming before the river regulations in the settlements of Sárköz along the Danube and found planned and productive floodplain management, which he called *fokgazdálkodás*. See: Andrásfalvy, *A Sárköz ősi ártéri gazdálkodása*.

57 Examining the Tiszavidék, Miklós Szilágyi did not find any traces of active floodplain management similar to that observed in Sárköz, and he doubted that the farming system before the river regulations would have been planned or very productive. See: Szilágyi, "Az ősi ártéri gazdálkodás elméletéhez."

in this regard. The main point is, therefore, that there are uncertainties about both the need and the production side, but in my view, they do not exceed the uncertainties about the types of sources used by researchers so far (e.g. tax censuses). Moreover, the cadastral survey also allows analyses which were not feasible on the basis of these other sources.

One of the important aims of the present study was to shed light on the need to reevaluate the statements made about floodplain farming, as in the light of newer sources, some questions are approached from a different perspective. It is also worth reconsidering these questions in light of new source-critical findings related to the sources used so far. The synthesizing character of environmental history requires that the statements made so far be checked from time to time, taking into account new findings in different disciplines and reevaluating prevailing conclusions if necessary.

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Environmental Impacts of Medieval Uses of Natural Resources in the Carpathian Basin

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Various natural resources were abundant in medieval Hungary, and contemporary sources offer a portrait of the kingdom as rich because of these natural conditions. The different forms in which these resources were put to use were decisive for the history of the Carpathian Basin, including its environmental history. In the Middle Ages, there were two key economic activities which played an especially significant role both in the sphere of local production and in foreign trade and which also had a significant environmental impact: livestock farming on the Great Plain (primarily but not exclusively of cattle) and mining, including the processing of primary metals, which was closely related to mining in certain mountain areas. On the basis of analyses of sources drawn from the monastic network, medieval rural churches, and selected archaeological findings and written evidence, we examine the environmental consequences of these activities with particular focus on the changes in the settlement network and relative population density. Our data suggest that the long-term effect of the prevailing practices in the most lucrative, export-oriented economic sectors of the late medieval Kingdom of Hungary—both of which contributed to the ability of the country to withstand pressures from the advancing Ottoman for about 130 years and to some extent even beyond—was serious environmental degradation in the affected regions. The environmental problems caused by these practices could not be fully overcome for a long time. Certainly, the impact was increased by the consequences of the Ottoman wars and the changing climatic conditions of the Little Ice Age, but the process began well before the Early Modern crisis, in some respects as early as in the late thirteenth and early fourteenth centuries.

Keywords: natural resources, environmental impact, settlement network, medieval mining regions, Middle Ages, Kingdom of Hungary

The three most important economic sectors of late medieval Hungary were crop farming, animal husbandry, and mining.[1] Regarding productivity in these sectors and their importance in foreign trade, sources prove that huge incomes

1 The research on which this article is based was made possible with the support of the National Research, Development, and Innovation Fund of Hungary (NKFIH) PD-128970 research grant, and it is a contribution to the PAGES' LandCover6k project. Some other aspects of this article were developed within the framework of another project led by the same organization (NKFIH K-128880), which considered the long-term effects of the Mongol Invasion on population density and extensive animal husbandry.

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were generated by the export of both cattle and non-ferrous and precious metals, mainly copper. Although there are some hints that these sectors became strategic earlier, there is little written evidence before the fifteenth century and even less in the Árpád age (1000–1300). Since animal farming and mining became large-scale in the fourteenth century and continued to increase throughout the fifteenth and sixteenth centuries in the Carpathian Basin, both had deep impacts on the natural environment, and triggered big human pressure leading to a large-scale transformation in the ecosystem. Certainly, there was a third sector of the economy that exerted similar pressures and that was also present, if to different extent, throughout the kingdom. The transformation of the natural environment to ploughland or to areas in which the populations engaged in various agricultural activities was a much longer process. The large-scale extension of cultivated areas started well before the Mongol Invasion (1241–1242), and it went hand-in-hand with the colonization of areas that had been uninhabited until then. However, written, and archaeological evidence suggests that the regenerative ability of the mosaic-like medieval agricultural landscape was considerably stronger than that of later land use systems, including both modern field systems and industrial agriculture. Therefore, our hypothesis is that the environmental impact of the agricultural practices which prevailed at the time was not as long-lasting as, for instance, that of mining. Furthermore, grain and wine played a limited role as exports in the foreign trade of the Kingdom of Hungary before the mid-sixteenth century, meaning that the royal treasury had lower expectations when it came to potential profits. Therefore, we do not touch on this subject in this paper.[2] Here, we trace the pressures put on the ecosystem by animal farming and mining by drawing on direct evidence concerning the economic activities we discuss and some available indirect sources concerning shifts in settlement patterns, namely sources concerning the rural church network and the spatial distribution of monasteries. We focus on the late medieval period, though we also include the sixteenth century, because most of the practices that had come to prevail before the fall of the medieval Kingdom of Hungary in 1526, including economic and ecologic practices, continued without interruption until the 1560s or the 1570s. Furthermore, the character of sixteenth-century written data is very similar to the fifteenth-century data, and the number of written sources relevant from the perspective of our research increased in the first half of the

2 On the history of agricultural production and its role in the medieval economy of Hungary, see Laszlovszky, "Agriculture in Medieval Hungary." On the general issues of environmental changes in the context of the medieval economy in Hungary see Ferenczi et als., "Long-Term Environmental Changes."

sixteenth century. It has also been shown in the earlier secondary literature that, for example, *defterler* and other tax lists from the first decades of the Ottoman period in Hungary can be used in a regressive way to reconstruct the settlement systems of the different regions.[3]

Methods and Source Material

Given the scarcity of direct written evidence concerning the territorial impact of animal farming and mining on the settlement pattern and the environment, traditional historical methods do not lead us very far. Therefore, indicators and models based on analyses of phenomena that are not directly connected to our topic are needed to get closer to the process under investigation. Changes in the central elements of the settlement network can be interpreted as a measure of human pressure on the ecosystem and the exploitation of the available natural resources. We must remain aware of the nature of the sources at our disposal, so we emphasize that the results of this study refer to tendencies and our models can only be used to further an interpretation of the general picture, as one might arrive at significantly different results in particular regions if one were to have additional sources or to use the sources we have drawn on in a different way.

The settlement network cannot be fully reconstructed for the Middle Ages in Hungary, and this statement is valid for all the medieval periods, even for the Late Middle Ages, a period on which we have considerably more sources. Various significant attempts to reconstruct the whole settlement system of the kingdom represent outstanding scholarly work from different generations of medievalists, although they had to work with very fragmented written source materials, particularly in the study of the earlier centuries of the Middle Ages. The first large scale attempt to reconstruct the settlement network of the second half of the fifteenth century was a major contribution from the first positivist period of Hungarian medieval research. However, Dezső Csánki's enterprise remained unfinished, and large parts of the medieval kingdom were never covered.[4] The

3 Engel, *A temesvári és moldovai*. For the sixteenth-century Ottoman tax registers on the territory of Medieval Hungary, see also Káldy-Nagy, *A budai szandzsák 1559. évi összeírása*; Ágoston, "A szolnoki szandzsák 1591–92. évi összeírása"; Káldy-Nagy, *A gyulai szandzsák 1567. és 1579. évi összeírása*; Káldy-Nagy, *A budai szandzsák 1546–1590. évi összeírásai*; Káldy-Nagy, *A csanádi szandzsák települései*; Káldy-Nagy, *A szegedi szandzsák települései*; Blazovich, "A Dél-Alföld települései."

4 Csánki, *Magyarország történeti földrajza*.

work of György Györffy, who aspired to publish a historical geography of the Carpathian Basin in the eleventh–thirteenth centuries, is similarly incomplete, although the data on most of the counties have been published.[5] A third publication worth mentioning is the digital database compiled by Pál Engel on the landed estates in the Late Middle Ages.[6] This work is the most complete of the above, covering the whole territory of the kingdom. Its aim, however, was to reconstruct the domains, not the settlement network. Therefore, from our point of view, it is similarly incomplete. Furthermore, archaeological field surveys have shown that there were many settlements—some of them were farmsteads or temporary dwellings, other were villages—that never appeared in any of the written sources.[7] In the villages in the Árpád Era, we have to keep in mind that the pit-houses of the period were certainly not built to stand for centuries. The timespan for which these houses were used was probably between thirty and fifty years. Since there are hardly any houses that were renovated in that period, we have to take into consideration the possibility that many of the villages we know from the Árpád Era were homes to one or two generations of rural communities, and we also have to keep in mind that there may well have been a certain level of mobility when it came to the rural settlements. Another problem is—partly related to the above—that we do not have direct sources on population numbers, either.[8] Consequently, we have to use diverse indicators when seeking the answers to the questions we pose.

In this context, it is important to note that there are datasets closely related to population density and economic activity in the Middle Ages. Almost all of them are at our disposal: the network of church institutions.[9] While the network of rural or parish churches is mainly linked to population density, the monastic network is relevant from the perspective of economic activity. As a third element, we can use the data on late medieval Orthodox churches (sometimes together with data on villages the populations of which belonged to the Orthodox faith) where this data are relevant, since in this case, religion was quite closely connected to their economic pursuits, namely to transhumance, even if some communities may have been comprised

5 Györffy, *Az Árpád-kori Magyarország.*

6 Engel, *Magyarország a középkor végén.*

7 Laszlovszky, "Tanyaszerű települések"; Laszlovszky, "Space and place."

8 Kubinyi and Laszlovszky, "Demographic Issues."

9 F. Romhányi, "Kolostorhálózat"; F. Romhányi, "A középkori magyar plébániák."

of different social groups.[10] There is also a fourth limited set of data: the eleventh-century and twelfth-century estates of monasteries, donated by the rulers. The rulers donated these estates not exclusively for religious reasons, but also as part of their royal "regional policies." Often, the donation charters refer to the uses of natural resources, but even when they did not or when the document itself did not survive, the spatial distribution and the environmental conditions of the landed estates may reveal how the lands were used.

Because of its very nature, foreign trade—both export and import—can also be seen as a good indicator of ways in which natural resources were used. As royal power was generally strong in medieval Hungary, regulations related to foreign trade appear in written records. Thus, the appearance of certain goods (metals, cattle, etc.) in the written sources connected to foreign trade activity can be interpreted as a sign of the importance of these goods and the growing volume in the economic output of the country. In this context, we can use the commercial goods mentioned in diverse privileges given to different towns and trading companies, as well as toll lists and account books. Even international conflicts which imply clashing economic interests can be interpreted as indicators of the ways in which natural resources were put to use.

Documented Historical Processes

In a discussion of natural resources and particularly mineral ores in the context of the medieval Kingdom of Hungary, gold and silver come first in mind. Historical data and extensive academic literature and significant scholarly debates on the roles and impact of mineral mining and trade confirms this general picture.[11] Therefore, we do not discuss these questions in detail here, but rather merely summarize a few of the more important conclusions from the secondary literature which are relevant to the questions we are raising concerning economic indicators and environmental impact. Certainly, both gold and silver played an important role in the economy of the country, especially after the

10 The case of Ráckeve and some other villages with Serbian populations on Csepel Island, today to the south of Budapest, is an exception. These villages were settled in the second half of the fifteenth century under completely different circumstances.

11 On the economic history of medieval Hungary in general, see *The Economy of Medieval Hungary*, edited by József Laszlovszky, Balázs Nagy, Péter Szabó, and András Vadas (Leiden: Brill, 2018). On the history of mining and metallurgy in Europe cf. Ian Blanchard, *Mining, Metallurgy and Minting in the Middle Ages: Continuing Afro-European Supremacy, 1250–1450 (African Gold Production and the Second and Third European Silver Production Long-cycles)* (Stuttgart: Franz Steiner, 2005).

economic reforms of King Charles I of Anjou in the early fourteenth century.[12] The colonization of the peripheries of the kingdom and other marginal areas itself was a long process, and ore mining was one of the most important drivers of this process from the outset. Ores and raw metals were important export goods of the Hungarian Kingdom as early as around 1200. The toll regulation of Stein issued by Duke Otakar of Styria and Duke Leopold of Austria in 1190 mentioned copper, tin, plumb, and iron, along with salt, among the imported goods, and copper was mentioned in the toll regulation of Hainburg (1245), as well.[13] After the Mongol Invasion, however, the mining regions experienced intensive development. Many of the major mining towns received their royal privileges in that period, including Besztercebánya (today Banská Bystrica, Slovakia) Körmöcbánya (today Banská Kremnica, Slovakia), and Selmecbánya (today Banská Štiavnica, Slovakia; in Latin Argentifodina), although the mine in the latter had existed nearly two centuries earlier.[14]

Copper, which was produced in great quantities (especially in the late fifteenth and early sixteenth centuries), is usually also on the list. As for iron production (including bog iron), researchers tend to make less frequent mention of it. Written and material evidence concerning the production sites has been collected and evaluated by Gusztáv Heckenast and Gábor Vastagh.[15] The exploitation and smelting of iron, mainly bog iron in the tenth and eleventh centuries, has been studied by the archaeologist János Gömöri,[16] but the iron production met with less interest later.[17] At the same time, these studies were mainly connected

12 Batizi, "Mining in Medieval Hungary."

13 Wenzel, *Magyarország*, 23. However, Gusztáv Heckenast expressed his doubts concerning Hungarian iron exports to Austria in the twelfth century, see Heckenast, "A kora Árpád-kori," 149.

14 Györffy, *Az Árpád-kori Magyarország,* vol. 3, 243–47. The region belonged to the estate of the Benedictine Abbey of Garamszentbenedek (today Hronsky Benadik, Slovakia), founded in 1075 by King Géza I, which was given Baka as well, where another mine existed in the Árpád Era. The settlement was first mentioned in a charter in 1217 under the name *Bana* (mine). The name *Argentifodina* (i.e. silver mine) first occurred in 1240, when the parson of the settlement was also mentioned. The fact that both names were used without an adjective suggests that Selmecbánya was the first and most important royal silver mine in the whole region. On the mining privileges issued in the fourteenth and fifteenth centuries, see Weisz, "A bányaváros, mint önálló"; Weisz, "Mining Town Privileges"; Weisz, "Az alsó-magyarországi bányavárosok," (about issues connected to the use of wood: 38–40).

15 Heckenast, *A magyarországi vaskohászat*; Vastagh, *Tanulmányok a kohászat*.

16 Gömöri, *Az avarkori és Árpád-kori*.

17 The first important interdisciplinary monograph on this topic: Heckenast, Gusztáv, Gyula Nováki, Gábor Vastagh, and Elemér Zoltay, *A magyarországi vaskohászat története a korai középkorban* [History of iron smelting in Hungary in the Early Middle Ages] (Budapest: Akadémiai Kiadó, 1968). For the latest summary on the topic based on the earlier secondary literature, see: Batizi, "Mining in Medieval Hungary."

to the production sites in present-day Hungary, and they focused on the earlier period. This aspect of their research is crucial to the general picture, because very important mining areas and production centers were situated outside the modern political borders of the country, and for the late medieval period, one must assume considerably larger amounts of iron products. This can be confirmed by the much bigger population of the country and also by the significant spread of iron objects and building materials in the Late Middle Ages.

Iron mining and smelting are much less documented in the Late Middle Ages compared to other activities and ores in the context of mining. Iron was much more common than non-ferrous metals, and it was often produced in the same regions as gold, silver, and copper. Therefore, written evidence survived mainly about the latter, although there are hints concerning iron production, too. The toll regulation of Stein, issued in 1190 by Prince Otakar of Styria and Prince Leopold of Austria, listed iron among the goods imported from Hungary. The intensification of iron mining can be traced back to the second half of the thirteenth century, and not only in the northern mountain region. In 1291, for instance, German miners from Eisenerz in the Alps settled in Transylvania, more specifically in Torockó (today Râmetea, Romania), to work in the iron mines there (the German name of the settlement, Eisenburg, also referred to the presence of iron ore).[18] Based on the contemporary written sources, there were at least six sites where iron ore was mined in the Carpathian Basin in the Middle Ages: the Aggtelek-Rudabánya Mountains, the Slovak Ore Mountains (known in Hungarian as the Gömör-Szepes Mountains, Slovakia), the region of Belényes (today Beiuș, Romania), the eastern part of Temesköz (in Romanian Banatul Montan), the area surrounding Torockó, and the Apuseni Mountains (known in Hungarian as Erdélyi-szigethegység) in central Romania, including the region of Hátszeg (today Hațeg, Romania) with Vajdahunyad (today Hunedoara, Romania) as its center.[19] Though the data from written sources are scattered, the fact that

18 Szentpétery, *Regesta regum*, no. 59. The German name of the settlement, Eisenburg, is also telling. Medieval Styrian iron production probably began in the eighth and ninth centuries. It then intensified around 1100 and remained important until the nineteenth century. Cf. Sperl, Gerhard, *Steirische Eisenstraße*, edited by Montanhistorischer Verein für Österreich Leoben, 1984.

19 Sources indicate iron mining and metallurgy around Rudabánya from the tenth century, based on archaeological findings. Török, "Vasérc, vasbuca, vastárgy." Several iron mines and furnaces functioning in the mountainous region of northern Hungary were mentioned as early as in the thirteenth century, after the Mongol Invasion (1241), cf. Heckenast, "A vashámor," 2–4. The hammer mill in Csetnek (today Štitnik, Slovakia) was first mentioned in 1344 (Heckenast, "A vashámor," 10). On the developing metallurgy of the region see also the privilege of Master Konrad, the bell-casting master of King Louis I (1357: MNL OL

many of these mines remained or became royal property during the Late Middle Ages indicates the importance of iron mining and iron production in these regions. Certainly, written sources from the fifteenth and sixteenth centuries do not say anything about the beginning of mining activity in these areas, and none of the various archaeological investigations which have been done have yielded any meaningful findings concerning the early periods of medieval iron ore mining. The presence and accessibility of mineral resources does not necessarily mean that these resources were used. However, the evolution of the settlement networks—indicated by different types of written sources—in the areas where these kinds of mineral resources were found could be interpreted as evidence of the economic importance of these resources and may further a more subtle understanding of the changes in population density in a mining region over time. It can also offer an indirect proof for the growing importance of mining activity in less documented areas, as relatively well-documented mining areas can be compared with regions from which we have fewer written sources but about which we know that they had similar natural resources. If so, indicators can confirm—or actually call into question—the importance of some mining regions based on the evaluation of the local settlement system.

The list of important natural resources continues with salt, the mining of which was recorded since the late eleventh century. Alongside ores, salt was another important mineral that was exploited in large quantities. Salt played a significant role in the trade and commercial activities of this earlier period, and it continued to be mined and sold on the same scale in the Late Middle Ages. This also put significant pressure on the ecosystem, as we can clearly see from

DF 280773; on master Konrad, see Szőke et als., "Konrád mester," and the company of the Thurzó family, see Izsó, *Szemelvények,* 45, 48, 56, 58 etc. Iron mines in Upper Hungary were mentioned e.g. in Dobsina, Gölnic, Igló, Jolsva, and Vihnye (today Dobšina, Gelnica, Spišská Nová Ves, Jelšava, and Vyhne, Slovakia), too. Sources indicate iron mining and processing in the region of Besztercebánya and Selmecbánya, as well. Heckenast, "A vashámor," 3. In the Temesköz, a charter issued by King Sigismund of Luxembourg concerning the acquisition of the castle of Kövesd mentioned the iron mine of Boksánbánya (today Bocşa Montană, Romania); 1395: Wenzel, *Magyarország,* 124. Medieval iron slag was found in the area of Vaskoh (today Vaşcău, Romania) during an archaeological survey, and an eighteenth-century description of ores and other mineral resources of Hungary described the iron ore of the region as one of the best raw materials, though there is no written evidence of its medieval or early modern use, cf. Tóth, "Az első magyar nyelvű," 130. In Vajdahunyad (today Hunedoara, Romania), there is data from the fifteenth and sixteenth centuries (1493, 1509) indicating the mining of iron (and gold) (MNL OL DL 29875, 24348, 24364, 26508, 26510, short summary in Hungarian: Izsó, *Szemelvények*, 137–38). We do not enumerate here the smaller mining regions with more limited metal production (e.g. Nagybörzsöny, Telkibánya), but they too contributed to the processes described below.

the better documented later periods. Salt production seems to have increased step by step. The first medieval intensification of salt mining took place around or shortly before 1100, when shipping on the Maros River was established. On the northern border of Transylvania, the monastery of Meszes was founded by Duke Álmos, brother of King Coloman, at the older salt road, which went through the Meszes Pass, during the same period (1102). Its connection to salt transportation is attested by the privilege it received in the 1130s.[20] In a second phase, between the 1170s and the 1210s, King Béla III and King Andrew II contributed to the development of salt production and trade by employing Jewish and Muslim officials *(comes camerae)* and by granting privileges to different churches and monasteries.[21]A further increase in the quantities transported necessitated the navigability of the Szamos River. Most of the riverbed was probably cleared by the last decades of the thirteenth century, when shipping was mentioned in charters.[22] It is difficult to estimate the quantity of salt that was mined, but data suggest that it increased gradually throughout the Middle Ages, and sources suggest that the incomes of the royal treasury from salt represented a large fraction of the royal incomes.[23]

Similarly, sources from the early fifteenth century document large-scale cattle trade, but as early as 1255, the toll list of Buda mentioned live cattle and cattle skin as important tariff articles.[24] Considering that the Cumans were settled in the mid-thirteenth century on a territory that became the center of cattle farming, one may suspect that the story must have begun earlier.[25] This type of extensive animal husbandry was made possible by at least two factors which transformed the region: the destruction of the area caused by the Mongol invasion of 1241–1242 and environmental changes due to changing hydrological conditions, both of which resulted in a significant process of settlement desertion. It should also be noted that extensive animal husbandry, dominated by cattle breeding,

20 1165: Szentpétery, *Regesta regum*, no. 107.

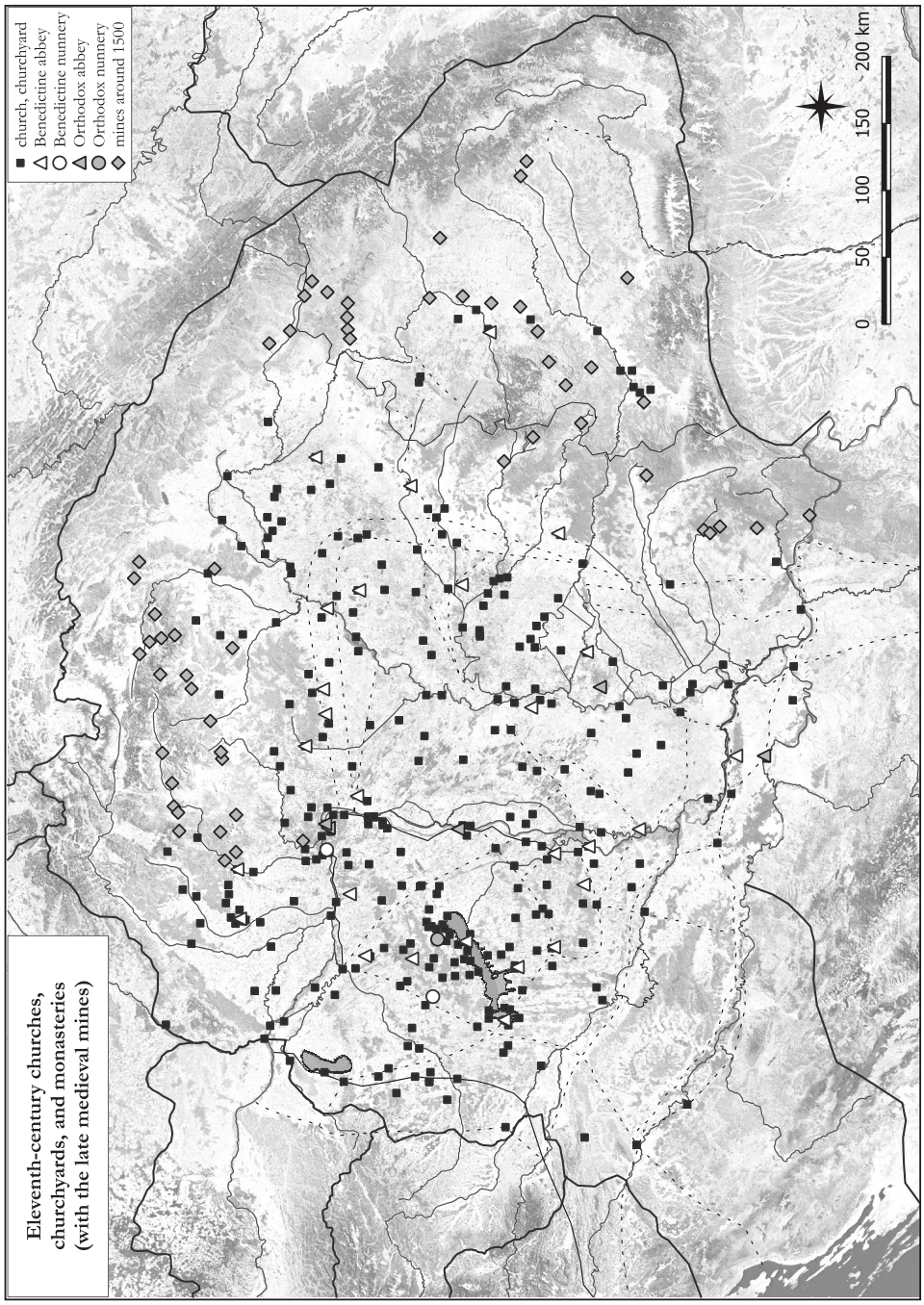
21 In 1233, the conflict resulted in the issuing of the Oath of Bereg, which was intended to regulate the participation of Church institutions in the commercialization of salt. Cf. F. Romhányi, "Salt Mining."

22 1292: Szentpétery, *Regesta regum,* no. 3878. On salt shipping and the levy of tolls in the Árpád Era, see Weisz, "Megjegyzések az Árpád-kori."

23 In addition to the article by B. F. Romhányi (footnote 21), see also Draskóczy, "Salt Mining."

24 Szűcs, *Az utolsó Árpádok,* 103–4. Szűcs emphasizes that there was a clear turning point in the structure of Hungarian exports. Beginning in the 1280s, Hungarian cattle, copper, and grain began to dominate (333).

25 There are some hints of early thirteenth-century cattle exports (see the toll regulation of Radkersburg and the circulation of Friesach deniers in the first half of the thirteenth century), but large-scale cattle farming and cattle trade began after the Mongol Invasion. Cf. Lyublyanovics, *New Home, New Herds*; Sárosi, *Deserting villages*.



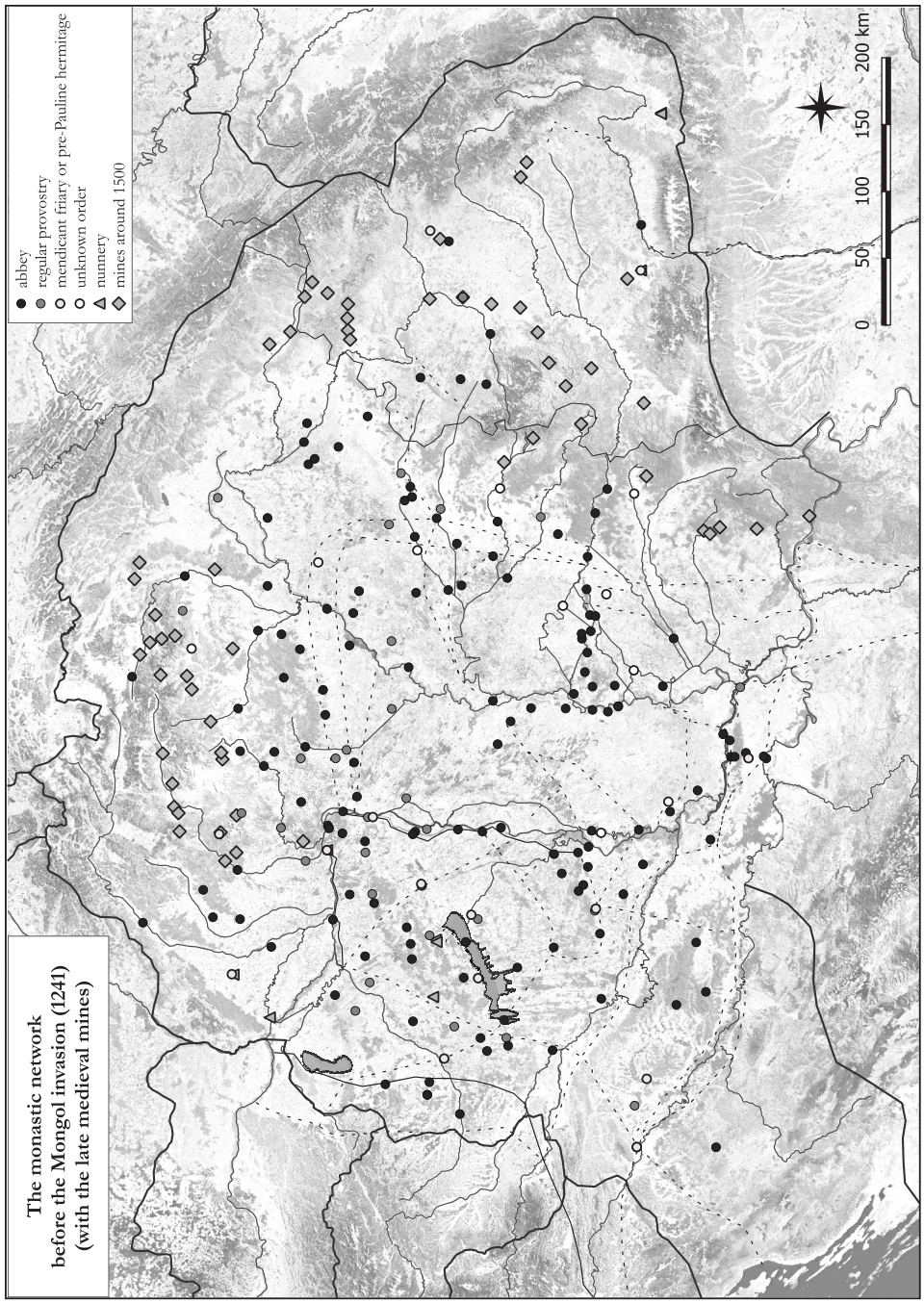
Map 1. Eleventh-century churches, churchyards and monasteries (with late medieval mines). Map drawn by Beatrix F. Romhányi

was still characteristic of large areas of the Great Plain in the eighteenth and nineteenth centuries, and historical and ethnographic studies shed light on the ecological pressures caused by these activities and on their impact on the local environment. Particularly the *puszta*-type of animal husbandry can be studied well in this context. Another branch of animal husbandry was transhumance, which sources indicate was a prevailing practice in certain areas of the Carpathian Basin as early as the thirteenth century, though it is difficult to determine the phases of its spread. In this case, changes in the settlement network can help us establish a more thorough chronology, too.

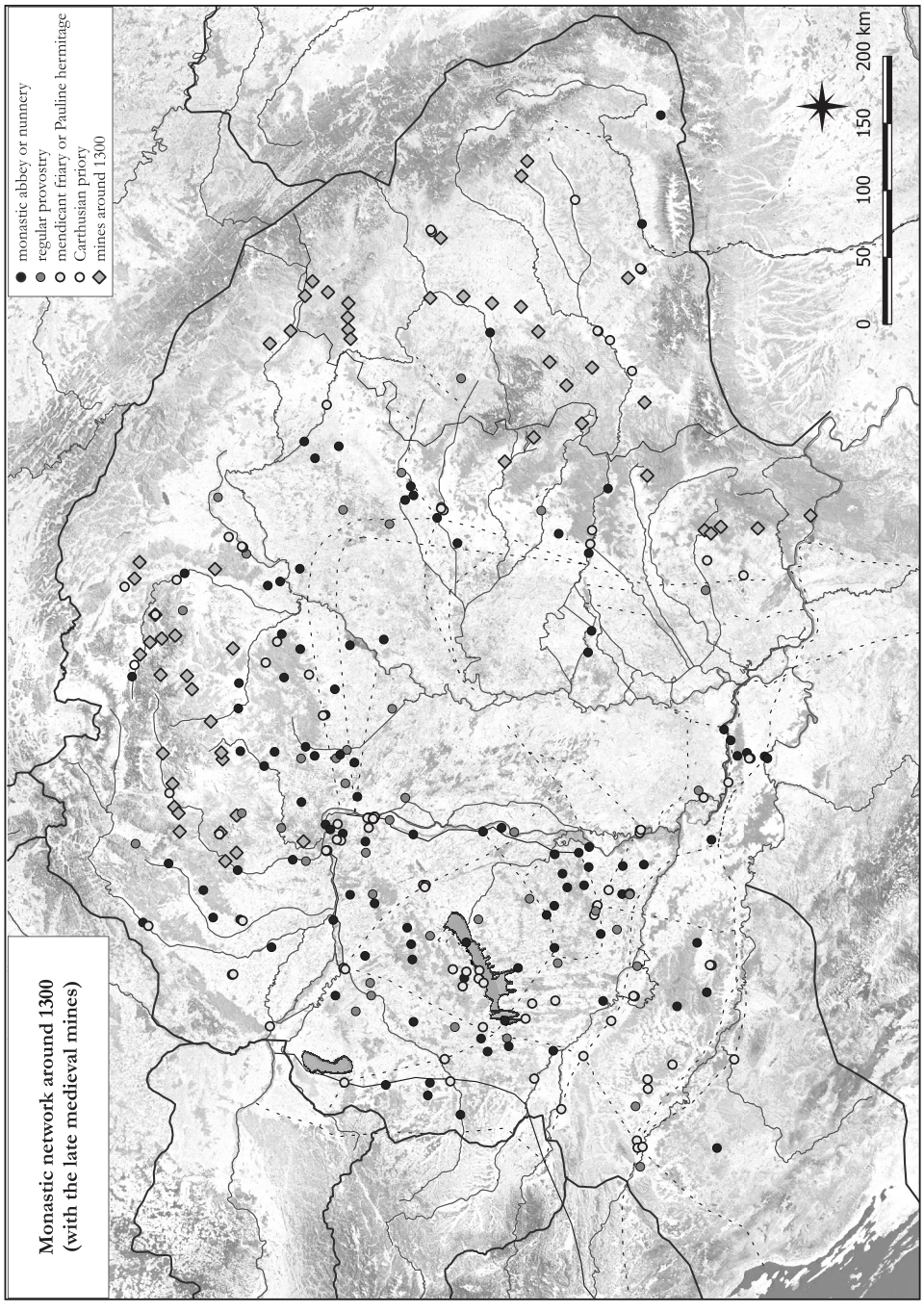
Changes in the Settlement Network

On the basis of the data connected to the spatial distribution of settlements and the indicators for this network, combined with the long-term processes described above, two major transformations of the settlement network can be observed in the Carpathian Basin between the eleventh and the sixteenth centuries (Maps 1–5). There were other significant aspects of inland colonization, but they are not so related to the two main issues discussed in this article: mining activity and extensive cattle production. The territorial expansion of areas under ploughland cultivation and other forms of agriculture was also an important process, but in most of the regions, it involved the extension of new field systems within the boundaries of the existing villages.[26] In other words, these were previously settled areas with an existing settlement system, and they started to be transformed by the more active and regular use of previously uncultivated areas. This inner colonization was also connected to the changes in the settlement network in the form of settlement dispersion or in the process of nucleation. The first major colonization process involving areas that had not previously been settled started with the mountainous regions around 1100 and lasting until the end of the Middle Ages or even into Early Modern times (mid-sixteenth century). Due to this process, large areas with their original forest coverage and without a significant settlement network started to be settled in a more intensive way. The main element of the transformation process was the clearing of forests. The Transdanubian Mountains and the North Hungarian Mountains were settled in a more intensive way in the first period, and here, woodland clearing led mainly to the emergence of agrarian settlements and villages. In the second phase,

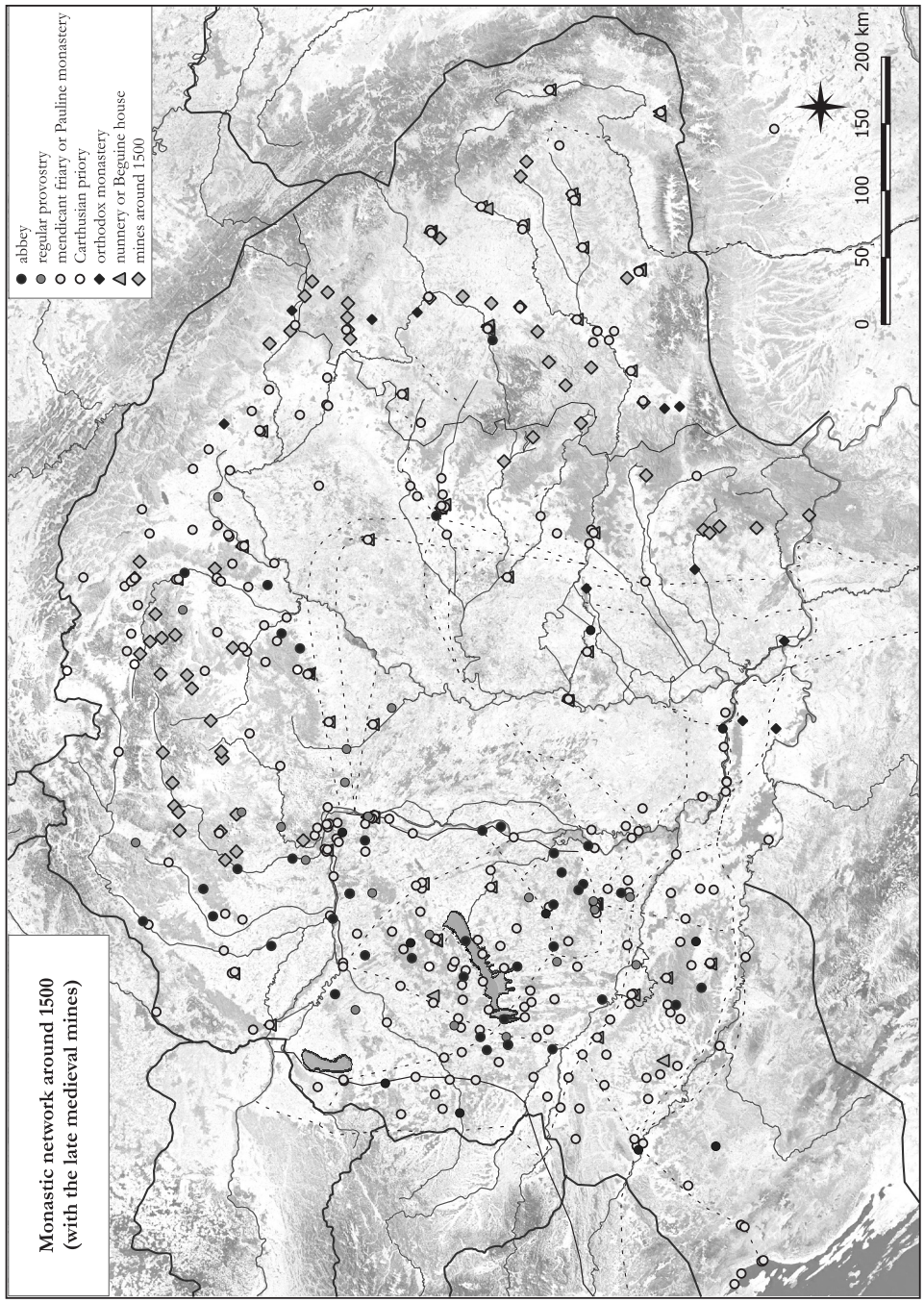
26 On the field systems in this context, see Laszlovszky, "Field Systems."



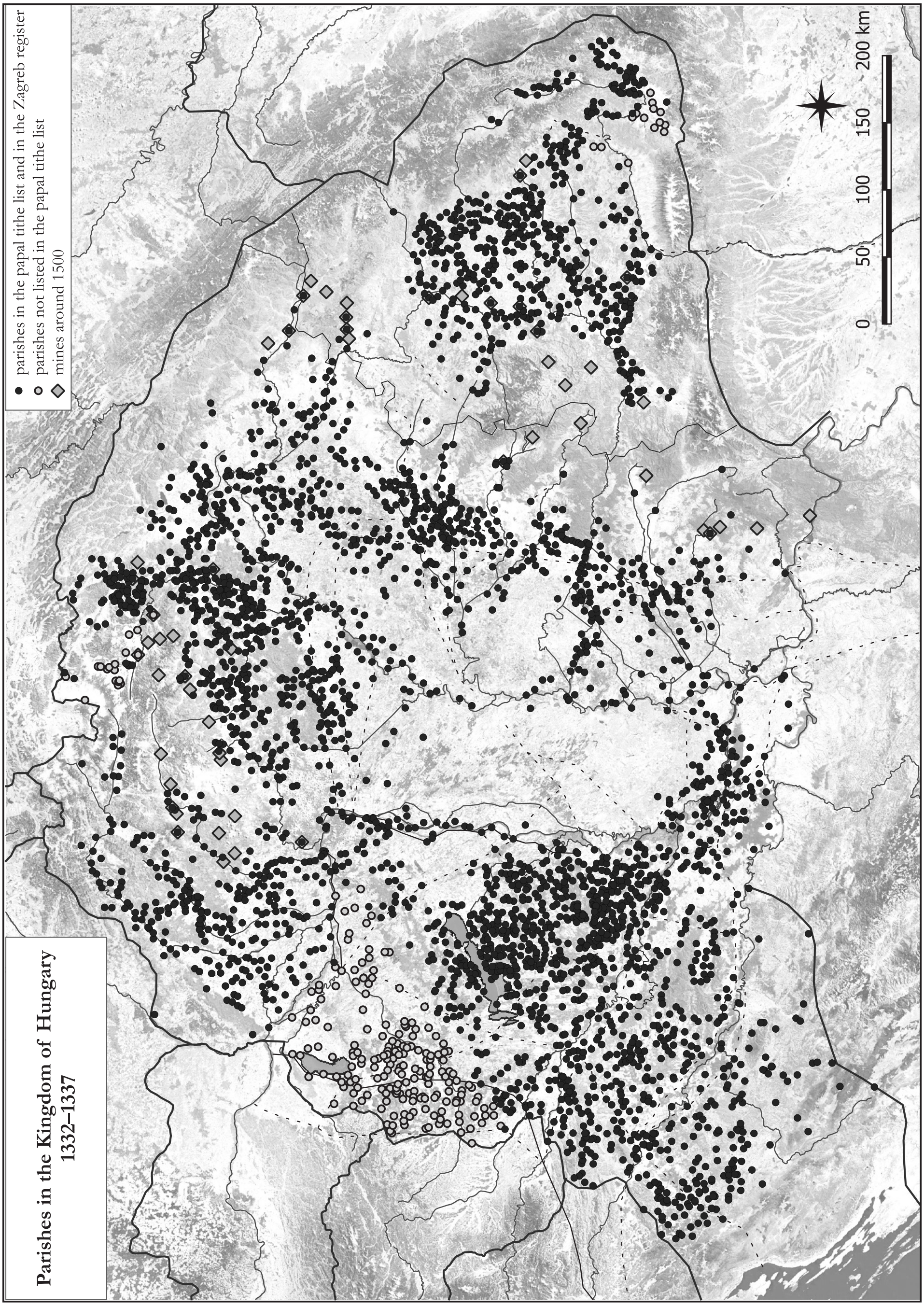
Map 2a. The monastic network before the Mongol Invasion, 1241 (with the late medieval mines). Map drawn by Beatrix F. Romhányi



Map 2b. The monastic network around 1300 (with the late medieval mines). Map drawn by Beatrix F. Romhányi



Map 2c. The monastic network around 1500 (with the late medieval mines). Map drawn by Beatrix F. Romhányi

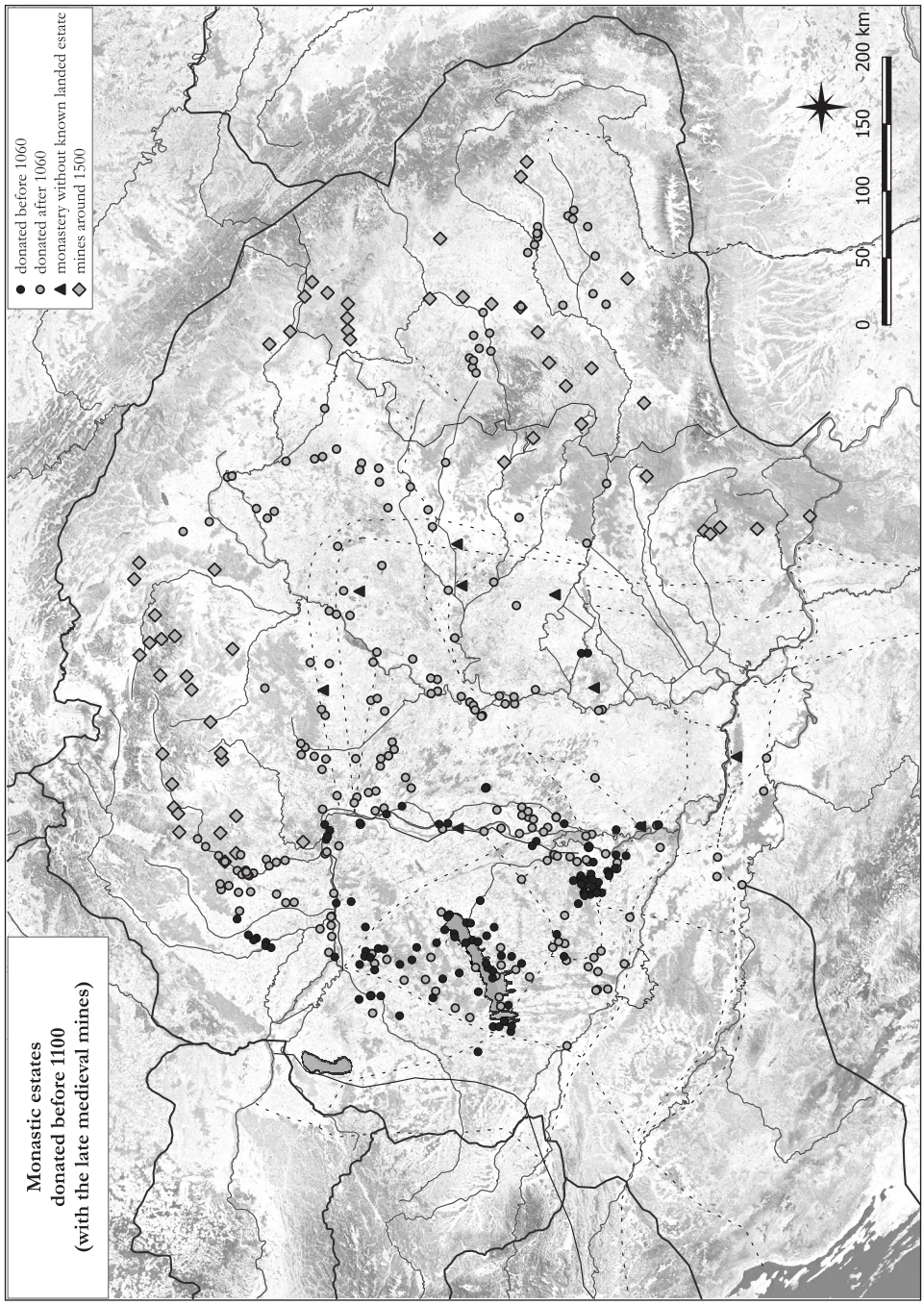


Map 3. Parishes in the Kingdom of Hungary, 1332–1337. (with the late medieval mines). Map drawn by Beatrix F. Romhányi

particularly from the thirteenth century, high mountain regions with dense forest coverage started to be exploited as well, with different goals and in various forms of settlement expansion. In these mainly peripheral regions of the kingdom, minerals were increasingly exploited, and pasture lands were created on a large scale in the mountains, especially for sheep and goat breeding. Parallel to this, the other transformation that took place on the Great Hungarian Plain seems to have started in the first decades of the thirteenth century, but it was accelerated in a radical way by the Mongol Invasion of 1241–1242.[27] As a result of these events and processes (the process of nucleation, urban development, expansion to the peripheral areas, and the Mongol invasion), the area between the Danube River and Csörsz-árok (or "Devil's Dyke," a line of Roman fortifications in the eastern Pannonian plain) became a very loosely settled region. Before this period, the settlement patterns and probably the population density were rather similar to settlement patterns and population densities in the other lowland and plain regions of the kingdom, but in the Late Middle Ages, a very different settlement structure emerged (Map 2a-c). The parish network concentrated on the rivers (the Tisza, Körös, Maros, and Zagyva Rivers), while the monastic network was almost completely missing from the territory (Map 3). The only monastic institutions in this region were the Franciscan and Dominican friaries in Szeged, the Benedictine abbey—later Observant Franciscan friary—of Csanád (today Cenad, Romania), and the Cistercian monastery of Egres (today Igriş, Romania). This institutional pattern was a mark of a livestock-raising society of the plain, where the dominant elements of economic production in the local rural communities were extensively reared cattle, horses, swine, and sheep.

The situation which prevailed in the area earlier can be reconstructed by using written sources mentioned in a previous part of this article. The special use and probably the special estate structure of that central part of the Great Hungarian Plain is referred to by the distribution of the estates given to royal abbeys. The monasteries themselves, especially those founded in the eleventh century, were usually outside the region in question (Map 1). Looking at the map of monastic estates donated before 1060, it is clear that the Great Hungarian Plain was not the region where this type of estate would have been present in the first decades of the Hungarian kingdom. The first monastic estates appeared on the territory after 1060, and the only abbey that received extensive landed estates there was Garamszentbenedek (today Hronský Beňadik, Slovakia),

27 Laszlovszky et als., "Contextualizing," 432.



Map 4. Monastic estates donated before 1100 (with the late medieval mines). Map drawn by Beatrix F. Romhányii

which was founded in 1075 by King Géza I.[28] The monastery's estates in the region concentrated on the Tisza River between Szolnok and Csongrád (Map 4). Monastic estates remained largely absent from the region discussed even in the twelfth century, when a large number of monasteries emerged along the Maros River. One of them was the Cistercian Abbey of Egres, founded by King Béla III in 1179. It was one of the wealthiest abbeys before the Mongol Invasion, but it had very few landed estates, and they were scattered along the river.[29]

At the same time, recent archaeological research in the region of Kiskunfélegyháza and especially in Bugac has revealed that a rich pre-urban settlement site connected to a monastic complex existed there before 1241.[30] Different types of indicators (monastic buildings, import objects, finds connected to trade, etc.) at these sites show that the region also reached a high level of development with a relatively dense settlement network and with emerging central sites. Other findings, for instance in the region of Orosháza, similarly reflect intensive economic activity and higher population density than after the Mongol Invasion.[31] These data and the specific character of the region's monastic network and the almost missing monastic estates suggest that both the estate structure (ownership) and the use of the territory were specific in the eleventh–thirteenth century. Furthermore, data from different parts of the territory imply that changes in land use had begun before the Mongol Invasion, resulting in the radical transformation of the settlement system, while large parts of the territory became pasture for extensive cattle farming.[32] Parallel to this transformation, the Árpád Era monastic network of the region disappeared almost completely.[33]

The settlement pattern that became characteristic of the Carpathian Basin in the Late Middle Ages first appeared in the papal tithe list of 1332–1337, which is a good indicator of the spatial distribution of the settlements[34] (Map 3). Big empty regions can be identified for a major part of the Great Hungarian Plain in this period, and large parts of the Transylvanian Apuseni Mountains, including

28 On the estates of the abbey in the Tisza region, see Laszlovszky, "Dedi eciam."

29 Hervay, *Repertorium historicum*.

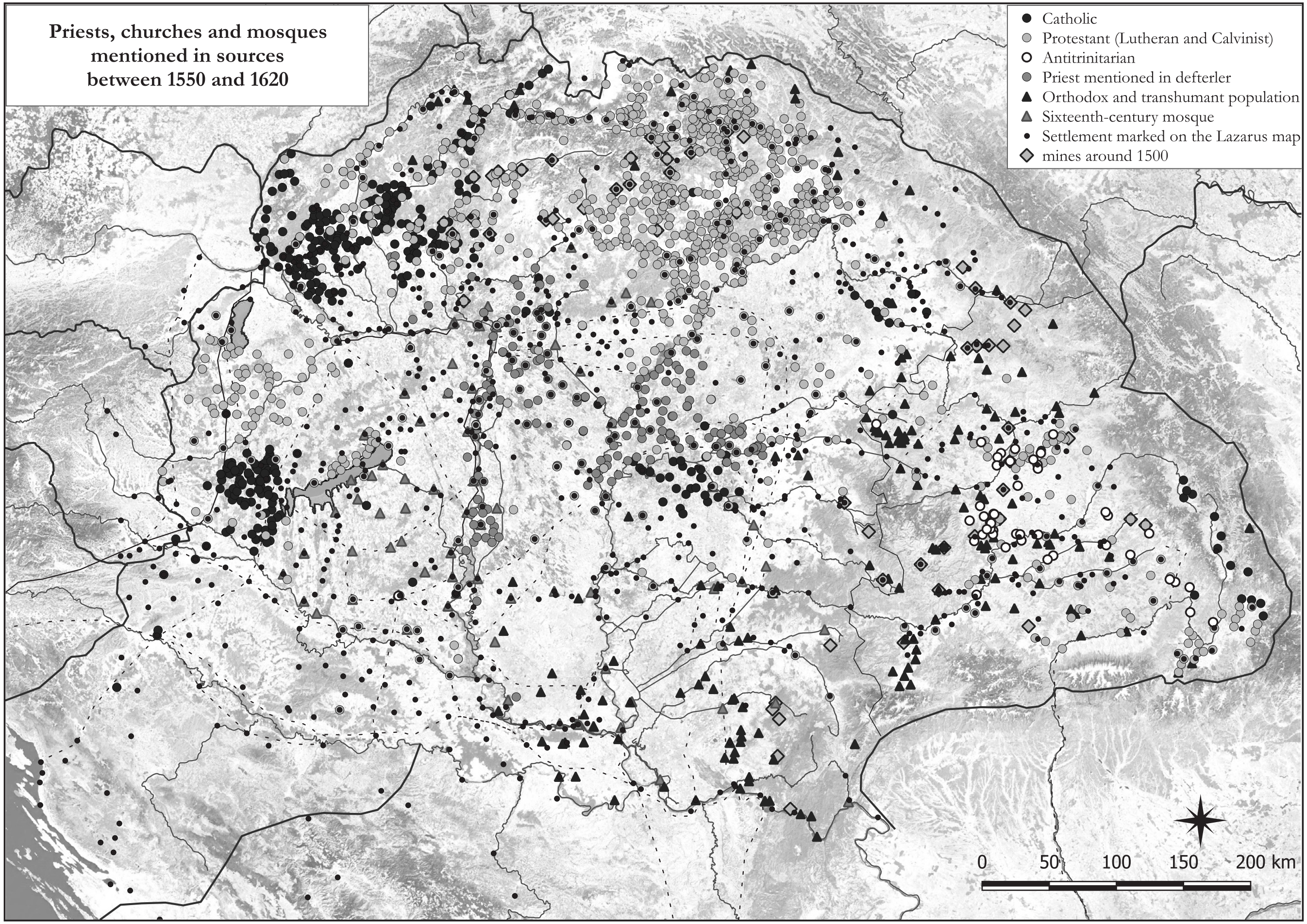
30 Rosta, "Egy elfeledett nemzetségi."

31 Rózsa et als., "Árpád Period."

32 Pinke et als., "Zonal assessment," 102; F. Romhányi, "Changes in the Spatial."

33 The reasons underlying the procedure are complex, including the transformation of church property after the Fourth Lateran Council, demographic changes in the region due to the Mongol Invasion, environmental and economic changes, etc. Cf. F. Romhányi, "Kolostorhálózat."

34 F. Romhányi, "A középkori magyar plébániák."



Map 5. Priests, churches and mosques mentioned between 1550 and 1620 (with the late medieval mines). Map drawn by Beatrix F. Romhányi

the Metaliferi Mountains, also seem not to have had a parish church network. At the same time, a very dense parish network can be observed in southern Transdanubia and medieval Slavonia (which are out of our present scope), but also in some parts of Transylvania and in the northern part of the Carpathian Basin, especially on the territory of the Eger Diocese. From the second half of the fourteenth century, an increasing number of new towns appeared in the mountainous areas. The number and size of the new churches suggests that the populations in these towns was growing, much as the growing number of monastic institutions from the fifteenth century indicates population growth in the region, although the network did not cover the mining regions evenly (Map 2b-c). In northern Hungary, pastoral care was offered by Franciscan (mainly Observant) friaries, while in the mountains between Transylvania and the Great Hungarian Plain, both Franciscan friars and orthodox monks assumed this task among the mixed Catholic and Orthodox population.

Concerning the periods after the Late Middle Ages, various groups of sources can be used in this context. They are of mixed character and comprise several registers, tithe lists, and canonical visitations of the sixteenth and early seventeenth centuries, referring to priests of diverse denominations. This set of data is especially useful for the northern part of the Carpathian Basin, but to a lesser extent also for Transylvania. As for the other parts of the Carpathian Basin, some limited conclusions can also be formulated. Although the lists were compiled over a longer period of time, between the 1550s and the 1620s, they give a fairly good picture of the effects of the Ottoman wars, namely increasing population density in the less affected parts of the country. Furthermore, the ongoing colonization of the mountainous areas can also be seen on the map (Map 5).

Environmental Impacts of Animal Husbandry

The (almost) monocultural animal husbandry on the plain had a serious impact on the environment and the settlement pattern. The indicators which we have used in our research show some of these effects. As we have argued before, a structural transformation took place in the settlement pattern of the Great Hungarian Plain in the thirteenth century. While the plain was densely sprinkled with rural churches, which indicates a relatively large, albeit dispersed human

population on the landscape, during the eleventh century (Map 1),[35] most of the region, especially within the Devil's Dyke, had been abandoned by inhabitants and ecclesial institutions by the early fourteenth century. The papal tithe list of 1332–1337 and regional settlement reconstructions show a vast uninhabited region in the middle of the plain.[36] If we consider this area, three basic soil regions characterize the prevailing land use patterns and settlement structures over the late Middle Ages. Loess soils are the most fertile, and where loess soils were found, the lands were tilled and population density was at its highest.[37] In contrast, animal husbandry prevailed in the almost entirely deserted areas with sand and clay soils.[38] In Homokhátság (which means "Sandy Ridge"), a sand soil region which has been the subject of thorough study, the settlement pattern became dense in the early Árpád Era and collapsed by the fourteenth century.[39] The settlements in the region suffered disastrous losses because of the Mongol invasion (1241–1242), and most of them were never resettled. Shortly after the Mongol invasion, Cumans who engaged in animal breeding were settled in the region. In the fourteenth and fifteenth centuries, the region was characterized by intensive aeolian processes, thus, wind very much reshaped the landscape.[40] The same happened in other sandy regions of the plain between the thirteenth and the fifteenth centuries. Interestingly, similar processes occurred in previous periods, too, e.g. under the Sarmatians (first–fifth centuries AD) and the Avars (sixth–ninth centuries), when animal husbandry cultures colonized the landscape.[41] At the same time, this economic transformation of the area may have put increasing pressures on the local ecosystem. Local settlement research and studies on wind-blown sand deposits partly excavated by recent large–scale archaeological investigations confirmed the scale and importance of these environmental changes. One particular archaeological site has also clearly demonstrated that a briefly used ploughland area, which was probably created as a consequence of the internal colonization process described above, was abandoned for agricultural use, and the sand-covered region was probably

35 According to István Méri the population in the upper Trans-Tisza region began to grow dramatically in the tenth and eleventh centuries. Méri, "Beszámoló," 51–52.

36 Györffy, *Az Árpád-kori Magyarország,* vols. 1 and 3.

37 Pinke et als., "A hajdúsági várostérség," 138.

38 Nyári et als., "Investigation of Holocene blown-sand," 46, 52–53; Vadas, "Late Medieval," 54.

39 Bálint, "Az Árpád-kori településhálózat," 1.

40 Kiss et als., 711, and 704–8.

41 Gábris, Túri, "Homokmozgás," 241, 245; Nyári et al., "Investigation of Holocene blown-sand," 54.

used for extensive animal husbandry.[42] The growing number of cattle and other animals kept in these areas significantly contributed to the richness and economic boom of some local urban settlements, the so-called *oppida* (market towns), but this spread of animal breeding also may have led to the emergence of huge *puszta* areas around the big rural settlement centers. Thus, one may well conclude that overuse of the land and, more specifically, the sensitive vegetation which grows in sandy soils to support animal breeding led to changes in the hydroclimatic regime which made the land more vulnerable to aeolian processes.

One question remains, however: what was the reason for the massive abandonment of the settlements that preceded the arrival of the Cumans in the area? Can the mid-thirteenth century Mongol Invasion be blamed for this, as is widely believed?[43] Curiously, massive settlement abandonment also took place in deep alluvial floodplains covered by clay soils according to a similar chronology. Clay soil indicates the sites of wetlands, which covered almost one-third of the plain. A multifactorial spatio-statistical investigation suggested that the settlement pattern of an extensive wetland landscape was located in the plain, shrunk and moved vertically, from the Árpád Era (which almost completely covered the Medieval Climatic Anomaly, beginning in 900 and ending in 1300) to the late Middle Ages (1301–1541), thus overlapping the first phase of the Little Ice Age.[44] The massive settlement abandonment was concentrated in the low-lying zones of the region (which were vulnerable to floods) and took place before 1300. To summarize the written sources related to forms of land use, the permanently inhabited flood-free loess ridges were used for diverse forms of farming, while the inhabitants of the rather temporary settlements of the low-lying and clay-covered floodplains dealt mainly with animal husbandry and fishery or other activities linked to the benefits of waters.[45] During the Late Middle Ages, floodplains were entirely abandoned, and the population concentrated mainly in the market towns and the few villages of the loess ridges or on the edge of the floodplain, which had a similar soil structure. The fields of the deserted settlements merged into the area of the emerging market towns, and a specific type of urban settlement, the cattle-breeding market town,

42 Nyári et als., "Multidisciplinary analysis."

43 Györffy, *Az Árpád-kori Magyarország*, vol. 3, 34; Pálóczi-Horváth, "Túrkeve története," 53.

44 Pinke et al., "Zonal assessment," 101. For a more comprehensive overview of the medieval climatic history of the Carpathian Basin, see Vadas and Rácz, "Climatic Changes."; Vadas, "The Little Ice Age."

45 Györffy, *Az Árpád-kori* Magyarország, vol. 1, 510; Jankovich and Szatmári, *Régészeti kutatások*; Szabó, "A dömösi prépostság"; Szabó, *A dömösi adománylevél.*

evolved, where animal husbandry became the core sector of the local economy.[46] An archaeobotanical investigation of the plain revealed that the proportion of species with high moisture demand increased significantly from the first centuries of the Árpád Era (1000–1241) to the last (1242–1301).[47] Like other paleoclimatic examinations, this finding suggests that rapid climate change took place in the second part of the thirteenth century,[48] when climatic extremities, e.g. long-lasting droughts and severe winters became more frequent[49] and caused higher humidity on the plain and higher flood levels on the floodplains. At the same time, interdisciplinary research based in part on a wide range of written sources has clearly demonstrated that the first decades of the fourteenth century were the most serious period of this climatic change, which bore witness to significant increases in areas covered with water.[50]

The Use of the Woods

Woodland areas in medieval Hungary were used in many different ways, and historical and interdisciplinary studies have reconstructed the relevant aspects of the uses to which woodlands were put in a complex way. Hungarian historical research has identified the importance of this natural resource and the related source materials in the nineteenth century.[51] Ethnographic studies on the eighteenth century also contributed to our understanding of traditional forms of woodland exploitation and of the clearing process.[52] At the same time, the complex and interdisciplinary understanding of the uses to which woodlands were put in medieval Hungary is a result of more recent studies.[53] For the particular discussion points of the present article, it should also be noted that woodland and forest management in the mining regions of Hungary in the seventeenth and (even more so) eighteenth centuries has been very intensively

46 Makkai, "A pusztai állattartás," 31–32.

47 Pinke et al., "Zonal assessment," 102.

48 Kern et als., 111, 114, 121–24.

49 Kiss, "Weather and Weather-Related."

50 For data and further literature, see Andrea Kiss, *Floods and Long-Term Water-Level Changes in Medieval Hungary* (Cham, 2019). Another aspect of environment-driven crises has been addressed by Andrea Fara, "Production of and Trade in Food Between the Kingdom of Hungary and Europe in the Late Middle Ages and Early Modern Era (Thirteenth to Sixteenth Centuries): The Roles of Markets in Crises and Famines," *Hungarian Historical Review* 6 (2017): 138–79.

51 Tagányi, *Magyar erdészeti oklevéltár*.

52 Takács, *Egy irtásfalu*; Takács, *Irtásgazdálkodásunk emlékei*; Hegyi, *A népi erdőkiélés*.

53 Szabó, *Woodland and Forests*.

studied. The basic concepts of modern woodland management were developed in some of these regions, particularly in Selmecbánya (today Banská Štiavnica, Slovakia). However, this geographical overlap with the medieval mining regions does not mean that forest management practices can be seen automatically in a strong continuity context, as major legal and institutional development only began in the eighteenth century. Thus, the medieval use and exploitation of woodlands in the mining regions should be seen in a different way. This aspect is also crucial for a discussion of the pressures put on and changes which took place in the relevant ecosystems.

Medieval documents or the written sources do not enable us to reconstruct the forest coverage of the areas around the mining towns or in the mining regions. In a similar way, the amount of wood extracted from these areas cannot be calculated with the help of documentary evidence. It should also be noted that forests were used in the mining regions for several purposes: as timber in the construction of mines, to prepare charcoal, or to build ore crushers, etc. Therefore, we have to take into consideration all possible sources connected to these regions concerning woodland. The connection between mining and the use of wood was referred to in a donation charter issued in 1263 by King Béla IV when he gave Andrew, the judge of Besztercebánya, a forest as a reward for his merits in silver mining. From then on, the forests around the Northern Hungarian mining towns were usually in the hands of the richest burghers.[54] Trip-hammers and ore crushers were mentioned in the region of Körmöcbánya (today Banská Kremnica, Slovakia) as early as 1331.[55] According to a register from 1468, there were 29 ore crushers and four furnaces in Banská Kremnica alone.[56] Another register says that in 1522 there were 43 mines, five furnaces, and five ore crushers in Selmecbánya (today Banská Štiavnica, Slovakia), employing 918 workers. There was a significant increase in metal production compared to the previous decades.[57] Parallel to this, the mining towns, taking advantage of their royal privileges,—aimed to expand the territory where they could harvest the wood necessary for the mines and furnaces.[58]

54 Szentpétery, *Regesta regum,* no. 1332.

55 Wenzel, *Magyarország*, 45.

56 Izsó, *Szemelvények*, 67. On the ore crushers and mills in the Kremnica region, see Vadas, "A középkori Magyar Királyság."

57 Izsó, *Szemelvények*, 81.

58 Weisz, "Az alsó-magyarországi bányavárosok," 40. For examples of local regulation of logging and woodland clearing see Weisz, "Mining Town Privileges," 305.

The mines also contributed to the financing of the royal treasury. Indeed, the decrees issued by King Louis I in 1351 mention the *urbura* in connection with iron.[59] Iron was mentioned along with gold, silver, tin, and plumb in 1427 when King Sigismund of Luxembourg donated the *urbura* collected in certain mining towns to Queen Barbara, though he retained the incomes from copper.[60] In the late-fourteenth century, King Sigismund exchanged certain royal domains for castles of the Csáki family in Temes County, one of which was the castle of Kövesd (today Cuieşd, Romania), which had an iron mine that was mentioned explicitly in the charter.[61] The region in question is better known today as Resica (Reşiţa, Romania), and it was one of the major metallurgical centers of Romania from the mid-eighteenth century until recently. However, iron production can be traced back in the region to as early as the twelfth century: an iron smelting workshop was excavated by Dumitru Ţeicu in Felsőlupkó (today Gornea, Romania),[62] and different forms of iron ores were identified at several sites of the region that belonged to the royal domain of Illyéd (today Ilidia, Romania) in the Middle Ages. Further mines in the region which were mentioned in the fourteenth and fifteenth centuries include Székesbánya (north of today Dognecea, Romania), Bényes (today Biniş, Romania), Boksánbánya (today Bocşa Montană, Romania), and further to the northeast Galadna (today Gladna Română, Romania). These localities were royal estates throughout the Middle Ages or became royal estates in the Late Middle Ages.[63]

Rulers were very concerned with running the mines. As early as 1349, King Louis I granted a privilege for merchants from Genoa in the copper trade, and in 1376 the same privilege was granted to Florentine merchants, too.[64] Four years later, merchants connected to the Medici family acquired a share in Hungarian copper mining, and in 1385, the company made a contract with Venice, the center of the European copper trade, according to which the major share of the copper produced in Hungary would be sold in Venice (except for the part exported to Flanders).[65] In the early fifteenth century, a shift can be seen in the trading network. It was connected to the person of Mark of Nuremberg, who,

59 Izsó, *Szemelvények*, 19.

60 Wenzel, "Okmányi adalék."

61 Wenzel, *Magyarország*, 124.

62 Ţeicu, *Banatul montan*, 261 and 267.

63 F. Romhányi, "The Banat region."

64 Wenzel, *Magyarország*, 158.

65 Izsó, *Szemelvények*, 41. Sources indicate regular commercial contacts with and the economic presence of Venetian merchants in Hungary as early as the 1220s, when one of the most important goods was

for instance, prohibited the import of Polish (medieval Ilkusz, today Olkusz, Poland) plumb in 1405 because of conflicts in copper production.[66]

One also finds direct orders concerning the mines from the fifteenth century. In 1426, King Sigismund ordered George of Jolsva, the bailiff of Zólyom castle (today Zvolen, Slovakia), to secure the necessary wood supply for the new plumb mines,[67] and he regulated the use of the forests around Gölnicbánya (today Gelnica, Slovakia) in 1437.[68] His successor, King Albert, took the miners of Offenbánya (today Baia de Arieş, Romania), Körösbánya (today Baia de Criş, Romania), Zalatna (today Zlatna, Romania), and Körösfő (today Izvoru Crisului, Romania) under his special protection.[69] In 1475, the Thurzó Company made a contract with the Northern Hungarian mining towns. According to this contract, the company would establish water lading machines (Wasserkunst) in exchange for which it would receive one sixth of the mined ore as payment. The contract was confirmed and complemented by King Matthias in the same year, by that the necessary wood should be given to the company free of charge.[70] In 1479, King Matthias allowed the town of Selmecbánya to harvest the wood needed for mining from the royal forest free of charge. This permission was expanded by King Wladislaus II, who ordered in 1496 that the wood had to be given to the town free of charge by any landowner.[71] In 1500 and 1502, Wladislaus II confirmed the right of the Lower Hungarian mining towns to harvest the necessary wood in the royal forests, and this privilege was given to the Upper Hungarian mining towns in 1504 and 1507, as well.[72] Wood was also needed in the salt mines, if in lower quantities. In 1498, for instance, King Wladislaus II donated salt worth 100 guilders to the Cathedral Chapter of Gyulafehérvár (today Alba Iulia, Romania) and in compensation gave the salt mine officials of Torda (today Turda, Romania) the right to cut timber with which to build salt ships in the forest of the Chapter.[73] The intensive

Hungarian silver transported as far as the Levant. Szűcs, *Az utolsó Árpádok*, 323. On the importance and scale of medieval Hungarian copper mining, see Paulinyi, *A középkori magyar réztermelés.*

66 Paulinyi, *A középkori magyar réztermelés*, 36–37.

67 Tagányi, *Erdészeti oklevéltár* 1, 25.

68 Wenzel, *Magyarország*, 331–33.

69 Ibid., 126–27.

70 Izsó, *Szemelvények*, 45.

71 Tagányi, *Erdészeti oklevéltár* 1, 30.

72 Tagányi, *Erdészeti oklevéltár* 1, 30; Izsó, *Szemelvények*, 46.

73 Tagányi, *Erdészeti oklevéltár* 1, 30. However, wood for the ships built in Dés (today Dej, Romania) were sometimes transported from as far as the region of Radna (today Rodna, Romania). Draskóczy, *A magyarországi kősó.*

royal interventions to provide wood for the mining sector is absolutely understandable. Hungary and Bohemia were the major suppliers of gold and silver in late medieval Europe, and the kingdom's copper production was also significant. In the 1380s, the Hungarian copper export can be estimated at 8–10 thousand tons per year. In 1495, when John Thurzó made his contract with the Fugger family on copper production within Hungary, the production of the planned kiln of Besztercebánya (today Banská Bystrica, Romania) was set at 300 quintals per week, giving a total of approximately 920 tons per year. Thus, that kiln alone would produce about 10 percent of the fourteenth-century export. The investment was intended to increase the quantity of the copper produced by the company and also to improve the quality, which meant multiple smelting, which demanded more energy. According to the accounts of the Fugger family, the company had invested 277,500 guilders by 1499, and profits reached roughly 2.5 million guilders between 1496 and 1546.[74] The Thurzó company was involved in copper and precious metal production in areas outside of northern Hungary. The mines of Belényes (today Beiuş, Romania), where both silver and copper were mined, were restarted, and reorganized by John Thurzó in the early-sixteenth century.[75]

Large-scale logging, however, took its toll. In 1347, King Louis I allowed the miners of Nagybánya (today Baia Mare, Romania) and Zazár (today Săsar, Romania) to cut the necessary timber for the mines in any forest, be it royal or noble property, in part since there was no suitable material anymore in the town's surroundings.[76] Sources also indicate conflicts between miners and owners of forestlands. In 1459, the towns of Szomolnok (today Smolnik, Slovakia) and Svedlér (today Švedlár, Slovakia) turned to the king, since the bailiffs of the castles of Krasznahorka (today Krásna Hôrka, Slovakia) and Szádvár hindered the work of the charcoal-burners, destroying their kilns and causing other damages, as well.[77] Between 1479 and 1503, a long-lasting conflict emerged between the

74 Izsó, *Szemelvények*, 57–59.

75 Wenzel, *Magyarország*, 118. The silver mines of the Bishop of Várad around Belényes (Beiuş) were first mentioned in 1297 (Györffy, *Az Árpád-kori Magyarország,* vol. 1, 599), then, in 1374 (Izsó, *Szemelvények*, 127).

76 Tagányi, *Erdészeti oklevéltár* 1, 20; Izsó, *Szemelvények*, 117–18. About this case, see also Weisz, "Mining Town Privileges," 304. Another charter issued in 1376 (Fejér, *Codex diplomaticus Hungariae*, IX/5. 98.) may indicate that there was already wood of suitable quality in the closer vicinity of the mines, too, though it seems to have been wood used as building material for different edifices *(cives et hospites… molendinum, casas, fornaces, balnea, allodia, et alias quaslibet haereditates aedificari facientes)*, and not for the mines directly or to burn as charcoal.

77 MNL OL DL 24901 (short summary in Hungarian: Izsó, *Szemelvények*, 106).

miners of the region of Nagybánya on the one side and the Drágfi family and their bailiffs of Kővár Castle near Kővárremete (today Remetea Chioarului, Romania) on the other because of forest use.[78] The miners of Offenbánya (today Baia de Arieş, Romania) and the Romanian knezate of Nagylupsa (today Lupşa, Romania) had a similar conflict between 1485 and 1487, where both the felling of timber for mines and the making of charcoal were mentioned.[79]

The first indication of rafting on the Hron/Garam River dates from 1209 *(tributum lignorum, quae feruntur super Gran)* and on the Váh/Vág River from 1206 and 1271, referring to the use of wood from the high mountains.[80] Similarly, wood was a major source of income in the mountainous regions of the Drugeth domains in Ung County. As Pál Engel has pointed out, the former border zone *(gyepüelve),* which was settled in the fourteenth and fifteenth centuries, was mainly used for logging *(silva dolabrosa)*. This is also supported by the presence of numerous mills on different streams in an area where ploughland was very limited at the time.[81] However, the first clear evidence of the use of rafts in shipping other goods, in this case salt, is a charter issued in 1507.[82] Before this, only reusable boats (often log boats) were used in salt transport, as written sources from the late eleventh century indicate.[83] The territory where, as the charter says, rafts were used in a new way is the salt region of Máramaros County, where this practice continued into the 1860s.[84]

The intensive use of forests suggests that deforestation reached a critical rate in the mining regions. However, the same environment was affected by another economic activity, the grazing of sheep. Sources indicate that as early as the thirteenth century, transhumant shepherds used the lands in the Apuseni

78 Izsó, *Szemelvények*, 121–22.

79 MNL OL DL 32505 (short summary in Hungarian: Izsó, *Szemelvények*, 132–33).

80 Alexander Fehér, *Vegetation History and Cultural Landscapes: Case Studies from South-west Slovakia* (Cham: Springer, 2018); Richard Marsina, ed., *Codex diplomaticus et epistolaris Slovaciae,* vols. 1–2 (Bratislava: SAV, 1971–1987); Bratislava Obzor, and Veronika Novák, "Mátyusföldi települések az okleveles források tükrében" [The settlements of the Mátyusföld region as reflected in the charters], in *Mátyusföld* vol. 2, edited by László Bukovszky 45–61 (Komárom: Fórum Kisebbségkutató Intézet; Dunaszerdahely: Lilium Aurum Könyvkiadó, 2005); Ferdinand Uličný, *Dejiny Slovenska v 11. a 13. storočí* (Bratislava: Veda, 2013).

81 Engel, "Ung megye," 956.

82 The expression is *super struibus lignorum*. Iványi, *A római szent birodalmi,* no. 450. Before that, *strues* meant only a raft the wood of which was sold as building material or other raw material, but nothing else was shipped on it.

83 F. Romhányi, "Salt trade."

84 Paládi-Kovács, *Magyar néprajz*, vol. 2, 979. In early modern times, rafting—especially of building material—was wide-spread on other rivers, too, e.g. on the Vág and Maros.

mountains to graze their herds.[85] Their gradual movement towards the north is reflected partly in the foundation of small orthodox monasteries and churches built from the second half of the fourteenth century[86] and partly in the increasing number of Wallachian villages, especially after the 1420s, when Ottoman raids destroyed large parts of southern Transylvania.[87] Similarly, Orthodox, mainly Ruthenian settlers arrived from territories beyond the northeastern and northern Carpathians. Their presence can be traced back to approximately the same period. In 1337, Palatine William Druget settled orthodox peasants in the village of Korumlya (today Koroml'a, Slovakia).[88] Large groups of Ruthenian (Podolian) settlers came to the region after Prince Fyodor Koriatovych was forced into exile (1392) and became the lord of the Munkács and Makovica Castles (today Mukachevo in Ukraine and Zborov in Slovakia) and count of Bereg and Sáros Counties.[89] The donation charter of Queen Mary issued in 1390 offers further evidence of the presence of transhumant shepherds in Szatmár County. It gave Terebes (today Racova, Romania) to the ancestors of the Drágfi family, Balk, Drag, and John. Three years later, they came into conflict with another local landlord, Ban Simon of Medgyes, whose tenants killed their tenants' sheep *(iobagionum seu Olahorum)*.[90] The conflict must have involved the use of the land, more specifically the use of the pastures. The spread of these settlements continued in the fifteenth and sixteenth centuries.[91] In 1437, several Orthodox

85 Miskolczy, *Románok*, 17–31.

86 Rusu, *Dicţionarul mănăstirilor.*

87 Köpeczi, *Kurze Geschichte,* 186–95.

88 Engel, "Ung," 974 (1337: *olahos descendere fecisset*). Ruthenians were often called *valachi* in the charters because of similarities in their lifestyles, but in the case of Koromlya, a charter of 1437 says clearly that they were Ruthenians and that at the time they even had a priest of their own.

89 Kuczyński, "Fedor Koriatowicz." The prince spent time in Hungary in the 1360s and 1370s. The monastery of Saint Nicholas, which he founded near Munkács (today Mukachevo, Ukraine), was called a parish of the Ruthenian (i.e. Greek Orthodox) rite in 1458. Its priest, Lucas, was confirmed by King Matthias Corvinus (Collectio Kaprinai, series B, vol. 6, no. 42). This means that the church was a recognized center of pastoral care for the Orthodox population after the Union of Florence.

90 Németh, *A középkori Szatmár*, 301.

91 For the fifteenth century see Mihályi, *Máramarosi diplomák*, 223 (1418: *duas capellas ligneas, unam videlicet Christianorum et aliam Ruthenorum* in two villages in Máramaros County); Németh, *A középkori Szatmár*, 268 (1424, Szakasz—*capella Olahorum*). Németh's book contains considerable data on the Wallachian population in Szatmár County. A further example from 1516: MNL OL DL 86750 (a conscription of a domain on the border of Bereg and Máramaros Counties lists three wooden churches—*capella lignea more volachorum*—in Ruszkova, Polyána, and Rosálya). In Zemplén County, new Orthodox chapels were built in the sixteenth century, e.g. in Felsőcsebény and Oroszsebes (today Vyšné Čabiny and Ruská Bystrá, Slovakia), in the mountains to the north and east of Nagymihály (Samu Borovszky, *Magyarország vármegyéi és városai: Zemplén vármegye és Sátoraljaújhely r.t. város* [The counties and towns of Hungary: Zemplén County and the town

chapels were listed beyond the Vihorlat Mountains in Zemplén County.[92] By the late-fifteenth century, shepherds of Romanian and Ruthenian origin had reached the western Carpathians, Árva, Trencsén, and Turóc Counties.[93] The expanded grazing significantly contributed to deforestation.

In addition to the above, the Ottoman wars between the fifteenth and seventeenth centuries also affected the territories in question, if in an indirect way. On the one hand, a significant part of the population fleeing the devastated southern regions and the Hungarian plain took refuge in the Carpathians. The first Protestant registers listing the pastors and the communities between the 1560s and the 1620s indicate a population density which would have been unthinkable before the Ottoman wars and which began to decline after the 1660s.[94] The situation was slightly different in Transylvania, but immigration from Moldavia, and Walachia was almost uninterrupted, and for the most part targeted areas which were suitable for pasture. In other parts of the country, in the frontier zones of the region occupied by the Ottomans, fortifications needed a continuous supply of wood, which accelerated the process of deforestation in the frontier zones. Ágnes R. Várkonyi has emphasized that the maintenance of the Ottoman period defense system of Hungary put tremendous additional pressures on the forests in the mountainous regions (e.g., in the 1680s, the domain of Likava Castle regularly had to deliver large amounts of timber, poles, stakes, roof shingles, etc. for different fortifications

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of Sátoraljaújhely] (Budapest–Sátoraljaújhely, 1905) 42 and 96). In Ugocsa County, a charter issued in 1471 listed thirteen villages inhabited by Wallachians and Ruthenians (MNL OL DL 70956). In 1491, the Orthodox population of Máramaros County and the surrounding mountainous region had a bishop who resided in the monastery of Körtvélyes (today Hrusheve, Ukraine). MNL OL DL 36886.

92 Engel, "Ung," 974.

93 The *valachi* living on the territory of the Árva and Likava Castles received a privilege from King Matthias Corvinus in 1474. Wenzel, *Magyarország mezőgazdaságának*, 330–31. On the colonization process of Trencsén County, see Fekete Nagy, "Trencsén megye," in Csánki, *Magyarország történeti földrajza,* vol. 4, 61–62.

94 Csepregi, Zoltán, *Evangélikus lelkészek Magyarországon 2: a zsolnai zsinattól (1610) a soproni országgyűlésig (1681)* [Lutheran pastors in Hungary part 2: from the synod of Zsolna, 1610 till the diet of Sopron, 1681] (Budapest, 2018). I would like to thank Professor Csepregi for his additional information about the database. Furthermore, see Dienes, Dénes ed., *Református egyházlátogatási jegyzőkönyvek, 16–17. század* [Protocols of canonical visitations of reformed churches, sixteenth and seventeenth centuries] (Budapest: Osiris, 2001); Tomisa, Ilona ed., *Katolikus egyházlátogatási jegyzőkönyvek, 16–17. század* [Protocols of canonical visitations of Catholic churches, sixteenth and seventeenth centuries] (Budapest: Osiris, 2002). On the mosques established on the territory under Ottoman rule in the sixteenth century, see Sudár, Balázs, *Dzsámik* és *mecsetek* a *hódolt Magyarországon* [Mosques in Ottoman Hungary] (Budapest: MTA Történettudományi Intézete, 2014).

which were 150–200 kilometers distant Likava itself), which had already been largely depleted by the mines and furnaces.[95]

Medieval Transformation of the Land Cover in the Mining Regions of the Carpathian Basin

In this section, we offer a short review of the main directions of land cover changes that took place between the eleventh and the sixteenth centuries in the ca. 50,000 km^2 mountainous regions of the northern and eastern part of the medieval Kingdom of Hungary. By the eleventh century, most of the lower regions and foothills, the environment of the mines in use in the Apuseni Mountains and the Northern Middle Mountains (northern Hungary and eastern Slovakia), became cultural landscapes. The ratio of open lands increased gradually due to human use, mainly grazing and forest clearance for charcoal production (for instance). Moreover, pastoral activities were associated with forest burning, which was a drastic form of clearance, as indicated in many pollen reconstructions of the Carpathians.[96] This happened in the central part of the Apuseni Mountains, where the ratio of herbaceous pollen increased permanently from the Iron Age (eighth–sixth century BC) in a site situated at 1240 meters a.s.l. (above sea level) and in the environment of a bog (1400 meters a.s.l.) from the late Roman Period (fourth century AD).[97] The presence of cereal pollens was stable, but their ratio was low in the total pollen profile in ten of the sites studied in the mountains from the late fifth century to the end of the sixteenth.[98] In contrast, the first cereals are found in the 4280–3570 BC deposit layer of the Ponor karst area (1040 meters a.s.l. Apuseni Mountains) and in a layer of the Iaz peat bog dated to 4300–3700 BC (300 meters a.s.l. Apuseni Mountains).[99] The earliest evidence of forest grazing and farming culture was identified at 4740–4620 BC in the Căpăţâna peat bogs (1220 meters a.s.l. Apuseni Mountains), but major deforestation began only around 1400 AD, linked to a migration wave of the transhumant Orthodox population reaching the area, as well as the rapidly rising demand for wood in the industrializing mining region.[100]

95 R. Várkonyi, "Környezet és végvár," esp. 17.
96 Feurdean, Tanţău, "The Evolution," 81.
97 Bodnariuc et als., "Holocene vegetation."
98 Törőcsik and Sümegi, "Pollen-based reconstruction."
99 Fărcaş and Tanţău, "The Human Presence."
100 Fărcaş and Tanţău, "The Human Presence"; Grindean et als., "Middle to Late Holocene," 34.

Similar temporal dynamics appear in the paleo-ecological records of sites in the Aggtelek-Rudabánya Mountains, very close to an important iron mine.[101] The ratio of cereal pollens, however, increased here significantly from the late tenth century to the end of the eleventh and showed a consistently high proportion until the late sixteenth century.[102] Human use was reconstructed in the Western and Northern Carpathians, including the Tatra Mountains and Szepesség Region (today the Spiš Region, Slovakia) from the early phase of the Migration Period (fifth century), but the ratio of cereals began to grow only towards the end of the eleventh century.[103] As a result of the colonization policy of King Béla IV, thousands of settlements and dozens of new towns began to emerge in the Carpathians, including the Tatra Mountains, over the course of the fifty-year period beginning in the mid-thirteenth century.[104] In other words, there was a dramatic increase in human pressure on the ecosystems in the mountains beginning in the thirteenth century. Rapid colonization following extensive pastural and mining activity reduced the forest coverage in Sáros and Zemplén Counties (in the northern Carpathians) and Borsod and Gömör Counties (in the northern middle mountains) by the late fifteenth century to an estimated 41–60 percent, 21–40 percent, 41–60 percent, and 21–40 percent, respectively.[105] As it has been discussed in literature with regard to the Northern Middle Mountains in the fourteenth and fifteenth centuries, "the forests came to an end there, and the neighboring counties began to eliver their forests to the mining regions."[106]

The traces of small-scale forest clearance were recorded in the Bronze Age peat deposit at 1143 meters a.s.l. in the Lápos (Romanian Lapuş) Mountains, close to the northern Transylvanian mining region.[107] Then, the human impact gradually intensified beginning in the twelfth century. The fourteenth and the fifteenth centuries, when the modern cultural landscape evolved in the region, bore witness to large-scale logging and intensive agricultural activity. In the neighboring Gutai Mountains, the first sign of grazing is found in the ca. eleventh deposit layer of the crater lake Steregoiu (ca. 800 meters a.s.l.), but serious human impact appears only from the 1700s.[108] In contrast, Fărcaş and

101 Sümegi et als., 42.
102 Törőcsik and Sümegi, "Pollen-based reconstruction."
103 Törőcsik and Sümegi, "Pollen-based reconstruction"; Mályusz, *Turóc megye*, 1922.
104 Szűcs, *Az utolsó Árpádok*, 316.
105 Szabó, "Changes in woodland," 111.
106 Mályusz, *Turóc megye*; Weisz, "A bányaváros mint önálló", 49–50.
107 Peters et als., "Holocene vegetation," 15.
108 Feurdean et als., "A paleo-ecological," 132.

Tanţău found pollen evidence of minor cereal production here in the layer dated to 820±75 AD.[109] The deposit in the crater lake Preluca Ţiganului is situated in the Gutăi Mountains, and it has the earliest evidence of a human-driven decrease in forest diversity in a 2,300-year-old deposit. In other words, forest clearance and grazing may have started in the late Iron Age (300 BC).[110] According to a historical estimate based on late-fifteenth-century common estimations *(aestimatio communis)* that covers nearly 3,000 km^2 (almost one percent of the Carpathian Basin),[111] forest coverage may have been 76–100 percent in Máramaros County, where important salt and precious metal mines were in operation, and 21–40 percent in Közép-Szolnok County, which covered the northeastern part of the Apuseni Mountains.[112]

Conclusion

Both written sources and changes in the settlement system prove that the mountainous areas of the Carpathian Basin that are rich in ores and—in Transylvania and Maramureş—in salt were increasingly exploited from the second half of the thirteenth century, after the Mongol Invasion. Mining was intensified in at least three periods: first in the first half of the fourteenth century, then in the last decades of the fourteenth century, and finally at the end of the fifteenth century. The increasing quantities to be shipped and the extremely expensive transportation costs of the time[113] led to a transformation in transport infrastructure: around 1500, rafts began to be used instead of boats, and the use of rafts became widespread in the following centuries, especially on the Tisza and its tributaries, thus contributing to the decline of forests. As the documents cited above indicate, the forest maintenance that accompanied land use management in the majority of the medieval communities was not characteristic of the mining regions studied here during the fifteenth and early sixteenth centuries.[114] However, forest management, including maintenance, belonged to the eminent interest of local communities, since forests (wood) were the main energy resource before the Industrial Revolution in the

109 Fărcaş and Tanţău, "The Human Presence," 34.
110 Feurdean, "Holocene forest," 442.
111 Vadas and Szabó, "Not Seeing the Forest," 478.
112 Szabó, "Changes in woodland," 111.
113 Braudel, *Civilization and Capitalism,* 362–68.
114 Szabó, "The Extent," 221.

eighteenth century. However, the melting ores offered such impressive profits for companies and the royal treasury that it was in the interests of the state to provide adequate wood to meet the needs of the mines. At the end of the Middle Ages, royal power tended to neglect the ownership and interest of local communities and landlords by allowing mining companies to clear forests. This step opened the gate for deforestation of huge areas in the Carpathians. When the destruction reached an extreme in certain mining regions in the sixteenth century, the central administration tried to correct its former stance and issued decrees that were intended to protect forestlands for instance by prohibiting iron mining in certain regions in 1564[115] and issuing a new regulation concerning the forests used by the lower Hungarian mining towns in 1565.[116] These efforts, however, proved useless, because of the conflicts with the Ottoman Empire and the civil wars of the sixteenth and seventeenth centuries, when the protection of lands, including forests, was hardly the primary concern. Moreover, as was the case in Transdanubia, influxes of refugees from the Ottoman wars led to a population increase in the mining regions from the mid-sixteenth century, thus putting increased human pressure on the forests in the mountains.[117] Alongside mining, transhumance also became more widespread in the regions, reaching the westernmost part of the Carpathians in the fifteenth century. These economic activities resulted in the gradual deforestation of the regions. The process was probably hastened by the needs of military constructions, which were also a consequence of the Ottoman wars.

Our hypothesis is that the increasing number and intensity of hydroclimatic extremities linked to the medieval climate change that preceded the Little Ice Age may have contributed to or driven the desertion of settlements in the sandy ridge and floodplain regions of the Great Hungarian Plain in the thirteenth century. The Mongol Invasion merely ended a crisis which affected the farming system of the plain. The form of land use that became dominant in the region in the late Middle Ages—extensive grazing of cattle and sheep—remained the most prevalent practice until the eighteenth century. However, the increasing use of pastures, the partial extension of pastures towards the hills, the changing runoff coefficient due to deforestation in the bordering mountain regions, and the effects of warfare may have contributed to the aridity of the Hungarian

115 Tagányi, *Erdészeti oklevéltár*, vol. 1, 77.

116 Heckenast, *A magyarországi vaskohászat*, 109–10.

117 Vadas and Szabó, "Not Seeing the Forest," 478.

Plain in the Early Modern era and the decreasing profitability of large-scale animal husbandry in the region.

Thus, the lucrative, export-oriented economic activities of the late medieval Hungarian kingdom, which contributed to the ability of the country to withstand Ottoman pressure for about 130 years (before the 1520s) and, in a more limited way, even longer (into the wars of the sixteenth and seventeenth centuries), led in the long run to serious environmental degradation the effects of which could not be fully overcome for a long time. Certainly, this impact was increased by the effects of the Ottoman wars themselves and the changing climatic conditions of the Little Ice Age, too, but the process began well before the Early Modern crisis, in some respects, as early as the late thirteenth and early fourteenth centuries.

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Millennial Record of Earthquakes in the Carpathian-Pannonian Region: Historical and Archaeoseismology

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This is a short essay on earthquakes in the Carpathian-Pannonian region and its surroundings. Earthquakes have been recorded using seismographs since 1902 in Hungary. The relatively small number of seismic events and the long return period of major earthquakes make it necessary to use historical data in order to assess seismic hazard. Historical earthquake catalogues aim for exhaustiveness both in time and space, but they are limited by the lack of documentary data. A simple arithmetical assessment is provided to estimate our lack of knowledge of past seismic events. All destructive earthquakes of the twentieth century (above magnitude 5) are included in the catalogue (100%). Of the seismic events which took place in the seventeenth, eighteenth, and nineteenth centuries, only 23% are on record, while this figure drops to 4.6 percent for the eleventh–sixteenth centuries and 0.2 percent for the first millennium AD. On average, we have no information about 90% of the destructive earthquakes which occurred in the Carpathian-Pannonian region over the course of the past two millennia. According to both instrumental measurements and historical sources, there were relatively few earthquakes in the central era of the period of time in question. This era coincides roughly with the two centuries of Ottoman rule (the sixteenth and seventeenth centuries). Were there really few earthquakes over the course of these two centuries, or we do not have the relevant records? We contend that warfare resulted in the destruction of settlements and the annihilation of documents.
Fragile historical documents can be supplemented by the study of robust edifices, an approach to the study of the past which is known as archaeoseismology. Evidence of damage and destruction can be identified, and earthquake parameters can be assessed. One can find evidence corroborating other sources indicating an earthquake (e.g. Savaria), and one can also identify traces of previously unknown seismic events (Visegrád). One can also assign intensity values to the existing historical records. Damage observed to a Roman road in Savaria, to the medieval donjon of Nagyvázsony offers support for our fundamental contention. In order to understand the seismic hazard that was faced in the Carpathian-Pannonian region, renewed study of historical sources and new archaeoseismological investigations are needed.

Keywords: earthquakes, archaeoseismology, historical sources, Carpathian-Pannonian region

Introduction

Earthquakes cannot be predicted. There are abundant references on the internet and in the secondary literature concerning seismic events that allegedly were successfully forecast. Several natural anomalies were harbingers of the 1975 Haicheng event in China, and an evacuation order was issued by an exceptionally cautious civil protection leader, who was in a position of power at the time and who thus probably saved tens of thousands of lives. In contrast, there was no foreshock or any other kind of anomaly on the basis of which predictions might have been made concerning the 1976 Tangshan earthquake, which hit the city at night and caused at least 250,000 deaths. The few successful cases when an earthquake was predicted should be seen as lucky coincidences at most, not suitable for generalization.[1] How can we reduce damage to people and property by earthquakes in the future? Anything that happened in the past can happen in the future. We therefore need to learn as much as we can about the past. This may help us prepare for events in the future.[2] In the following, we provide a very short overview on the seismic history of the Carpathians and the Pannonian Basin.

Historical Seismology

Measurements of seismic activity using sophisticated instruments began in Hungary in 1902. For any moment before this date, we have data on seismicity based on historical documents only. Grossinger[3] was the first to summarize these documents in a Latin catalogue published in 1783, immediately followed by a German translation of Sternberg,[4] both of whom listed 150 events. A century later, Jeitteles[5] described 220 earthquakes from the same period in great detail, noting felt features and damage. After a few short communications, Réthly[6] published his monumental catalogue, listing events up to the end of 1917. Two hundred and thirty-five of these events are recorded from the same period as Grossinger. Réthly was the first to distinguish between main shock

1 Hough, *Predicting the Unpredictable.*
2 Ambraseys, "Archaeoseismology."
3 Grossinger, *Dissertatio.*
4 Sternberg, *Geschichte.*
5 Jeitteles, "Geschichte der Erdbeben."
6 Réthly, *Kárpátmedencék.*

and aftershocks. He gave catalogue entries in the original language and added Hungarian translations with references to the original sources. His catalogue is an exemplary work in every sense.[7]

Zsíros[8] prepared a computerized catalogue containing more than 20,000 events. Most of the information concerning these events came from instrumental measurements taken after 1970. Comparing his methods with previous studies, we found that he increased the data given by Grossinger more than fourfold (!) for the period which came to an end in 1783. References are provided for all of the data. This catalogue has been supplemented by new data compiled using instruments by researchers at the Seismological Observatory in Budapest. Figures 1 and 2, which illustrate the temporal and spatial distribution of earthquakes in the Carpathian-Pannonian Basin, are based on this database.

Historical earthquake catalogues are prepared with the intent of making a complete listing of known events for a given area. The best examples to follow are the catalogues compiled by Guidoboni and Comastri[9] for the Mediterranean region, by Ambraseys[10] for the Mediterranean and the Middle East, and, to cite a local example, by Hammerl and Lenhardt[11] for Lower Austria.

Our ability to provide a complete account of catalogue of seismic events, however, depends, of course, on the availability of sources. Hungary is characterized by a lack rather than an abundance of sources, in part because of its stormy history.

Earthquakes of magnitude 5 or larger are plotted by decade in Figure 1. A magnitude 5 earthquake causes structural damage to buildings. Earthquakes and seismic events which took place after 1901 were measured using new instruments, so these measurements were used to plot them on the graph, while other sources, including narrative sources, were used to plot seismic events before this. The part of the graph which covers earthquakes of a magnitude of five or more in the twentieth century can be considered complete, as it is based on data provided by relatively sophisticated instruments. The graph offers the impression that, the further one goes back in time, the fewer earthquakes there were. Clearly, this is unlikely. This difference is a sign, rather, of the lack of sources.

7 Ambraseys, *Earthquakes*, 6.
8 Zsíros, "Earthquake activity."
9 Guidoboni and Comastri, *Catalogue*.
10 Ambraseys, *Earthquakes*, 6.
11 Hammerl and Lenhardt, "Erdbeben."

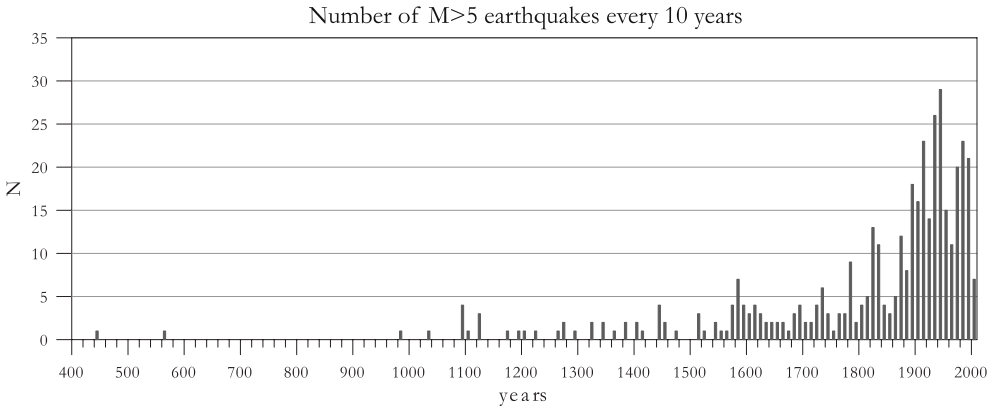

Figure 1. Number of known earthquakes in the Carpathian-Pannonian region and surroundings in the past two millennia. Magnitude 5 and larger events are shown for each decade. See also Figure 2 for the investigated area.[12]

We assume that there were similar numbers of earthquakes in previous centuries. The locations and times of seismic activities are consequences of processes of plate tectonics, which hardly show significant variations over the course of centuries or even millennia.[13] On average, there were 15 events every decade in the twentieth century, coming to a total of 205 earthquakes. The approximate parameters of these events are known. Between 1600 and 1900, sources indicate that there were on average five events per decade, coming to a total of 144 earthquakes, instead of the 615 ones if we assume that earthquakes occurred with the same frequency as in the twentieth century. This means that there are no records in the available sources of three fourths of the destructive earthquakes (which would mean 461 events). There are scattered records of earthquakes before 1600, including decades for which there are no indications that there were any earthquakes whatsoever. Between 1000 and 1600, the sources indicate only 57 earthquakes, which would be 4.6% of the 1,230 quakes which probably occurred. There are only three records of three earthquakes from the first millennium. In other words, if one were to rely entirely on these sources, one would conclude that 0.2% of all the earthquakes which occurred in the period of time covered in this discussion took place over the course of this period of 1,000 years (Fig. 1). If, in contrast, we were to make the logical assumption that earthquakes were as common in the first millennium as they were in the twentieth

12 *Earthquake Catalogue.*

13 Bada et al., "Present-day stress field."

century, we can conclude that the sources make no mention of 99.8% of all earthquakes. Historical observations for 1 to 1900 AD indicate only 5.2 percent of the number of earthquakes which we can assume to have taken place. These are the earthquakes that are listed in the aforementioned catalogues. Calculations of seismic risks are based on these data, as are the hazard maps (Table 1).

Table 1. Known earthquakes and earthquakes assumed to have taken place in the Carpathian-Pannonian region and surroundings. For the area studied see Figure 2.

Interval	Duration in years	Number of earthquakes assumed to have occurred	Number of earthquakes recorded	Percentage recorded/ occurred
1900–2000	100	205	205	100%
1600–1900	300	615	144	23%
1000–1600	600	1,230	57	4.6%
1–1000	1000	2,050	3	0.15%
1–1900	1900	3,895	204	5.2%
1–2000	2000	4,100	409	10%

There are various mathematical methods available to assess the seismicity of any region, be it as large[14] or small.[15] The simple arithmetic used in the present study is intended to reveal major gaps in our knowledge and emphasize the importance of further study.

Why do we know so little about past earthquakes of the period before sophisticated instruments were available to detect and measure seismic activity? There are three major factors to be considered. (1) Were any records of earthquakes created at all? (2) Were the records preserved? (3) If a source was created, do we know of it, have we analyzed it, and was it included in the earthquake catalogue?

There are more than 4,000 Roman inscriptions in Pannonia dating to the period between the first and the fifth centuries AD.[16] Most of them were unavailable to Réthly. Roman inscriptions rarely mention earthquakes. Rather, they note completion of construction or reconstruction of a building. Thorough historical and archaeological study of the sites is necessary if we wish to interpret these inscriptions accurately. People of the Early Middle Ages rarely left any written records in the region. Late medieval sources, especially sources found

14 For the Pannonian Basin, see Tóth et al., "Seismic hazard."

15 For the Vienna Basin, see Nasir, "Assessing the completeness."

16 Kovács, "Römische Inschriften."

in the territory of the Kingdom of Hungary, are substantial, and many of them have either been published in print or are available online. There are about half a million medieval charters of a legal nature. They do not provide much information concerning seismicity. Travelogues, reports by envoys, and geographical and historical handbooks[17] probably provide the most substantial amount of data, if one approaches them with an open mind. Private correspondence, frequent from the sixteenth century onwards, and reports published in foreign journals beginning in the seventeeth century provide a considerable amount of data. It is too easy to rely on the monumental catalogue compiled by Réthly and his successors. One must be aware that his data were gathered up until the late 1910s, and later amendments and additions were made.

Zsíros,[18] who was aware of this deficiency, found a significant number of new sources and added the data he found in them to his catalogue. Additionally, he added geographic coordinates to the sites, assigning intensity and magnitude values to seismic events. His sources are precisely referenced. However, word-by-word citations and especially translations on this scale constitute a task beyond the capabilities of one person. The extent and precision of Zsíros's work is shown by the fact that he identified three times the number of earthquakes (460) identified by Réthly, making note of 1,453 events during the period covered by Grossinger until 1783.

If there were historical records produced, did they survive tumultuous centuries of history in the Carpathian-Pannonian region? Figure 2 shows the maximum extent of Ottoman rule in the sixteenth and seventeenth centuries. This meant severe destruction of life and property due to incessant warfare and robbery. This part of the region also seems to be characterized by a low number of earthquakes (Fig. 2), while there were significantly more to the west and east. Recurring warfare in the sixteenth and seventeenth centuries resulted in the destruction of towns and cultural centers (especially monasteries) and depopulation in general. One third of medieval churches of Pest County are known from archaeological evidence only, because the relevant historical documents were lost.[19] Written records were neither produced nor preserved during this period. No Gothic buildings, ecclesiastic or secular, survived in Buda, which was the medieval capital and royal seat of Hungary. The royal archives and library, the city archives, the royal registries and charters, records of city councils,

17 Csukovits, "Források."

18 Zsíros, *A Kárpát–medence.*

19 Tari, *Pest megye*, 210–14; F. Romhányi, "Medieval ecclesiastical buildings," 259.

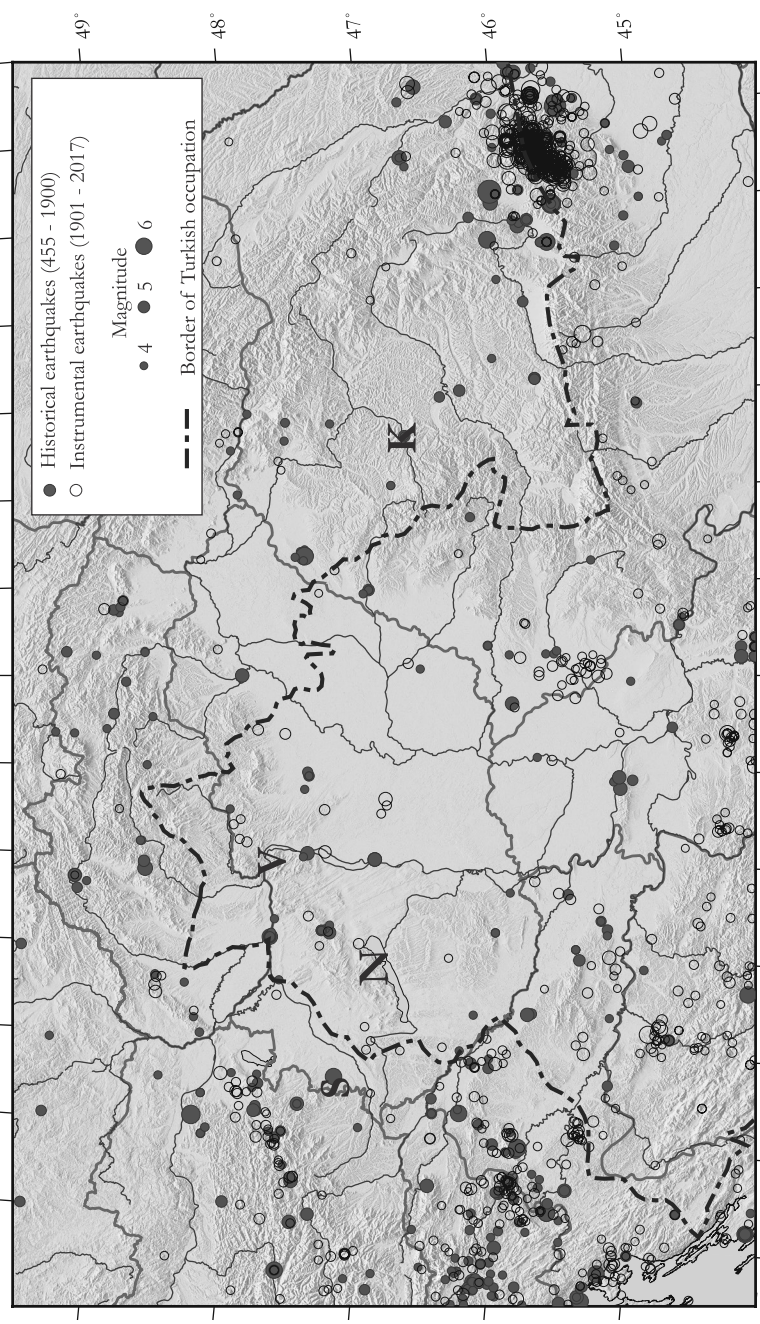

Figure 2. Earthquakes measured using instruments and earthquakes to which there are references in historical sources larger than magnitude 4 in the Carpathian-Pannonian region and surroundings.* One notes the low number of earthquakes in the central part. Is it due to a lack of seismic activity or a lack of historical records? A dotted line marks the largest northern extent of Ottoman rule in the sixteenth and seventeenth centuries.** Recently discovered earthquakes are indicated by capital letters: Nagyvázsony (N), Visegrád (V), and Cluj-Napoca (K). S – Savaria.

* Source: *Earthquake Catalogue.* ** Szalay, *A magyar nemzet.*

financial records, and private correspondence were all lost due to the wars with the Ottomans.[20] Particularly painful is the loss of *historia domus* records, which were dutifully written and preserved by monks in each monastery. These were major sources of Réthly's studies in other regions. Turkish-language records, written in the Arabic alphabet, are certainly available, waiting to be studied.

When creating Figure 2, we asked whether the Carpathian-Pannonian region was really relatively free of major destructive earthquakes in its center or not. Is it true that there were many major earthquakes in the west and the east but almost none in the center? We cannot offer an answer based on the small number of surviving historical records. Given the methods on which it is based, archaeoseismology may yield a more nuanced understanding of seismic activity in the Carpathian-Pannonian region, and it may well provide significant quantities of new data, irrespective of the historical record. Two examples illustrate this point below.

Archaeoseismology

Archaeoseismology is the study of seismic activity in the past on the basis of archeological sites. It has not yet been used in Hungary. An archaeoseismologist studies archeological excavations and surviving edifices for deformations caused by earthquakes.[21] If one can exclude other causes (foundation problems, damages caused by warfare, etc.),[22] earthquake intensity is assessed, and attempts are made to establish, within a limited framework, the time of earthquake. The nature of the damage helps localize the fault responsible for the shocks(s). This method is a suitable approach to finding corroborating evidence of suspected historical earthquakes (e.g. Savaria)[23] and identifying seismic events unrecorded in historical sources (Visegrád).[24] Additionally, one can assign intensity values to earthquakes, independently from historical records (Buda,[25] Kolozsvár[26]).

Archaeoseismology was essentially invented in Greece as way of explaining layers of collapsed edifices excavated in the palace of Knossos, Crete.[27] The first

20 Zolnay, "A történeti forrásanyag," 30–34.
21 Marco, "Recognition"; Kázmér, "Damage."
22 Ambraseys, *Earthquakes*.
23 Varga, "Magnitude."
24 Kázmér et al., "Tizenhatodik századi."
25 Ibid.
26 Kázmér, "Evidence."
27 Evans, *Minos*; Jones and Stiros, "Advent of archeoseismology"; Jusseret, "Contextualising."

handbook was published in Athens.[28] Large-scale field surveys[29] were followed by clear essays on methodology in Italy[30] and Spain.[31] Progress is being made in attempts to produce analogue models first and foremost in Portugal,[32] and Germany is in the vanguard in computer analysis.[33] There are examples of widespread use of archaeoseismology in Turkey[34] and Israel[35] and novel studies elsewhere in the Mediterranean region, including Algeria,[36] Tunisia,[37] Libya,[38] Egypt,[39] Jordan,[40] Lebanon,[41] and Syria,[42] to name a few.

The Mediterranean region lies along the collision zone between the European and the African plates, in a so-called plate margin environment, where seismicity is high. Additionally, there are rare but major earthquakes in intraplate environments, far from any plate margin. Archaeoseismology is eminently suitable as an approach to the study of past earthquakes in this region. However, the findings are often met by skepticism. The Lower Rhine Graben, centered around Cologne, was recently identified as possibly the seismically most active region of intraplate Europe, as proven by two millennia of archaeological documentation of past earthquakes.[43] In the Carpathian-Pannonian region, Manfred Kandler, an Austrian archaeologist, was the first to suggest that collapsed walls in the Roman city of Carnuntum near Vienna were destroyed by an earthquake or earthquakes. His ideas were initially rejected, and this prompted him to publish his findings in Hungary.[44] As other studies began to be published supporting[45] and throwing

28 Stiros and Jones, *Archaeoseismology*.
29 Karcz and Kafri, "Evaluation"; Nikonov, "Methodology"; Korjenkov and Mazor, "Seismogenic origin."
30 Galadini et al., "Archaeoseismology."
31 Silva et al., "Archaeoseismic record."
32 Vasconcelos et al., "Experimental investigations."
33 Hinzen et al., "Quantitative methods" for monumental buildings. We appreciate the role of Morais and others "Cyclic behaviour" on using computer models to describe the behavior of vernacular buildings.
34 Akyüz and Altunel, "Geological"; Benjelloun et al., "Construction."
35 Ellenblum et al., "Crusader castle"; Marco, "Earthquake-related damage."
36 Roumane and Ayadi, "Archaeoseismology."
37 Bahrouni et al., "Historical"; Kázmér, "Why seismic hazard."
38 Bacchielli, "Cyrenaica earthquake."
39 Karakhanian et al., "Archaeoseimological studies."
40 Al-Tawalbeh et al., "Archaeoseismic analysis."
41 Lewis, "Baalbek."
42 Meghraoui et al., "Evidence"; Kázmér and Major, "Distinguishing damages"; Kázmér and Major, "Safita castle."
43 Reicherter et al., "Aquisgrani terrae"; Hinzen et al., "Archeoseismic study."
44 Kandler, "Erdbebenkatastrophe."
45 Decker et al., "Earthquake of Carnuntum."

into question his contentions,[46] his views gained some acceptance. Recently, an international conference was organized dedicated to the Carnuntum earthquake of the 4th century AD.[47]

There are a few promising initiatives elsewhere in the Carpathian-Pannonian region. A large portion of the Roman city wall in Siscia (modern Sisak in Croatia) lies, collapsed, several meters from the foundation.[48] Damage observed to St. Michael's Church in Cluj-Napoca (in Transylvania, Romania) indicates an earthquake of intensity IX, far larger than anything suspected before.[49] Major subsidence in the floor of the Franciscan monastery at Visegrád indicates that there was a major earthquake, causing liquefaction, at some point between 1513 and 1540. Both the monastery and the adjacent church were ruined.[50] Using numerical techniques to model the process of deformation and damage, we

Figure 3. Uneven subsidence of a Roman road in Savaria. This kind of deformation is often caused by seismically induced liquefaction of the subsoil. Szombathely, Roman garden. #2156

46 E.g. Hammerl et al., "Carnuntum case."
47 Konecny et al., *Carnuntiner Erdbeben.*
48 Skrgulja and Kázmér, "Deformed Roman monuments."
49 Kázmér, "Evidence for earthquake."
50 Kázmér et al., "Tizenhatodik századi."

arrive at data on the energy released,[51] and we can draw conclusions as to whether the damage was caused by a sudden, seismic shock or continuous loading.[52]

Preliminary information is given on two sites to show that archaeoseismological research is possible and desirable in Hungary. A Roman road in Savaria (modern Szombathely) shows asymmetric subsidence which may be attributable to seismic activity (Fig. 3): a person or a horse-drawn cart could not move or stand on the 1.5-meter wide tilted edge of the road. This kind of deformation seems a prime example of uneven subsidence caused by seismic-generated liquefaction. A minor trench or a hand boring might reveal sandy subsoil to corroborate the presence of liquefiable sand. Stairs of the spiral staircase from the fifteenth-century donjon in Nagyvázsony were displaced by roughly 4 cm, obviously caused by lateral loading, possibly due to an earthquake (Fig. 4).

Figure 4. Displaced steps of the spiral staircase in Nagyvázsony donjon. A coin with a diameter of 24 mm for scale. #0376

Historical seismology is like a large-resolution snapshot: a single event is documented in great detail. An earthquake which took place in 1202 AD in the Middle East, which was the largest earthquake known to have taken place there, offers an example of a dramatic seismic event which has been thoroughly studied. It was recorded at more than hundred sites within a circle with a radius

51 Morais et al., "Preliminary estimation."

52 Besharatinezhad et al., "Modelling."

of 500 km.[53] Later, the fault responsible was identified in Mount Lebanon.[54] The more snapshots we have, the more accurate our hazard assessment.

Archaeoseismology is like a deep borehole: a single site might record successive construction-destruction-reconstruction events over the course of centuries. Although recurrent episodes of damage to the same edifice are not easy to recognize and date, a few promising results are available. For instance, the crusader fortress of Al-Marqab on the coast of Syria,[55] the Roman theater in Capitolias (modern Beit-Ras in Jordan),[56] and the Byzantine dead city of Umm al-Jimal (also in Jordan) each offer evidence of at least two successive seismic events. While dating is still ambiguous at the Jordanian sites, we find evidence for reconstruction after the first earthquake and abandonment after the second event. Usually, historical sources and archaeoseismology work hand-in-hand, especially when dating is considered.

Summary

Earthquake hazard can be reliably assessed only if we are aware of past seismicity. The relatively small number of seismic events and long return period of major earthquakes make it necessary to use historical data in seismic hazard assessment. However, the lack of documentary data in the central region of the Carpathian-Pannonian region makes this a challenging task. This area practically coincides with the maximum extent of two centuries of Ottoman rule in the sixteenth and seventeenth centuries. An arithmetic assessment suggests that we have no record of 90 percent of the destructive earthquakes which, in all likelihood, occurred in the Carpathian-Pannonian region over the course of the past two millennia.

We suggest that, by using archaeoseismology, we can contribute previously unknown data to this discussion. Damage caused by earthquakes can be recognized, and earthquake parameters can be assessed. Preliminary studies identified previously unknown seismic events (Visegrád) and assigned intensity values to historical records. The damage observed on a Roman road in Savaria and in the medieval donjon of Nagyvázsony offer two examples of the potentials of archaeoseismology. Renewed extensive study of historical sources and the

53 Ambraseys and Melville, "Analysis."

54 Daeron et al., "Sources."

55 Kázmér and Major, "Distinguishing damages."

56 Al-Tawalbeh et al., „Two inferred Antique earthquakes."

further use of archaeoseismological investigation are needed if we seek to arrive at a nuanced understanding of seismic hazard in the Carpathian-Pannonian region.

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Dendrochronology and Environmental History: The Difficulties of Interpretation

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The study provides insights into questions concerning forest management and timber use by drawing on case studies in the dendrochronological research which has been underway over the course of the past couple of decades in Hungary. The essay refers to natural resource-use and historical and demographic questions which arose in analyses of the wooden materials. The study questions some of the topoi of historical research, such as the immense forest loss traditionally associated with the Ottoman wars.

Keywords: dendrochronology, Hungary, forest resources, Ottoman wars, environmental history

The dendrochronological research which has been underway in Hungary for more than two decades now has brought to light a number of environmental history (related) data which goes beyond the use of the method in dating. If one takes a closer look at these data, several questions arise many of which remain unresolved. This study discusses some (if not all) of these questions.

In 2017, Gergely Rákóczi, associate of the Dobó István Castle Museum of Eger, excavated a wooden sluice bridge structure in Eger in the bed of the Eger Stream.[1] Based on the four samples, the earliest year in which the oak trees which were used for the construction could have been cut was 1798. Analyses of the beams showed that the trees were considerably older than what is considered the ideal age for cutting (90 to 120 years), as the samples had 242, 257, 117, and 168 consecutive rings. Thus, these four samples offered a dataset which spanned a long period and could be used for dating and other investigations.

A relatively new and increasingly used method in dendrochronology which has yielded important insights is dendro-provenancing. By using many regional chronologies, researchers try to identify the original habitats of the trees used for timber and thus offer a spatial comparison.[2] As Fig. 2 shows,[3] the tree rings

1 Rákóczi, "Zsiliphíd."

2 Bridge, "Locating the origins."

3 From the statistical data marked on the map, "t" is the result of the t-test. This text, which is frequently used in archaeology, demonstrates the extent to which the values in two datasets could be said to match

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Figure 1. Structure of the sluice bridge in the bed of the Eger Stream
(Photograph by Gergely Rákóczi)

in the samples from Eger fit best with the chronology from trees in present-day Slovakia, which means that their original habitat was probably there.

This conclusion seems logical, as the Archbishopric of Eger had significant land holdings in this region. Furthermore, it harmonizes with the familiar topoi concerning the Ottoman Empire's use of Hungary for its timber and the

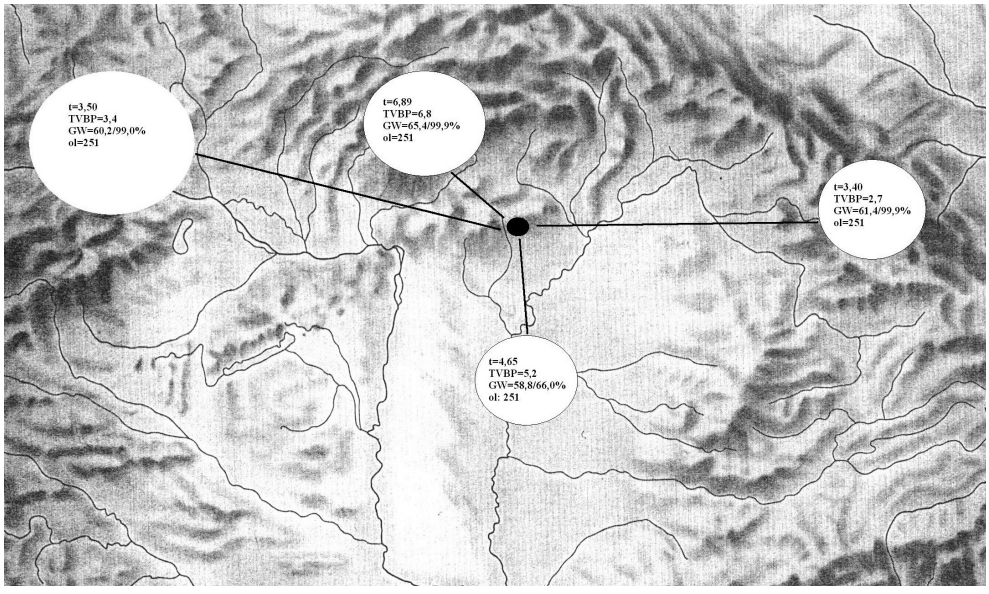

Figure 2. The relationship between the data from Eger and chronologies of different areas

each other. TVNP is the Baillie-Pilcher's t-value and GW is *Gleichlaufigkeitswert* (correlation), which indicates the correlation in the running of two curves. The fourth data (ol) marks the number of overlapping tree rings. On the statistical methods used in dendrochronology, see Schweingruber, *Der Jahrring*.

destructive impact on forests of the war to liberate the country from Ottoman occupation, as it suggests that there was a dearth of suitable trees in the Great Hungarian Plain and timber had brought in from the north. However, data referred to by Eszter Magyar concerning the valley of the Hron (Garam) River (a river in Slovakia was a tributary of the Danube) are frequently cited in support of the contention that the region of present-day Slovakia was not used for timber mining.[4] In Magyar's words, "as is clear from a lawsuit in 1544, […] the dynasties of charcoal burners who had been working in the easily accessible forests of the area since the death of King Matthias I [1490] cut down and charred the forests for the second or third time in little more than 50 years."[5] The finds from Eger, however, shed light on this conclusion, as the trees felled in the late 1700s at the age of 200 to 250 were already about 100 to 150 years old at the end of the Ottoman period. This suggests that during the period of the Ottoman presence in the Carpathian Basin, the forests in present-day Slovakia were never completely timbered or burned.

In 2012, during the construction of the new gym of the Saint Elisabeth High School in Esztergom, Edit Tari, an associate of the Balassi Bálint Museum, excavated a number of timber-framed Ottoman-period wells.[6] The most "beautiful" and elaborate structure was no. 60, the timber of which was cut during the winter of 1584–1585.[7] The builders used trunks cleaved in two, so in each case it was possible to measure the full series of the tree rings, while in most of the samples, both the bark and the sapwood were removed. Fortunately, in eight cases, they were not accurate enough, and in three cases not even the bark was removed decently. If one looks at the relative age of the timber used for the well, it is clear that very young trees were used. Thus, the well supports the conclusion concerning timber mining by the Ottomans in the forests of the Carpathian Basin.

However, when applied in these cases, dendro-provenancing yields surprising conclusions. The timber of the well can be best dated according to the chronology valid for the Vienna Basin. In other words, the timber used in

4 Magyar, *A feudalizmus kori erdőgazdálkodás*.

5 Ibid., 82.

6 The official name of the site was Esztergom-Szent Erzsébet iskola udvara (Víziváros) [Esztergom–Saint Elisabeth High School Yard (Víziváros)]. Only a preliminary report of the excavation has been published so far: Tari, "Az Esztergom-vízivárosi," 195–210.

7 The reference chronology is the Viennese dataset gathered by Michael Grabner and his colleagues. The statistical values of the comparison: t=5,62; TVBP=5,2; GW=71,4/99,9%; overlap: 64 tree rings. The values of the Hungarian dataset: t=3,87; TVBP=4,9; GW=69,8/99,0%; overlap: 64 tree rings.

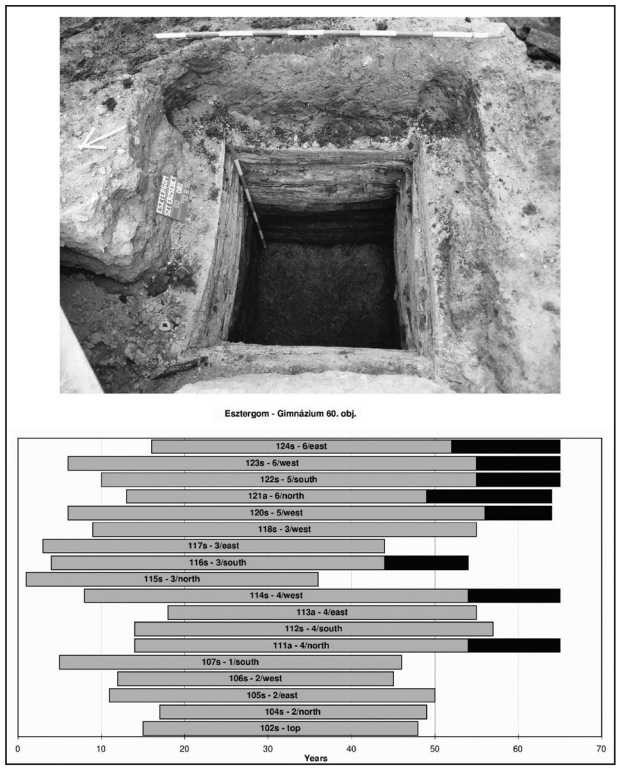

Figure 3. Well 60 (image by Edit Tari). Relative age of the beams (the light fields on the diagram mark the hardwood, while the dark fields indicate the sapwood of the tree rings)

Esztergom came from the Danube River valley or the surroundings of Vienna.[8] This means that the timber mining was not "Ottoman" but rather "Ottoman period." In other words, it was done on the other side of the border.[9] One is also confronted with the rather surprising fact that, among the three (hostile) polities that shared the territory of the medieval Kingdom of Hungary, there was considerable trade. This somewhat contradicts the traditional view.[10]

In 2015, Gábor Wilhelm and Máté Varga, archaeologists from the Katona József Museum, excavated two "barrel wells" in the center of the town of Kecskemét (Nagykörösi Street 7–9), i.e. two well structures in which, within the timber frame, there barrels, one in each (objects 19 and 26).[11]

8 Other reference chronologies used in the comparison were oak chronologies from Slovakia and the central part of Hungary.

9 See Vadas and Szabó, "Not Seeing the Forest"; Ágoston, "Where Environmental"; Szabó, "Erdők a kora újkorban."

10 See Várkonyi, *Ünnepek és hétköznapok*.

11 Molnár, "Kecskemét–Nagykőrösi utca 7–9," 129–55.

Figure 4. Structure of well no. 19. Photograph by Máté Varga

Similar structures are familiar from the Roman period (e.g. from Ménfőcsanak) but are unique in late medieval contexts.[12] The timber material is well suited for analysis, and it turned out they were cut at the earliest in 1486 and 1484.[13] As there was no way to provide a more precise dating for the samples, it cannot be determined whether they made their way to Kecskemét in the late Middle Ages and the barrels, which were considered useless, were re-used in this manner or whether they were brought to the town in the period of the Ottoman occupation and were recycled as "rolls." Unfortunately, there is no way to resolve this question, which is regrettable, as the timber originates from Transylvania. More precisely, they best match the chronologies of Biertan (Berethalom) and Târgu Mureş (Marosvásárhely).[14] This means that they made their way Kecskemét by trade. The question of what was originally stored in them is fascinating, if still unanswered, and it would be similar interesting to know whether the barrels also testify to trading activities across the borders in the Ottoman period similar to the practices observed in the context of the site at Esztergom. The uncertainty lies in the fact that, because of the *post quem* dating of the barrels, it cannot be determined whether they were brought to the town in the last years of the unified Kingdom of Hungary or only after the tripartition.

12 I know of only one other example from the Middle Ages, from ca. 1380 from the market town of Mohi/Muhi.

13 The reference chronologies were gathered by the Anno Domini Laboratory in Miercurea Ciuc (Harghita county, Romania, by Boglárka Tóth and István Botár). Statistical values of comparison: t=4,67; GW=64.7/95%; overlap: 119 tree rings, and: t=5,28; GW=68.5/99,9%); overlap: 130 tree rings.

14 There was no observable potentially relevant correlation with other chronologies (Vienna Basin, central territory of Hungary, Maramureş region, present-day Slovakia).

In Budapest, at Kacsa Street 15–23 (in the second district of the city), Katalin Éder and Tibor Hable (both of whom were associates of the Budapest History Museum at the time) found wooden wells the trees for which were felled around 1584–1585. These Ottoman-period objects also testify to "transborder" trade (certainly present towards the Kingdom of Hungary and presumably towards the Principality of Transylvania) in the life of the country after the fall of the medieval kingdom, as the material of the well can be best dated according to the Viennese chronology.[15]

As a method, dendrochronology bears surprises for scholars of significantly earlier periods as well. In 2011,[16] Katalin Sebők and Gábor V. Szabó (Institute of Archaeology, Eötvös Loránd University) unearthed a well that be dated to the Late Bronze Age (Urnfield culture) at Pusztataksony–Ledence.[17] Most of the timber in the well (twenty of the twenty-two pieces) was of ash *(Fraxinus sp.)*. The difficulty of interpreting the finds lies in the fact that one cannot draw a distinction among the three species of ash that are indigenous to the Carpathian Basin, the European ash *(Fraxinus excelsior L.)*, the flowering ash *(Fraxinus ornus L.)*, and the narrow-leaved ash *(Fraxinus angustifolia subsp. pannonica)* on the basis of the image of their tissues.

The habitats of the three species, however, differ. The first two species are mountainous, while the Hungarian subspecies of the narrow-leaved ash prefers

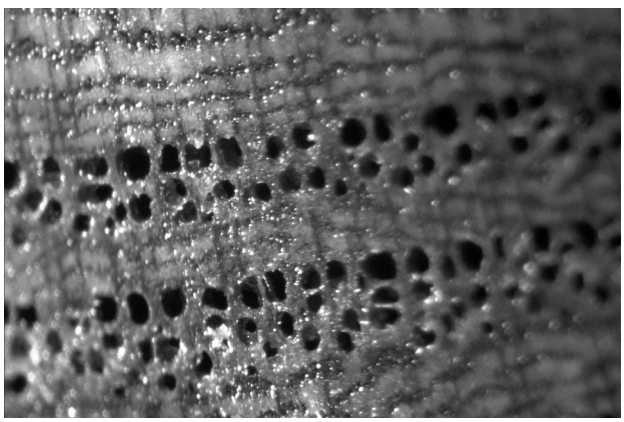

Figure 5. Image of the tissue of one of the ash beams (at a magnification of 20). Photograph by András Grynaeus

15 The reference chronology is the Viennese dataset gathered by Michael Grabner and his colleagues. Statistical values of the comparison: t=5,15; TVBP=4,5; GW=74,0/99,0%; overlap: 51 tree rings. See Várkonyi, *Ünnepek és hétköznapok*.

16 Fülöp, "The Birth of Wells."

17 NKT-01. o:637/s:869.

flood plains.[18] This provides us with an opportunity for further interpretation. One could assume that the trees were transported, in which case one gains valuable data concerning the economic life of a community very far away from Hungary today, both in space and time. However, one can interpret the data from an environmental history perspective. In that case, the data tells of the significantly different composition of species in the flood plain forests back then. Which reading of the data would be correct?[19] The site provides us with one more surprise: young (only 40- to 50-year old) trees were used here again. Why? This question, i.e. the age of the felled trees, is difficult for specialists even at sites on which they have more information.

In the cases of a number of excavation sites, information can be acquired on the ages of the trees used to craft different objects. A telling example is the case of the two Neolithic wells (nos. 629 and 583) that were unearthed at Szalkszentmárton–Táborállás in 2017 by Bernadett Kovacsóczy (an associate of the Katona József Museum).[20] The wells were built of trees felled with an eleven-year gap. For the older well, they used trees which were 200 years old, while for the younger, the trees were roughly 150 years old.[21] This indicates two things: when building wells, there were trees of those ages at the disposal of the community within a reasonable distance, which means that the forests in the territory had been left intact for at least 200 years. However, it also became clear that the newly settled population started to use the forests, so after a decade, they had to "fall back on" the less suitable timber, which was "only" 150 years old.

The use of old trees can be observed at many sites throughout Hungary, such as in the case of a Celtic-period well[22] unearthed at site no. 212 (Center for Heritage Protection, Hungarian National Museum, 2010) by the M3 highway at Pócspetri–Bikarét, where trees which were 100 to 160 years old were built into the well's structure. But the same could be observed at the Sarmatian-period wells found at Püspökladány–Sárréti Csali-tanya (2013)[23] and at site no.

18 Babos, *Fafajmeghatározás*, 58.

19 The two other beams were made of sessile oak *(Quercus petraea (Mattuschka) Lieblein)*. This indicates a mountainous origin if one assumes that all the timber came from the same area.

20 Kovacsóczy, "Előkelő avar férfi," 69–96.

21 In most of the samples, the sapwood was preserved and, in some cases, even the bark could be observed. As the planks were carved out radiately from the trunks, the datasets could be set to the center of the tree, allowing us to measure the width of (almost) every tree ring.

22 The excavation was led by Vera Majerik and Eszter Istvánovics. For a short overview of the excavation, see Larsson and Majerik, "Pócspetri határa," 146–47.

23 Szolnoki, "Püspökladány," 41.

14 at Tiszagyenda–Lakhatom.[24] One tends to conclude that the use of old trees indicates an undisturbed environment, while uninhabited territories and the use of younger trees shows a disturbed environment and densely inhabited areas. However, if one has some background knowledge of these periods, one may call into question the accuracy of this reading of the data.

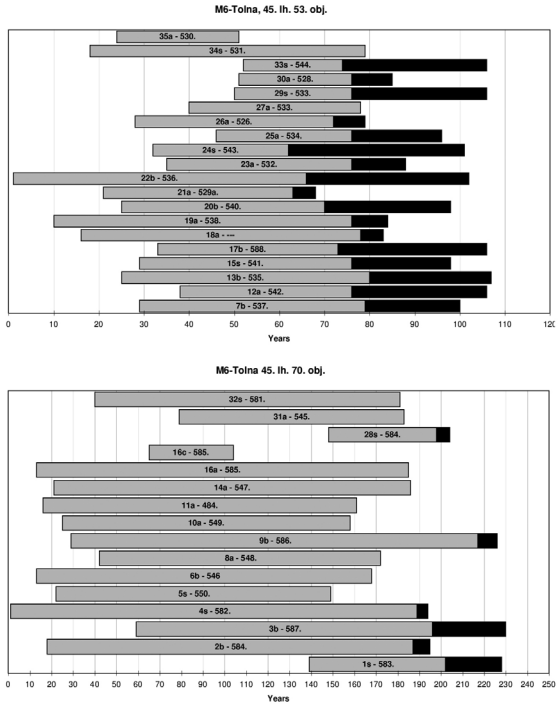

Figure 6. The relative ages of the beams of the wells of Szekszárd (the light fields on the diagram mark the hardwood, while the dark fields indicate the sapwood of the tree rings)

Site no. 45 by the M6 highway close to Szekszárd, which was excavated by János Ódor (Wosinsky Mór Museum) in 2010, prompts one to call into question the above conclusion.[25] Two Avar-period wells (nos. 53 and 70) were also made of timber from trees felled within a gap of eleven years. This is just a coincidence with respect to the aforementioned example, of course, but the interpretation is more problematic, as in this case, the structure of the older well was made of trees felled at about 100 years of age, while in the case of the younger well, the trees used were over 200 years old when felled.[26]

24 Hajnal, "Migration period."

25 Ódor, "Avar szőlő," 22–23, and Grynaeus and Ódor, "Dendrokronológia," 31

26 The planks for the wells were carved out radiately from the trunks in both cases, so we could measure the trees to their centers, and the bark was consistently removed as well. In the case of well no. 53, however,

Is it reasonable consistently to associate the use of older trees with demographic tendencies? Do we really have to assume that there were long periods during which areas were uninhabited and/or periods without forest clearance? Or would it be more realistic to set aside the notion of forests going untouched for generations and consider the possibility that forests were consciously used and cultivated? Could one reasonably make this assumption in the case of the Avars, the Sarmatians, and the Celtic-period populations? Or can one communities inhabited a certain area? The question is clear: should the features make this assumption with regard to periods in which different peoples/of the wood be understood as demographic data or as cultivation data? Do they yield conclusions concerning demographic processes or farming knowledge and practices?

At this point, one must consider methods of forest clearance in historical times. A number of questions and many possible answers arose in the course of an excavation led by Gábor Váczi (an associate of the Institute of Archaeology, Eötvös Loránd University) at site no. 5 at Tiszabura–Bónis-hát. The most important "source" was an Avar-period well. The eight beams studied included trees younger than 100 when felled and older than 200, but only one in between those ages.[27] Why?

Was this the result of clear cutting? This would explain the mixed ages of the trees. However, this may also have been the result of selective cutting, as

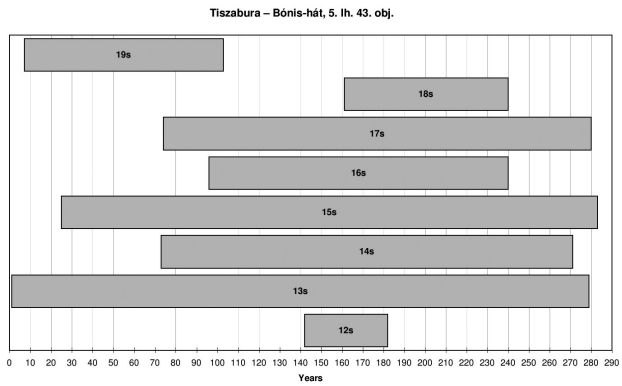

Figure 7. Tiszabura–Bónis-hát, site no. 5, relative ages of the beams of object no. 43 (the light fields on the diagram mark the hardwood, while the dark fields indicate the sapwood of the tree rings)

the sapwood was not removed, and in many cases, all of the sapwood was preserved. At well no. 70, from the sixteen plank samples, fragmentary or full sapwood was preserved in six pieces.

27 The planks were carved out from the trunks radiately, so we managed to include the tree rings to the center, but the sapwood had consistently been removed. As the datasets end at (almost) identical dates, it is likely that only the sapwoods were removed.

based on the sizes and the shapes of the beams, they may have been carefully selected. Or could their placement in the structure of the well be related to their age? There is no substantive data that could support or dismiss this possibility. Do we have so many unanswered questions simply because the low number of samples distort the results? Is this problem aggravated by the fact that parts of the samples have been destroyed (some of the beams and planks), so some parts of the dataset are missing, and some of the external tree rings may be rotten? Of course, one can also interpret the feature as a consequence of a particular method used to shape the beams, because assuming that the wood was cut from a suitably mature tree which was cleaved in half to create two 100 year-old beams, we may have only found one of them. This can also be understood as a special feature of the excavation, which can be traced back to the fact that only the bottom beams survived. The ones above them were destroyed over the centuries.

Can we assume that different methods of wood-cutting were used? I.e., is it possible that people at certain periods could not fell trees of any size? This may seem plausible, but it is unlikely that, if they were able to fell the old trees, they could not deal with the younger ones. Is it possible that the trees preserved traces of demographic processes? Or are both true? Did one of the peoples arriving in the region not know how to or did not want to fell larger trees, and so the trees survived only to be felled and used by later groups? Environmental reasons can also be considered, as for instance younger trees stands could have fallen victim to an ice-flood, while older trees may have proved to be more resilient. And in that case, we have not considered explanations concerning possible rituals or beliefs, such as "sacred oaks" left standing by previous peoples who had lived there.

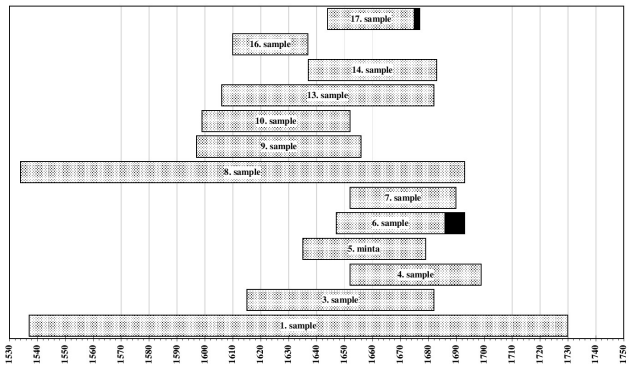

Figure 8. The relative ages of the beams found at Vácszentlászló–Hajta-patak
(the light fields on the diagram mark the hardwood, while the dark fields indicate the sapwood of the tree rings)

Which interpretation is correct? How far can an archaeologist/scholar go in interpreting such data? These questions are difficult to answer, but similar features can be observed at late medieval (Vácszentlászló–Hajta-patak[28]) and Árpád Era (Hódmezővásárhely–Kingéc[29]) sites, and these similarities limit the interpretive possibilities to some extent, certainly in connection with ritual practices.

What explanations are the most convincing in such cases? And what methods should researchers use when positing explanations? Should they brainstorm, or should they patiently wait until, at some point in the future, enough data have been gathered to yield definite answers? Should one consider stick to observations of features or should one build theories, which of course involves the risk of error? These questions are not simple to answer.

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28 Excavation led by Zoltán Farkas (Museums of Pest County) in 2011, where a water mill and the related wooden structures of a water mill that can be dated to the seventeenth and eighteenth centuries were unearthed.

29 Well no. 209. Excavation led by Viktor Csányi (Tornyai János Museum) in 2010. See Csányi, *Beszámoló*, Grynaeus, "A 164. számú kút."

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Transformations of Metal Supply during the Bronze Age in the Carpathian Basin

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This paper presents recent research questions which have been raised and methods which have been used in the study of Bronze Age metallurgy in connection with available natural resources (ores) in and around the Carpathian Basin. This topic fits in the most current trends in the research on European prehistoric archaeology. Given the lack of written sources, copper and bronze artifacts discovered in settlement and cemetery excavations and prehistoric mining sites provide the primary sources on which the studies in question are based. The aim of compositional and isotope analysis of copper and tin ores, metal tools, ornaments, and weapons is to determine the provenience of the raw materials and further an understanding of the *chaine operatiore* of prehistoric metal production. The Momentum Mobility Research Group of the Institute of Archaeology, Research Centre for the Humanities studies these metal artifacts using archaeological and scientific methods. It has focused on the first thousand years of the Bronze Age (2500–1500 BC). Multidisciplinary research include non-destructive XRF, PGAA (promptgamma activation), TOF-ND (time-of-flight neutron diffraction) analyses and neutron radiography, as well as destructive methods, e.g. metal sampling for compositional and lead isotope testing, alongside archaeological analysis. Microstructure studies are also efficient methods for determining the raw material and production techniques. The results suggest the use of regional ore sources and interregional connections, as well as several transformations in the exchange network of the prehistoric communities living in the Carpathian Basin.

Keywords: Copper Age, Bronze Age, metallurgy, scientific analysis, exchange networks

Introduction

Given the lack of written sources from the period in question, an important research question is simply where did the raw materials, used by prehistoric communities come from. If we determine the provenance of stone and metal raw materials, we can venture hypotheses regarding the connections among prehistoric groups. Over the course of the past decade, montan-

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archeological research (*Montanarchäologie;* archeology of raw material mining) and archeometallurgy have proven the existence of several prehistoric copper ore mining sites in various European regions. As a result, most current research trends in the archaeological study of the Copper and Bronze Ages are connected to scientific analyses of metal artifacts discovered in settlement and cemetery excavations, as well as ores found at prehistoric mining sites.[1]

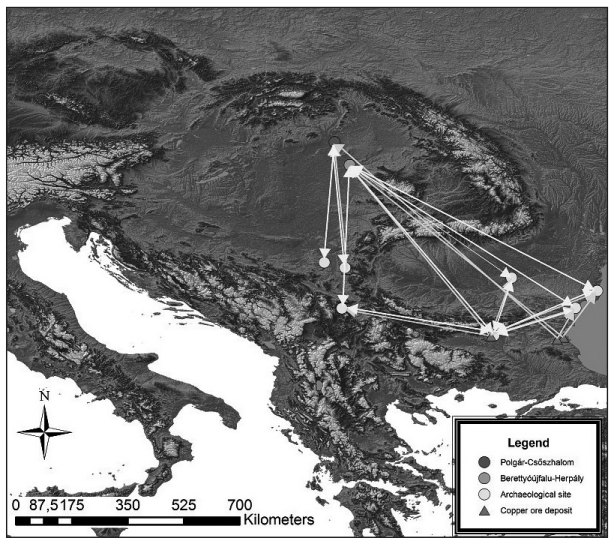

Figure 1. Map of social interactions based on the archaeometallurgical analyses of the first copper artifacts in the Carpathian Basin[2]

In the central areas of the Carpathian Basin metal, ores were not available, or in a very small amount.[3] Compositional analysis of the first small items of copper jewelry, which appeared in the late Neolithic period (the fifth millennium BC), revealed that they were made of high-purity copper. Thanks to recent lead isotope analyses, the conclusion has been reached that these artifacts came to the Carpathian Basin from communities living in the vicinity of mines in Serbia and Bulgaria (Fig. 1).[4] The very few lead isotope data so far indicate that they are objects that were imported from the Balkans even in the Copper Age, possibly with the use of mines in the Slovak Ore Mountains and the eastern Alpine

1 Stöllner, "Montan-Archaeology"; Pernicka et al., "Lead Isotope Analyses."

2 Siklósi et al., "New Data on the Provenance," Figure 34.

3 Ecsedy, "On the early development," 218–20; Szabó, "A késő bronzkori," 24; Szabó, *A dunántúli urnamezős*, 69; Czajlik, *A Kárpát-medence;* Czajlik, "Lokaler, regionaler."

4 Siklósi et al., "New Data on the Provenance."

region.[5] We can suppose that the development of local metallurgy began in the Copper Age.[6]

Analysis of Bronze Age Artifacts in Central Europe

The metalwork of the Bell Beaker culture (around 2500 BC), which began to emerge at the dawn of the European Bronze Age, is an important research topic, mainly because artifacts used by these communities were the first metal objects in the western part of Europe. On the basis of the available data, scholars outlined a uniform metal type, the so-called *Bell Beaker metal*, which consisted of 98% copper with arsenic, antimony, and nickel impurities.[7] A selection of 1,943 trace element analyses of copper finds from the material of Central European communities (southern and central Germany, Bohemia, Moravia, and the Carpathian Basin) used between 4500 and 2000 BC resulted in a picture which differed from the western European Bell Beaker metal: the artifacts were categorized into 13 different groups. According to the compositional analyses, 65 of the 80 eastern Bell Beaker objects were made of tin-rich or fahlore coppers with varying impurities (antimony, arsenic, silver) and a small (less than 4%) amount of tin. The various dominant elements suggest that there was no uniform Bell Beaker metal in this region.[8]

Elemental composition data of the next period prove that the most widespread raw material of the Central European Early Bronze Age (from 2100 BC; contemporaneous with the 3rd phase of the Early Bronze Age and the Middle Bronze Age in Hungary)[9] was the so-called *Ösenring* metal, the characteristic fahlore type of the neck rings.[10] The latter copper, which contained silver, arsenic, and antimony impurities, has been associated with ore occurrences in the triangle of the Eastern Alps, Slovakia, and the Czech-Saxon Ore Mountain range based on the distribution area of the mentioned neck rings (Fig. 2).[11] Lead isotope

5 Schreiner, *Erzlagerstätten im Hrontal*; Csányi, "Das kupferzeitliche Gräberfeld"; Siklósi et al., "The spread of the products"; Siklósi, Szilágyi, "New data on the provenance."

6 Bondár, *A késő rézkori fémművesség*.

7 Needham, "Analytical implications"; Needham, "Copper dagger."

8 Merkl, "Bell Beaker."

9 P. Fischl et al., "Old and new narratives," Figure 1.

10 Schubert and Schubert, "Spektralanalytische Untersuchungen"; Pernicka et al., "Lead Isotope Analyses."

11 Junk et al., "Ösenringbarren"; Höppner et al., "Prehistoric copper production"; Radivojević et al., "The Provenance, Use, and Circulation."

tests which were used to arrive at more accurate determinations of provenance indicate that the raw material of these artifacts derived from the Slovak region.[12]

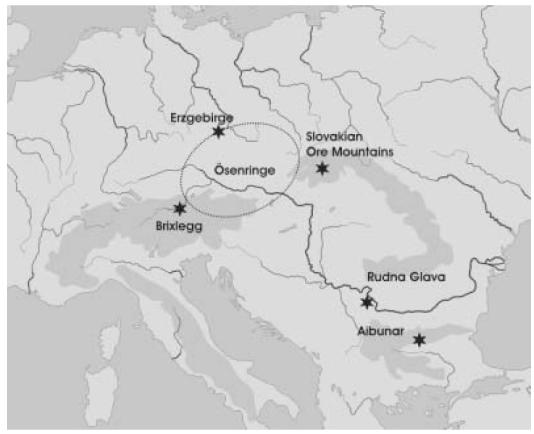

Figure 2. Prehistoric copper mining regions associated with *Ösenring* metal type[13]

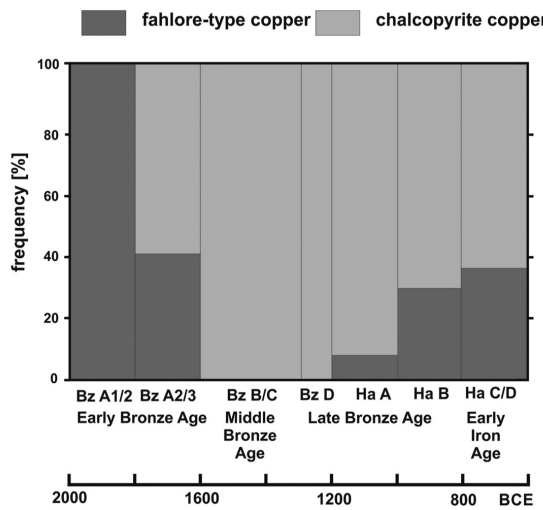

Figure 3. Abundance of copper with fahlore and chalcopyrite signatures produced in the eastern Alps from the beginning of the Bronze Age to the Hallstatt period based on the compositions of approximately 1200 prehistoric metal artifacts from Tyrol, Salzburg, and southern Bavaria[14]

In the 1960s and 1970s, the transformation of the raw material used at the beginning of the Central European Middle Bronze Age (contemporaneously

12 Duberow et al., "Eastern Alps"; Radivojević et al., "The Provenance, Use, and Circulation," Figure 7.

13 Höppner et al., "Prehistoric copper production," Figure 7.

14 Radivojević et al., "The Provenance, Use, and Circulation," Figure 10.

with the transition from the Middle to the Late Bronze Age in Hungary) was detected by the Stuttgart metallurgy project (*Studien zu den Anfängen der Metallurgie* or SAM project).[15] This metal type, which contained arsenic and nickel, spread in a wide region of Europe, also called *Einheitskupfer* or eastern Alpine copper. The new unified metal type, based on lead isotope data, was associated with chalcopyrite ores (Fig. 3) of the Mitterberg region, situating to the south of Salzburg.[16] According to the most recent radiocarbon dates, these ore sources were exploited from the 16th to the 14th centuries BC.[17]

Analysis of Bronze Age Artifacts in Hungary: State-of-the Art and New Perspectives

As we have seen, research on Eurasian copper raw material has provided important data, although questions still remain regarding the origin of copper ores used by Bronze Age metalworkers in the Carpathian Basin.

Research on metal finds has intensified over the course of the past two decades in Hungary as well. Re-dating of the earliest axes from the 3rd millennium to the end of the 4th millennium provided important data concerning raw materials. Based on an evaluation of the Stuttgart database, 21 axes of the Bányabükk hoard prove that Copper Age and the earliest Bronze Age axes were made of pure copper. The raw material of later Fajsz-, Corbasca-, and Kömlőd-Kozarac-type axes[18] show a more varied picture, with fahlores containing impurities at 1–2%, namely arsenic, antimony, and silver. Occasional low nickel content suggests a mixture of ores.[19] This indicates that the raw materials the natural impurities of which made it possible to produce harder tools were sought and were not the result of intentional alloying.[20]

Analyses of metal finds from Bell Beaker burials (2500–2200 BC) were also begun. According to the findings, the raw materials out of which the daggers

15 Schubert and Schubert, "Spektralanalytische Untersuchungen."

16 Duberow et al., "Eastern Alps"; Pernicka, "Analyses of Early Bronze Age"; Radivojević et al., "The Provenance, Use, and Circulation."

17 Pernicka et al., "Bronze Age Copper," Figure 5–6.

18 Junghans et al., *Kupfer und Bronze*; Hansen, "Metal in South-Eastern"; Dani, "The Significance of Metallurgy"; Szeverényi, "The Earliest Copper Shaft-Hole Axes."

19 Junghans et al., *Kupfer und Bronze,* vol. 1–3; Junghans et al., *Kupfer und Bronze,* vol. 4; Krause, *Studien zur kupfer- und frühbronzezeitlichen*, Datenbank, Anr. 8952–8971, 8987, 10937, 10939, 12501–02, 12504, 12515, 13402–13409, 14419, 48801, 48807, 48841.

20 Shalev et al., "Investigation of early copper-based alloys," Table 2.

and pins were made usually consisted of pure copper (98–99%) with antimony, silver, lead, and tin impurities.[21]

Based on several metal analyses, neck rings, hair rings, spiral arm rings, pins, and daggers from the end of the Early Bronze Age (Fig. 4) which were excavated in western Hungary (2100–1900 BC)[22] were manufactured from fahlore copper rich in trace elements, such as antimony, arsenic, and silver.[23] Copper artifacts containing arsenic and nickel, beside fahlore copper ornaments and tools are known from cemeteries of the same period which were discovered in eastern Hungary.[24]

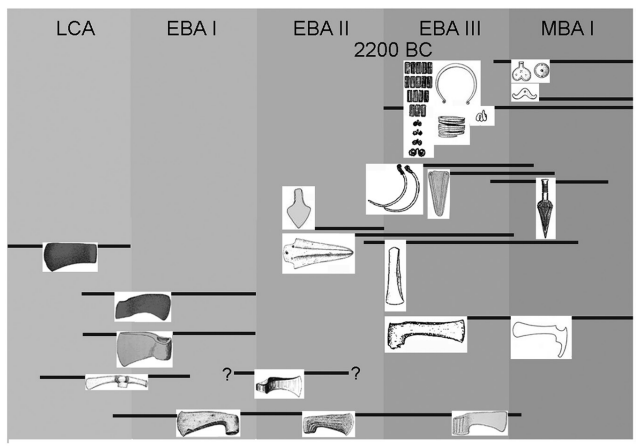

Figure 4. Typochronology of metal finds from the dawn of the Early Bronze Age until the first period of the Middle Bronze Age in Hungary[25]

At the beginning of the Middle Bronze Age (2000/1900 BC), tin bronzes appeared with 4–10% tin, which is a clear indication of intentional alloying (Fig. 5).[26]

Optical emission spectroscopy analyses of the aforementioned Stuttgart metallurgical project provided 116 data for Middle Bronze Age metallurgy of Western Hungary based on samplings of five hoards of Transdanubian

21 Endrődi et al., "Technological study."

22 Mithay, *Bronzkori kultúrák*, III.t.1–7; Junghans et al., *Kupfer und Bronze*; Költő, "Megjegyzések az Ordacsehi-Csereföld"; Somogyi, "A kisapostagi kultúra"; Kiss, *Middle Bronze Age*,176.

23 E.g. *Ösenring* and Singen copper; Krause, *Studien zur kupfer- und frühbronzezeitlichen*, Datenbank, 39.

24 Krause, *Studien zur kupfer- und frühbronzezeitlichen*, Datenbank; P. Fischl and Kulcsár, "Tiszán innen Dunán túl," Table 2.

25 P. Fischl et al., "Old and new narratives," Figure 9.

26 Shalev et al., "Investigation of early copper-based alloys," Figure 4; Kiss, "Arany, réz és bronztárgyak," Figure 1.

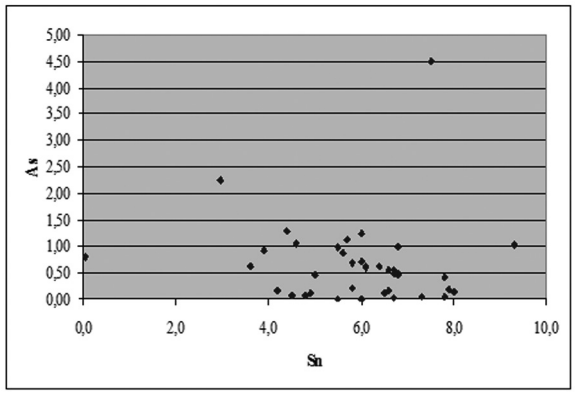

Figure 5. Tin–arsenic chart based on artifacts of the Zalaszabar hoard, Western Hungary

Encrusted Pottery (1800–1600 BC; the so-called Tolnanémedi horizon) and artifacts of a burial from the same period. The findings indicate that 80% of the local ornament types were made of the characteristic fahlore type *Ösenring* copper alloyed with tin.[27] Compositional analyses of the Zalaszabar hoard from the same period suggest that tools and jewelry, which were found together in hoards, were manufactured with the use of several casting procedures.[28]

Testing of the Koszider type hoards and several ornaments and tools from the end of the Middle Bronze Age in Hungary demonstrates a transformation in the use of raw materials similar to contemporaneous Central European Middle Bronze Age, with the dominance of so-called *Einheitskupfer* or containing arsenic and nickel.[29] In connection with the research on the find assemblage of the famous Nebra Sky Disc, dating to the 16th and 15th centuries BC and discovered in the region of Halle (northeastern Germany), elemental analyses of the axes of the Hajdúsamson hoard, axes and a sword from Vámospércs and Téglás were performed. As in the case of the material of the Nebra finds, the compositional data all match the mentioned eastern Alpine copper (with two exceptions from Téglás). This research yielded the first lead isotope data from Hungary confirming the association of the mentioned raw material with the chalcopyrite ore mines of the eastern Alpine region. Investigations of the Apa hoard, which has close typological relations to the weapons from Hajdúsámson,

27 Kiss, "The Life Cycle"; Kiss, *Middle Bronze Age*, 141–42, Fig. 39.

28 Kiss, "Arany, réz és bronztárgyak," Figure 3.

29 Schubert and Schubert, "Spektralanalytische Untersuchungen"; Liversage, "Interpreting composition patterns"; Krause, *Studien zur kupfer- und frühbronzezeitlichen*; Duberow et al., "Eastern Alps"; Pernicka, "Analyses of Early Bronze Age"; Pernicka et al., "Lead Isotope Analyses"; Radivojević et al., "The Provenance, Use, and Circulation."

and other contemporaneous find assemblages suggest that, in addition to Alpine and Slovak raw materials, ores from other regions of the Carpathians (in the area of Baia Mare and the Apuşeni Mountains) were also processed (Fig. 6).[30]

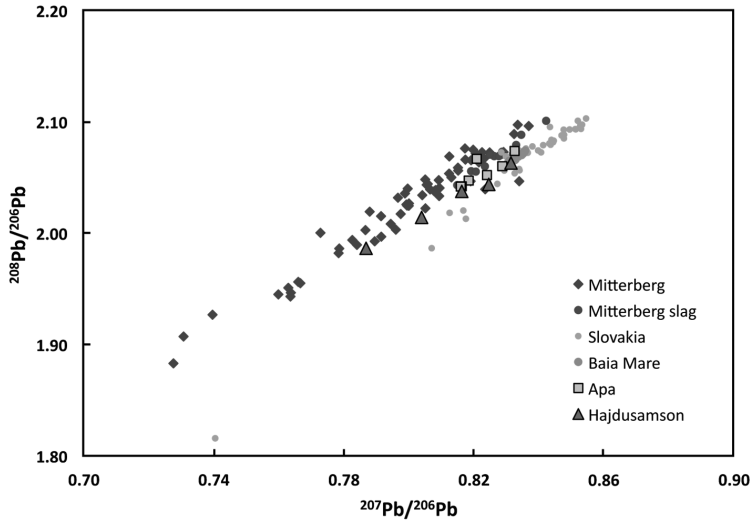

Figure 6. Lead isotope ratios of the objects from Apa and Hajdúsámson and of copper ores from Mitterberg, the Slovak Ore Mountains and lead ores from Baia Mare[31]

We have seen that data concerning elemental compositions suggest large trends, but the exact provenance of raw materials and the *chaine operatiore* of production need further confirmation.

The project of the Momentum Mobility Research Group of the Institute of Archaeology, Research Centre for the Humanities aims to study metal artifacts of the abovementioned period during the first thousand years of the Bronze Age in Hungary (2500–1500 BC). We analyzed ornaments, weapons, and tools from precisely dated inhumation and cremation burial assemblages of the Bell Beaker period (2500–2200 BC) and the Early and the Middle Bronze Ages in eastern and western Hungary (Fig. 7–8).

Multidisciplinary analyses of chemical composition are provided by non-destructive XRF, PGAA (prompt-gamma activation), and TOF-ND (time-of-flight neutron diffraction) analyses in cooperation with the Budapest Neutron Centre (Centre for Energy Research). XRF results can only be interpreted for the surface, while bulk area was analyzed by PGAA.[32] Neutron radiography and TOF-ND are

30 Pernicka et al., "Lead Isotope Analyses."

31 Ibid., Figure 20.

32 Maróti et al., "Non-destructive analysis."

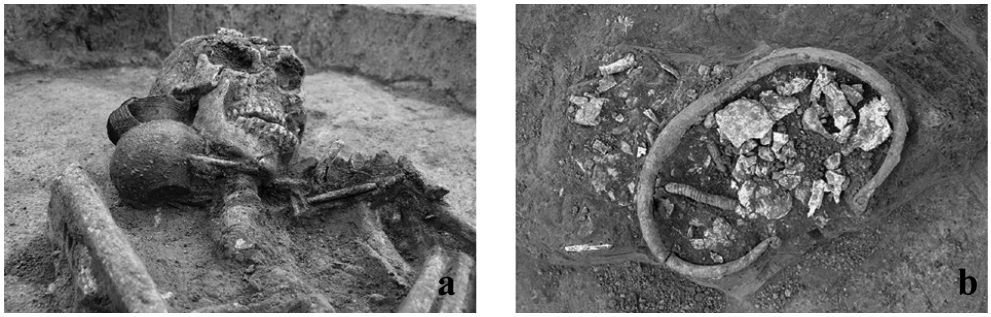

Figure 7. Metal ornaments from inhumation and cremation burials of the Middle Bronze Age cemetery excavated at Bonyhád

applied in order to determine production techniques (see summary of research facilities and relevant technologies available for the archaeometallurgical testing in Hungary).[34] It is important to note that while post-casting elaboration was formerly identifed by destructive microstructure analysis we could detect the hardening of the edge of flanged axes without any destruction of the artefacts (Fig. 8).[35]

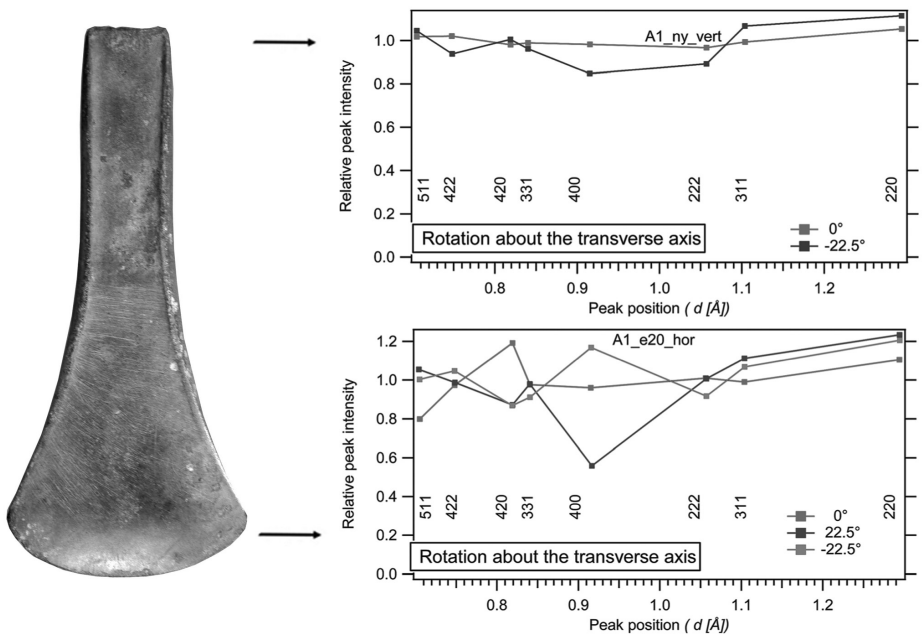

Figure 8. Texture results of the TOF-ND analysis of the flanged axe from Zalaszabar at the neck, and at the edge of the axe

33 Kovács et al., "Auf Mitteleuropa," Figure 2.

34 Szabó et al., "The possibilities and limitations."

35 Kiss et al., "From inhumation to cremation."

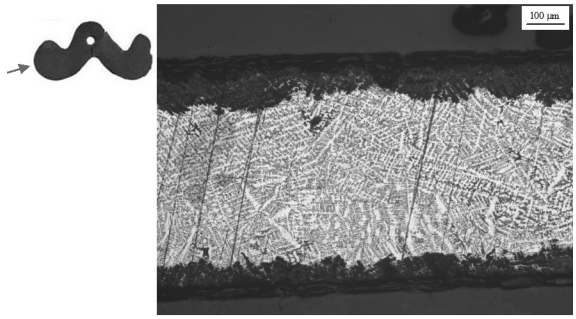

Figure 9. Dendritic structure of an as-cast pendant from Zalaszabar[36]

We perform destructive metallographic examinations on some objects, selected on the basis of non-destructive analyzes, in cooperation with the specialists of the Department of Materials Science of the University of Miskolc and the Department of Solid State Physics of the University of Debrecen (Fig. 9). We also study the effect of cremation to the microstructure of the bronze jewelry found in cremation burials.[37]

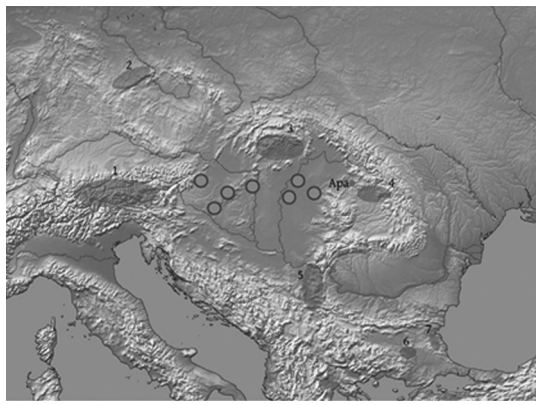

Figure 10. Multidisciplinary analyses of Bronze Age finds from Hungarian Early and Middle Bronze Age sites (Balatonakali, Budakalász, Nagyrév, Polgár, Sárrétudvari, Zalaszabar, Zsennye) with Central European prehistoric copper mining sites[38]

There are 42 ongoing lead isotope measurements (Fig. 10) performed in collaboration with the Curt-Engelhorn Archaeometry Center in Mannheim. The significance of these lead isotope analyses is emphasized by the fact that, with the exception of the above mentioned nine objects from the region of Debrecen, no additional lead isotope data were available from the inner areas of the Carpathian Basin.

36 Kiss et al., "A zalaszabari bronzkincs."

37 Kiss et al. "A zalaszabari bronzkincs"; Kovács et al., "Technológiai megfigyelések."

38 Map after Pernicka et al., "Lead Isotope Analyses."

Our results complement the research performed in the 1960s and 1970s and over the course of the past two decades. Changes in raw material use over time show similar tendencies to those in Austria and other parts of Central Europe. Though compositional data are still matter of discussion,[39] results suggest that, in the Early Bronze Age, copper ores which were mined in the territory of present-day Slovakia were used.[40] Based on some artifact types dating between 2800 and 1500 BC we can suppose networks of relationships which stretched over long distances. In the case of these artifacts, the question has arisen as to whether they were manufactured at and exported from the same workshop or they are locally made copies that indicate long-distance connections among Bronze Age communities.[41] E.g. lead isotope data concerning the weapons from the Hajdúsámson treasure and other swords and axes found near Debrecen suggest that the raw materials with which they were made originated from the Eastern Alpine region. The decoration motifs on these weapons, however, indicate that they were made locally in the Tisza region.[42] The findings summarized here indicate interregional connections, as well as several transformations in the exchange network of the prehistoric communities living in the Carpathian Basin.

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39 Radivojević et al., "The Provenance, Use, and Circulation"; Szabó et al., "The possibilities and limitations."

40 Kiss et al. "People and interactions."

41 Kovács, "Auf Mitteleuropa"; David, "Eine mit Spiralhakenranken"; Stockhammer, "The Dawn of the Copy"; Kiss, "The Bronze Age burial."

42 Dani et al., "The Hajdúsámson hoard – revisited."

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Along the Danube and at the Foothills of the North-Eastern Hungarian Mountains: Some Data on the Distribution of Stone Raw Materials in the Late Iron Age

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Stones as raw materials are important environmental resources often found at prehistoric sites. Since their various types essentially retained their original geological features, it is generally relatively easy to identify their origin. Nevertheless, there is hardly any systematic research on late prehistoric stone raw materials. Furthermore, these materials are mentioned very inconsistently and the geological terms, definitions and analyzes are absent from the discussions. The general picture that we can sketch based on secondary literature is therefore mosaic-like. However, it is by no means impossible to identify extraction sites. Based on on-site experience and using modern analyzes, it is possible, for example, to differentiate between individual types of sandstone and andesite. From the perspective of future research, analyzes of late Iron Age stone materials from well-studied archaeological contexts could contribute to understand better how stones as raw materials were used in late prehistoric periods.

Keywords: natural resources, stone raw materials, Carpathian Basin, Iron Age

Introduction

Stone raw materials are important environmental resources. They offer a good topic for research, since they are usually frequently present among the finds of both prehistoric settlements and cemeteries. An additional advantage of this material is that the various ways in which they were modified and put to use did not change them significantly, unlike in the case of many other raw materials, such as clay ceramics or in various ores. Given that their original geological conditions are essentially preserved, it is usually comparatively easy to identify their provenance. Regrettably, in spite of the suitability of this resource as a useful tool on the basis of which to pursue study of a given period, there is very little systematic research regarding stone raw materials from the Late Iron Age, in contrast with the secondary literature on earlier periods of prehistory. These materials are mentioned only inconsistently in the scholarship, and the geological terms, definitions, and analyses are missing from these discussions. The general

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image we can outline concerning the secondary literature is mosaic-like, and this reflects the lack of research.

The most important figures in the history of the Carpathian Basin in the Late Iron Age were the Celts. Their arrival and presence in the area can be reconstructed in comparative detail on the basis of historical sources and archaeological evidence. Regarding the latter, attention should be drawn to the several waves of western immigration which began in 450 BC and to the changing settlement areas of the different periods.[1] Furthermore, the remarkable

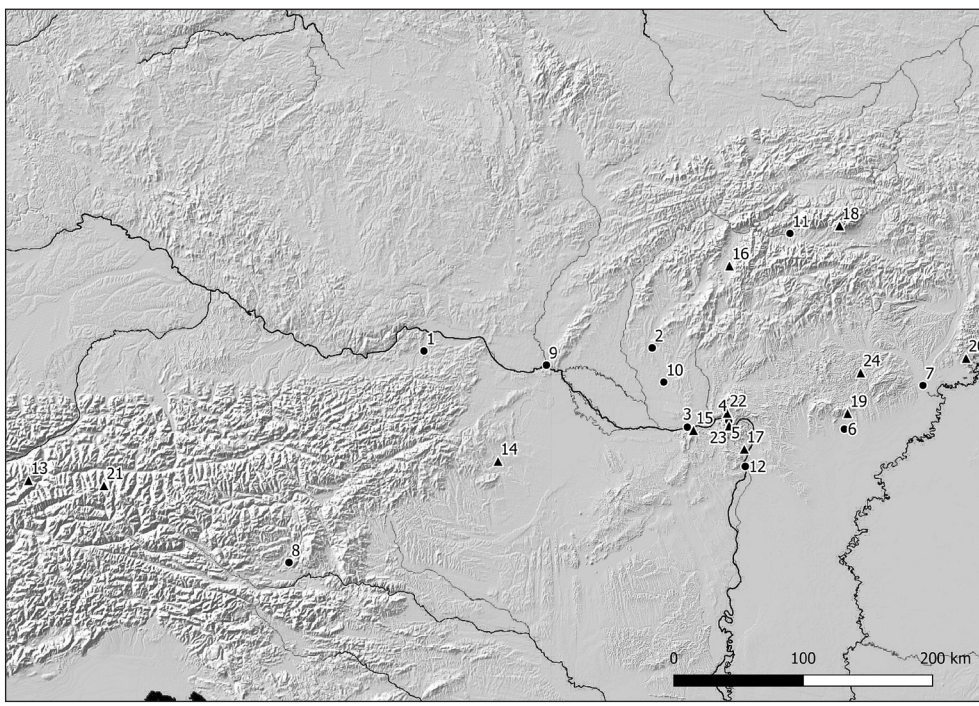

Figure 1. Archaeological sites from the Celtic period in the Carpathian Basin and in the Eastern Alps mentioned in the paper (black dots): a. 5th–3rd centuries BC, 1. Pottenbrunn – Steinfeld, 2. Nitra – Šindolka, 3. Süttő – Sáncföldek, 4. Szob – Kőzúzó, 5. Pilismarót – Basaharc, 6. Ludas – Varjú-dűlő, 7. Sajópetri – Hosszú-dűlő/Homoki-szőlőskert, b. 2nd–1st centuries BC, 8. Magdalensberg, 9. Bratislava – Devín, 10. Nitriansky Hrádok, 11. Liptovská Mara, 12. Budapest – Gellérthegy
Lithic raw material sources in the Carpathian Basin and in the Eastern Alps mentioned in the paper (black triangles): a. Identified, 13. Riepenkar, 14. Oberpullendorf – Pauliberg, 15. Lábatlan, 16. Rakša, 17. Budakalász – Ezüst-hegy, 18. Tatra Mountains, 19. Domoszló, 20. Tokaj Mountains, b. Assumed, 21. High Tauern, 22. Szob – Csák-hegy, 23. Pilismarót – Szekrény-hegy, 24. Ózd – Pétervására Hills.
Map edited by Zoltán Czajlik and Balázs Holl.

1 Szabó, "Les Celtes orientaux."

changes observed from the third century BC should be mentioned, which are associated with the formation of many larger and more structured settlements and with the more intensive utilization of natural resources. This process is well documented in the Western Celtic territories and especially in Czech lands and Moravia,[2] further important study has been published from the Scordiscan region,[3] but it cannot yet be outlined in the whole Eastern Celtic area. Similarly, the development of the next economic-technological stage, the establishment of the *oppida* (fortified Iron Age settlements representing the pre-industrial level), is not common here, and these settlements existed much shorter period in the region east from the Danube than in the west.

Taking into account the archaeological-historical circumstances, we would list the most important available data about the use of the raw materials needed for stone tools. Despite the obvious difficulties and the lack of data, due the increasingly intense archaeometric research which has been underway over the course of the past few decades, certain raw material sites and the networks in which they were involved are slowly being outlined, as are their positions in the regional resource supply chains.

Stone Tools

Although various stone tools were often found in the archaeological material of Celtic settlements, they were only rarely studied in detail, with clear discussions of their geological provenance. Two main tool categories should be given primary consideration in the research: the sharpening stones and the grinding/mill stones. For these different functions, stones with different characteristics were needed, as the first tool was used for sharpening metals, while the second was mainly used for grinding grain. While in the first case stones which contained quartz (e.g. sandstone) are especially favorable, hard rock types (e.g. extrusive igneous volcanic rocks: andesite, dacite, etc.) are suitable for grinding.

1. Sharpening stones

Most of the known sharpening stones were discovered used and fragmented, buried in buildings within settlement areas. In the Eastern Celtic territories, however, most of the large cemeteries also had some finds in the tombs,

2 Čisťakova et al., "Craft production," cf. Waldhauser, "Keltské rotační mlýny," and Wefers, *Latènezeitliche Mühlen*.

3 Ljuština, "Rotary querns."

and sharpening stones were unearthed among the personal belongings of the deceased.

The excavated whetstones of the Pottenbrunn cemetery (Austria, representing the Early Celtic Period) are made from flysch (sandstone; tomb no. 520, no. 1005) and quartzite originating from greywacke strata.[4] According to the authors, with regards to the provenance of the raw material, the gravelly alluvia of the Traisen River should be primarily taken into account. i.e. these objects seem to be made of local secondarily deposited raw materials.

The evaluation of the material from the Celtic site at Süttő - Sáncföldek is still in progress, but based on the excavated features, it can be dated to the period between the second half of the fourth century BC and the beginning or middle of the third century BC.[5] The whetstones of the site were studied by Dóra Kürthy, and most of them can be linked to the Lábatlan Sandstone Formation, located 8–10 km to the east of the Süttő plateau.

The sharpening stones from the third-century BC settlement of Sajópetri Hosszú-dűlő were mostly made of hard, fine-grained sandstone.[6] The exact geographical provenance has not been identified, but there are several different types of sandstone nearby among the sedimentary rocks in the valley of the Sajó River, i.e. within a distance of 15–20 km. It also should be noted that 50–60 km away from this microregion, connected to the valley from the West are the Ózd-Pétervására Hills, which include a sandstone zone significant in the regional context.[7] It would definitely be worth dedicating a more detailed geoarchaeological study to it. In the contemporary cemetery of Sajópetri–Homoki szőlőskert (grave nr. 62/136, 1 km to the south of the settlement) and in the pit 03.46A.194 of the settlement, whetstones from rhyolitic tuff were also excavated. This material originates from the east, from the Tokaj Mountains.[8] Similarly to the case of the Ózd-Pétervására Hills, the distance between the Sajópetri microregion, the southern part of the Sajó Valley and this raw material source is 40–50 km.

The Celtic settlement of Nitra-Šindolka is from the same period, and it has also been thoroughly studied. The majority (13) of the 17 geologically determined sharpening stones proved to be sandstone. Their provenance is unknown.[9]

4 Ramsl and Draganits, "Steinartefakte aus Pottenbrunn."
5 Czajlik et al., "Traces of prehistoric land use," 208.
6 Czajlik et al., "Matériel lithique," 279.
7 Horváth et al. "The Vajdavár Hills."
8 Czajlik and Mohai, "Pierres à aiguiser," 240.
9 Illášová, "Steinartefakte," 337.

The whetstone found in one of the pits of the *oppidum* at Gellérthegy, which is from the Late Celtic period (end of the end century BC and beginning of the first), was made of a fine variant of the Hárshegy sandstone, which was identified by Péter Bohn as a type known from the Ezüst-hegy in Budakalász.[10] This area can be reached along the Danube River on a 13–14 km long road, so it can be considered, from point of view of Gellérthegy, a microregional natural resource. The whetstones and polishing tools of the Bratislava-Devín *oppidum* were published by Karol Pieta as finds belonging to a workshop. Most of them are sandstone, but there is one tool made of rock crystal, which suggests goldsmithing.[11] As a possible provenance area for rock crystals within the Carpathian Basin, we can mention the Eastern Alps, specifically the High Tauern. This hypothesis is indirectly confirmed by the rock crystals unearthed at Magdalensberg,[12] and also by the Neolithic rock crystal mining site discovered at Riepenkar. Although the latter site is far from Devín, which is thought to be the western gateway to the Carpathian Basin, a number of rock crystal finds indicate the important route connecting the Riepenkar zone with the Inn and Danube valleys.[13]

2. Grinding stones, millstones

At the Celtic site of Süttő–Sáncföldek, we also excavated broken pieces of grinding stones deposited in a pit. Their material is andesite, and according to the research of Dóra Kürthy, they originate from the Börzsöny or the Visegrád Mountains.[14] Although further geological studies are necessary to determine their provenance accurately, it is certainly noteworthy that on the western edge of the source area of the andesite, on both banks of the Danube, very important, partly contemporary Celtic sites are located. The Celtic cemetery of Szob-Kőzúzó was found at the mouth of the Ipoly River.[15] The settlement presumably belonging to the cemetery[16] was discovered by the riverside approximately 500 m higher. Farther, 3 km away, on Csák Hill an andesite quarry that is still in use is located. On the right side of the Danube, in Pilismarót-Basaharc, another Celtic cemetery was excavated which is also significant in the supra-regional

10 Bohn, "Tabáni kelta leletanyag," 243.
11 Pieta, *Die keltische Besiedlung*, 174–75.
12 Niedermayr, "Die Mineralvergesellschaftungen," 55.
13 Leitner et al., "Die Ostalpen als Abbaugebiet," 66–68.
14 Czajlik et al., "Traces of prehistoric land use," 211.
15 Tankó, "The Graves of Szob."
16 Dinnyés et al., *Magyarország régészeti topográfiája*, 324–25.

context.[17] The contemporary settlement[18] was identified ca. 1–1.5 km east of the graves, on the riverbank. The best-known locality of andesite in the region is 4–5 km southeast of the Celtic sites of Pilismarót, on Szekrény Hill. For exact identification, further research is needed, but we know that the raw material of the grinding stones of Süttő originates from a distance of at least 40 km downstream.

The Late Iron Age third-century BC settlement of Sajópetri Hosszú-dűlő was excavated on an area covering more than 40,000 m^2, and it provided a huge amount of stone material, including larger, mostly fragmented tool stones. The only intact grinding stone was unearthed in the votive ensemble 02.A.93. The best-preserved rotary quern fragment was in the building 03.B.32. Most of these stone tools belong to semi subterranean buildings, and they are made of porous/compact andesite. To identify the provenance area of the andesite, we took into account the probable origin of the rhyolite tuff (Mád/Tállya/Szerencs) which was also discovered in the settlement, and in 2007, we suggested that it comes from the Tokaj Mountains, which are 40–45 km away, but we did not exclude the possibility that they came from the Mátra Mountains.[19]

Millstone and grinding stone exploitation sites (in total exceeding an area of 10km^2) were discovered at the foothills of the Mátra Mountains in the Domoszló microregion.[20] At the Pipis-hegy, Középső-hegy, Hosszú-hegy, Hegyes-hegy (etc.) a unique rock type of the Nagyhársas Andesite Formation was utilized. The size and the shape of the andesite bombs and boulders made it easier to produce the tool stones.[21] Based on geological analyses of excavated archaeological stone tools, the andesite from Domoszló was used as early as the Middle Bronze Age (Füzesabony culture) and until the seventeenth century (Szendrő-Vár), i.e. this raw material may have been known to the Celts as well. The most significant Celtic site in the surroundings is discussed in a 2012 monograph[22] on the cemetery of the Ludas–Varjú-dűlő, 10–12 km south-southwest of the raw material extraction site. The necropolis was established in the same period as the Sajópetri site, in the third century BC, but a settlement with a similar scale has not been discovered around it yet. Before the expansion

17 Jerem, "Pilismarót – Basaharc, Ungarn."
18 Horváth et al., *Magyarország régészeti topográfiája*, 291.
19 Czajlik et al., "Matériel lithique," 283.
20 Péterdi et al., "Domoszló: Grinding Stone."
21 Péterdi et al., "Domoszló: őrlő- és malomkő."
22 Szabó et al., *La nécropole celtique*.

of a lignite mine, there were rescue excavations on an area of 30 hectares,[23] and field surveys were done along the Bene Valley,[24] In the course of both, remains of smaller farmsteads were found in the vicinity. Nothing has been published on the stone material of the excavated settlement remains in Ludas, and there were no andesite tool stones in the burial sites of the Varjú-dűlő. However, there may still have been a connection between the site and the Mátra Mountains, as the graves are oriented to the main peaks.[25]

Based on the above-mentioned facts, we can assume that in the Late Iron Age, andesite was in use in the Börzsöny/Visegrád Mountains, the Tokaj Mountains, and the Mátra Mountains. In addition, previous studies suggest that the extraction of andesite in northern Hungary began in the Cserhát Mountain range relatively early, as the basaltic andesite millstones of the Sarmatian settlement of Üllő (third and fourth centuries AD) suggest.[26]

Péter Bohn examined two millstones from the Late Celtic *oppidum* at Budapest-Gellérthegy.[27] He identified the provenance area as laying either in the Börzsöny Mountains or the Visegrád Mountains, but no further research was conducted. In this case, assuming waterborne transport, we can calculate a distance of 50–60 km. Other *oppida* on the banks of the Danube (Devín and Bratislava) draw attention to a different important raw material source, namely the basalt of Pauliberg at Oberpullendorf (Austria).[28] During the Late Celtic period, this basalt was transported not only to the Danube Valley but also to areas lying more to the north, to the Moravian territories.[29]

The millstone found in a subterranean building at the excavation site of the fortified settlement of Nitriansky Hrádok belongs to the same period, and it is also made of andesite.[30] Although in the Northern Carpathians (e.g. Liptovská Mara), earlier Tatra granite and rhyolite were also used for stone tools, a remarkable quarry and production area for andesite grinding stones with semi-finished and waste products is known from Rakša, where there is a Late Celtic settlement nearby.[31] The site is located far from Nitriansky Hrádok

23 Domboróczki, "Recherches archéologiques," 168.
24 Czajlik et al., "Recherches microrégionales."
25 Szabó and Tankó, "La nécropole celtique," 88.
26 Péterdi et al., "Bazaltos andezit."
27 Bohn, "Tabáni kelta leletanyag."
28 Zirkl, "Zur Herkunft der Rohstoffe."
29 Čižmář and Leichmann, "Pozdně laténské žernovy," 126.
30 Pieta, *Die keltische Besiedlung*, 173.
31 Ibid.

(130 km), but probably most of the route (85–90 km) could have been made on the River Nitra.

One can also mention several relevant studies done outside the Carpathian Basin, in neighboring territories, such as northern Italy and Bohemia. The fourth-century and third-century BC grinding stones from the material of Monte Bibele originate from the volcanits located around Orvieto, which was at least 300 km away from the site across the Apennines and much farther if using sea lanes.[32] The era of the *oppida* is represented in Bohemia by specialized centers like Lovosice and the Kunětická Mountains. They supplied the entire northern part of the region and often even more distant areas with their products.[33]

Concluding Remarks

We examined three regions from the period of the Celtic expansion to the Carpathian Basin: the Traisental; the section of the Danube between Devín and Budapest; and the border zone of the Hungarian Plain and the mountains in northern Hungary, the region from the Mátraalja to the Tokaj Mountains. In the Pottenbrunn, Süttő, and Sajópetri microregions, the evidence suggests that the sandstone for sharpening stones was supplied mostly from local/microregional sources of raw materials. Nevertheless, in the case of Sajópetri, we should bear in mind the use of two different regional sources for raw materials, the Pétervására Hills for sandstone and the Tokaj Mountains for rhyolites. Based on the available data, in the oppidum at Budapest-Gellérthegy, we can observe the use of microregional sandstone raw materials, while the rock crystal artefacts in the Devín *oppidum* indicate an economic background that made it possible to procure special raw materials for these urban settlements.

The distribution of grinding stones suggests a regional network system. Andesite, the most commonly identified raw material in our region, is clearly linked to its geographical source sites within the Börzsöny/Visegrád Mountains and the Tokaj Mountains, and in the more distant Mátra Mountains we can even determine a very significant extraction site for it (the Domoszló region). The number of grinding stones from the fourth and third centuries BC with known provenance is still small, but in the case of Süttő and Sajópetri, we see that these heavy tools were transported over a relatively long distance.

32 Renzulli et al., "Provenance and trade."

33 Čisťakova et al., "Craft production," 234.

The exploitation of andesite from the Börzsöny/Visegrád Mountains did not stop during the period of *oppida*, as the findings at Budapest-Gellérthegy suggest, although this cannot be confirmed by a contemporary settlement discovered on the Danube Bend. We do not even have indirect data on the utilization of the andesite of the Domoszló region and Tokaj Mountains from this period, but we know of a mining site in the northern Carpathians (Rakša). The tools of several Late Celtic settlements in Moravia and millstones from the *oppidum* in Devín and Bratislava were made of basalt, and in their case, provenance can be determined precisely (Oberpullendorf–Pauliberg, Austria).

The studies listed above show that, in the case of the grinding/mill stones, the quality of the raw material was of primary importance, and despite their large size and weight, they were transported over considerable distances. At the same time, this also means that high-quality raw material may have significantly increased the value of the resource supply of a given micro-region.

We have seen that it is far from impossible to identify extraction sites. Based on field experience and with the use of modern analyzes, individual types of sandstone and andesite can be distinguished from one another. From the perspective of future research, we need analyses of Late Iron Age stone materials from well-studied archaeological contexts. Such analyses may lead us to a better understanding of the late prehistoric role of this natural resource, which has been somewhat neglected in the secondary literature.

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BOOK REVIEWS

Ottoman Law of War and Peace: The Ottoman Empire and its Tributaries from the North of the Danube. By Viorel Panaite. Leiden–Boston: Brill, 2019. xxiii+470 pp.

The first edition was a disaster. Diacritical marks were wrongly placed, the numbering of endnotes went so awry that it was almost impossible to couple the statements with their references, and the text badly needed proper editing. Nevertheless, we were using it since it was the only serious attempt available in English to define the status of the tributary states of the Ottoman Empire, and it offered many important insights into the ideological vocabulary used by the sultans in their communication with the outside world, not to mention the logic that shaped their thinking. Now, with the second edition, the content has finally found adequate form.

Viorel Panaite wrote his book for a Romanian public, and this was fortunate from some perspectives for the English version and unfortunate from others. Sometimes the non-Romanian reader wonders why some questions which seem commonplace to anyone familiar with the international secondary literature have to be discussed in detail and (the reader must remind himself that sometimes he also cannot avoid entering debates with his national historiography when writing for broader audiences) or why the Romanian version of specific terms in Ottoman political thought also has to be provided (some of the sources Panaite used were written in Romanian, which explains this detail). Nevertheless, the fact that the work was written for a non-Ottomanist public makes it a very thorough and clear introduction into how research on the Ottoman law of war and peace should be done. The book is also a useful handbook on the sources available on Ottoman political language.

The question Panaite aims to answer is not primarily concerned with an assessment of the Ottoman system of making politics in the international scene or, more specifically, creating and maintaining the tributary status from the present perspective of long-term "development of the nation" (which generations before him saw as their task). Rather, he wants to understand the attitude of the sultans on their own terms. His chapters offer a meticulous analysis of documents by focusing on their terminology, contrasting the notions found in the religious sources of Islamic thought and legal treatises with ideas found in the sultans' correspondence, and identifying the logic according to

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which the Ottoman state explained the legitimacy of its deeds. Thus, the image presented here is built on an admirable array of sources representing the various facets of the Ottoman way of understanding international power relations and the empire's place within them. At the same time, with his keen interest in the question of tributary states, Panaite also gives a voice to them and listens to how the tributary states reacted to the ideology of the the Ottoman state. This double perspective makes his survey even more intriguing.

The structure of the book by and large follows that of the first edition, but much has happened in the research concerning the Ottoman Empire and its tributaries in the more than twenty years since its first publication in 1997, so the second edition offers more not only in its form, but also in its content. The material used in the second edition highly exceeds the number of sources used for the previous version. Consequently, thanks in part to additional documentation, Panaite's theses become even more convincing, especially when it comes to controversies in Romanian historiography. For instance, Panaite offers a detailed discussion concerning the establishment of the two voivodates' tributary status and a lengthier explanation of why they should be seen as part of the empire. These debates offer an intriguing read and important lessons even for the readers who are not familiar with the works Panaite refutes. Panaite has written an excellent survey about Ottoman legal thought concerning war and peace, with particular emphasis on the status of the tributary principalities, even more specifically of Moldavia and Wallachia.

The question is whether Panaite's results can also be extrapolated to other Ottoman tributaries. In the chapter that promises a chronological survey of the process by which the tributary states submitted and accepted their status as tributary states, Panaite gives accounts of a number of events in other states and territories, discussing the various Greek and Balkan principalities, the Khanate of Crimea, Ragusa, and Transylvania. Later short-lived attempts to establish tributary states, such as the case of Cossack Ukraine, appear in other chapters in footnotes, while some territories, such as the Upper Hungarian Principality (or in its Turkish name, Middle Hungary) of Imre Thököly are given no attention at all. This is less of a problem, since the book does not promise a comprehensive analysis (although the last example is definitely north of the Danube, thus it is implied by the title). Throughout the book, Ragusa remains the most often cited example. Documents related to the city state are mentioned frequently as contrastive material or illustration for general statements concerning the use of legal terminology. For such a bulky volume, it would perhaps have been too

much to ask for even more, although Ragusa could have been a useful case to show how local interpretations could diverge from the Ottoman perspective concerning their status. The examples Panaite cites from the Moldavian and Wallachian cases are less suitable to show the potential of research on the double-faced self-representation of the Ottoman tributaries in two different international societies, both of which they claimed loyalty to.

In any case, the Ottoman attitude towards the tributaries was based on the same assumptions everywhere, and thus the legal vocabulary that Panaite examines in his analyses of the sources related to any of these specific territories enriches our knowledge and validates his point, even if the dissimilarities between the positions occupied by the specific states, mirrored by political practice, are left in the shadows, as he only addresses the terminology of the official documents. When it comes to the discussion of specific territories, however, we reach a weak point in Panaite's reconstruction. The most frustrating aspect of this for me, with my background in the research on Transylvania, is how little Panaite seems to know or, perhaps, care about this territory and its history. There have been long-running controversies in the Hungarian and Romanian secondary literature on Transylvania, plagued with mutual accusations of nationalist bias, but I can assure my reader that my objection here has nothing to do with this. Panaite fails to take into consideration some of the important findings from the Hungarian historiography, but he also does this with some of the relevant conclusions found in the Romanian secondary literature on Transylvania. Throughout the book, he mostly quotes the same five or six documents from the Transylvanian material, and although Sándor Papp's bulky collection of Transylvanian inauguration documents from the sixteenth century was published after the first edition of Panaite's monograph, it is remarkable that no single document is ever cited from it in the revised version. Whereas, as noted above, Panaite made liberal use of the sources of local origin related to Moldavia and Wallachia, in the case of Transylvania, he seems to have ignored both the Hungarian and the Latin sources (more accessible to a Romanian scholar). While he devotes considerable attention to Moldavia and Wallachia, it is hard to escape the impression that Panaite was simply less interested in Transylvania, a state with social, political, and cultural structures very different from the other two.

To mention but a few problematic cases, there might be points at which one could argue with Papp's conclusions in the abovementioned source publication (and various later papers), but to state that, after Süleyman I's rule, the princes were appointed only with sultanic *berat*s (pp.268–69) is to show disregard for

the facts and extrapolate from the Moldavian and Wallachian cases. In the last two decades, a number of Hungarian and German historians have repeatedly pointed out at various conferences and in publications that in the first period of the Transylvanian principality, the members of the Szapolyai/Zápolya family saw themselves and were treated by the Ottomans as kings of Hungary and not as princes of Transylvania, a fact that is altogether disregarded in this survey (cf. pp.125–27). Cristina Feneşan's very thorough account of the changes in the sum of the Transylvanian tribute in the seventeenth century also seems to have escaped Viorel Panaite's attention, thus he claims that after István Báthory's rule, the sum remained the same until the principality was incorporated into the Habsburg Empire in 1699 (p.300). Of course, everyone has blind spots, and one cannot explore every minor segment of a question with equal thoroughness. The problem is that Viorel Panaite claims that his book is about the three states, and he suggests in more than half of the cases that his statements are valid for each of the three, while in most instances, his analysis focuses on Moldavia and Wallachia.

This is sad, especially because the monograph will serve as a handbook for students of the Ottoman Empire's tributary states, a function otherwise well deserved. The analyses Panaite offers on the Ottoman chancellery's vocabulary and legitimation techniques, the role of customs in the Empire's political system, the framework of the tributaries' legal status (including the privileges they enjoyed and the obligations they had to fulfil), and the turning points in the tributary status of Moldavia and Wallachia are new and convincing, and they will certainly provide a springboard for further in-depth research. I can only hope that readers will concentrate on these chapters and look for information concerning Transylvanian history elsewhere. If so, this monograph will be of great benefit for historians of southeastern Europe and the Ottoman Empire.

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Tábori sebesültellátás Magyarországon a XVI–XVIII. században [Care for the wounded in the field in Hungary in the sixteenth, seventeenth, and eighteenth centuries]. By Katalin Mária Kincses. Budapest: Gondolat Kiadó, 2019. 180 pp.

Katalin Kincses' book offers a narrative of the history of care for the wounded in the field in Hungary in the sixteenth, seventeenth, and eighteenth centuries and situates this narrative in the larger context of European history. As she notes in her introduction, her work moves on the borders of several areas of the scholarly endeavor, including medical history, military history, cultural history, and the history of the sciences. This is one of the reasons why the subject has not been given the attention it merits in the earlier secondary literature. Kincses endeavors to address this oversight. In her monograph, using an array of interdisciplinary tools, she presents the history of medical care in the field in Hungary in the early modern era.

The book begins with a short historiographical introduction and then presents relevant antecedents from the Middle Ages (for instance the surgeons' guilds, which provided training, the appearance of surgeons in the army beginning in the thirteenth century, the development of field hospitals at the end of the fifteenth century, and the transformation of the hospitals that were run by the religious orders into secular hospitals in the fourteenth and fifteenth centuries). Kincses then turns to a discussion of the advancements that were made in military technology in the early modern era, or in other words, the military revolution and its consequences and innovations in the military sciences, which were influenced in no small part by developments in the natural sciences and which, beginning in the seventeenth century, led to the foundation of military engineering schools and educational institutions which ensured higher levels of theoretical knowledge.

In the next longer chapter, Kincses presents developments in the medical sciences in the early modern era in part through a discussion of the endeavors of the major figures of the time (Paracelsus, Hans von Gersdorff, Ambroise Paré) and in part through a discussion of some of the major books (for instance, Hieronymus Bock's *Kreuterbuch*). She also calls attention to the importance of practical experience in the flourishing of surgery, in particular in Italy (names like Giovanni de Vigo and Bartolomeo Maggi come to mind). I cannot help but note that, given his importance, Hieronymus Brunschwig should have been discussed in the main text and not simply in a footnote.

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By the sixteenth century, surgery had become the leading branch of the medical sciences because of the experiences doctors gathered with armies in the field and the many technical innovations. By the end of the seventeenth century, however, internal medicine had usurped its place, in part because it put theoretical questions in the foreground and in part because it built on clear knowledge of the anatomy. Kincses attempts to reconstruct the practices of surgery in Hungary during the era of the wars with the Ottoman Empire in part on the basis of monographs on surgery (which, regrettably, have survived in only a woefully incomplete and fragmented form). All over Europe, surgeons who worked for armies at the time could only perform their jobs if they were specifically entrusted and commissioned to do so. Thus, there were hardly enough of them to address the needs of a massive army.

The next chapter presents the history of care for the wounded in Hungary in the period of the Ottoman occupation by drawing on several specific examples, such as the siege of Eger in 1552, the camp hospitals of the Fifteen Years' War, and their plans. Kincses devotes particular attention to Miklós Zrínyi's plans for care for the wounded in the field, which are found in his writings on military strategy and the science of war. Kincses notes that Zrínyi was well acquainted with and made use of the contemporary European literature on military science, and thus he was very much aware of the issue of providing medical care for the wounded in the field.

In the next section, Kincses presents shifts in both organizational structures and attitudes which took place in the second half of the seventeenth century. She draws, in this discussion, on the writings of figures like Raimondo Montecuccoli and Luigi Ferdinando Marsigli. Surgeons, doctors, and pharmacists became indispensable parts of the army, as indicated by the fact that the Habsburg Army had physicians with the status of camp surgeon, and for the first time on the level of the regiment with the artillery. During the siege of Buda in 1686, a camp hospital was established on the Margaret Island, which also indicates the increasing importance of military health care.

During Rákóczi's War of Independence, the 1705 letters patent on the development of regular regiments and the 1707 *Regulamentum universale* were of tremendous importance from the perspective of military health care. Simon Forgách, Rákóczi's general, drew on the ideas of Zrínyi and the practices in the Habsburg army and had surgeons among his regiments. These surgeons were paid members of the military personnel, and this constituted an important innovation.

The last longer section of the book focuses on the reforms introduced by Joseph II and the Josephinian Military Academy of Surgery in Vienna. Kincses also touches on the Josephinum's wax figures, its collection of books, and the commemorative medals found in collections in Hungary which have some attachment to the Josephinum. In my assessment, in comparison with the earlier chapters, this chapter lacks an adequate presentation of the medical sciences at the time and the training and education provided for doctors and surgeons. Given the importance of the larger European context, it would have been worth mentioning the Prussian parallel, for instance alongside the Collegium medico-chirurgicum, the Pépinière in Berlin, which was a kind of "partner institution" of the Josephinum.

The amount of printed sources and the secondary literature on which Kincses has drawn in her research is impressive, but one still notes with some frustration that, in the case of the Hungarian secondary literature on medical history, some of the most recent publications went unused, even though they would have been relevant to the discussion. Kincses would have done well to have included the writings of Enikő Rüsz-Fogarasi, for instance, who has published on the history of hospitals in the Middle Ages and the early modern era, not to mention Zoltán Péter Bagi's essays on military health care during the Fifteen Years' War and the plan for a camp hospital and Péter Balázs's volumes on the eighteenth-century legal health regulations, which were valid for the entire empire. The works of András Oross on military history at the turn of the seventeenth and eighteenth centuries also would have merited mention. Although Kincses draws on archival sources several times, additional archival research and the use of publications based on archival sources might have added a degree of nuance to her discussion. The medical history of the siege of Eger in 1552, for example, is familiar to us not only from Tinódi's narrative. Archivist István Sugár wrote an exhaustive study of the barber-surgeons of the siege, and he studied the different types of wounds (and thus also the roles of firearms) on the basis of a 1553 application for aid for the wounded.

All in all, Katalin Kincses' monograph draws attention to a subject which so far has received little attention in the secondary literature on medical and military history. Her work may well form the foundation for further research on the topic. The chapters offer new insights into the changes which took place in the conditions of the army, developments in medicine in the early modern era, and the continuous interaction of the two in medical care for the military in the field.

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Styrian Witches in European Perspectives: Ethnographic Fieldwork. By Mirjam Mencej. London: Palgrave Macmillan, 2017. 454 pp.

It may seem self-evident that the study of witchcraft is one of the most eminent fields in which various interdisciplinary endeavors have intermingled in both historical and contemporary contexts. This has been particularly true since the 1970s, a decade that bore witness to the anthropological turn in the discipline of history, in which witchcraft studies played a significant role, and extended the methodological toolkit and framework of historical studies and brought the individual agents of history (people) to the forefront. This shift explains in no small part why Peter Burke could famously state in 1993 that "witchcraft has moved from the periphery of historical attention to a place near the center." From this point onwards, history has had even stronger connection to anthropology, which it should maintain, since modern anthropology can investigate existing analogue structures, modified by time, which can be relevant to historical investigations. Therefore, the works of anthropologists who are exploring the contemporary and present continuations of witchcraft are indispensable to any subtle understanding of the constantly reoccurring personal roles and social tensions brought to the fore by witchcraft, which in varying forms has persisted over time.

The work of Mirjam Mencej is an excellent example of this melting pot of social sciences (social history, cultural and social anthropology, ethnography, etc.). Although her work is rooted in many fields, the applied methodology is mainly anthropological and ethnographical (semi-structured personal interviews), with the extensive use of both historical and contemporary parallels from the available secondary literature (pp.23–33). This conforms well to her focus on the continuation of witchcraft and its contemporary and transformed forms and manifestations. Her study sheds light on the present status of a post-Yugoslavian hinterland while also emphasizing many local social aspects of the traditions of witchcraft. Thus, the work can be regarded as a reference point for historical investigations as well, since it suggests that traditional forms of witchcraft still endure in this region.

One of the most important virtues of Mencej's monograph is the combination of the empirical and theoretical approaches towards the study of witchcraft. As an overall remark, the reader is grateful for the frequent citations from the sources and interviews, which are so abundant that the quoted texts can be seen as an incorporated source edition, which is fortunate because of the

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language barriers. However, because of the colloquiality of the cited texts, they are rather hard to follow in some cases, though they nonetheless persuasively suggest that, for those people who are in the focus, witchcraft is an everyday narrative and explanatory system.

Mencej's study is based on semi-structured interviews with direct informants recorded in 2000–2001 and 2013–2015 by a number of participants (the main researcher, university students, etc.) in a collective research study. The fieldwork was conducted in the undeveloped rural region of Styria in northeastern Slovenia, a remote area with a decreasing population, limited economic opportunities, and major problems concerning the accessibility of general public infrastructure (for example, public transportation) and essential services (education, healthcare). It is a highly self-sufficient, close-knit agricultural society which was only recently (and partly) reached by the processes associated with modernization. Because of this, the study had to grapple with the general problems faced in contemporary witchcraft studies (the high age of the people interviewed, the relatively fast transformation of the outer cultural milieu, etc.). However, since many interviews (260) were done and a relatively dense body of material was available from many settlements, Mencej's study addressed these problems.

As a starting point, Mencej describes a standard type of historical witchcraft with the general features (shapeshifting witches, inflicting *maleficium* on different levels etc.) characteristic of the Habsburg territories and a relatively late decriminalization process in the middle of the eighteenth century. She examines the major discourses on local witchcraft (witchcraft, Christian, rational, new age). Although this may seem self-evident, these narrative explanations intermingle. One should note that the role of the devil in cases of witchcraft in this region is surprisingly uninfluential, and the matters of witchcraft are essentially interpersonal and less communal. Furthermore, as Mencej's discussion of these discourses reveals, one of the most significant issues concerns the belief in witchcraft itself. Mencej points out that even the most skeptical people may commit acts the meanings of which seem to be shaped by the narratives on witchcraft, though all the while they deny their beliefs (for example, by stating that the act of hiding an egg on someone else's property to counteract malicious acts against fertility of animals is not witchcraft, but when it is committed not as a response to a malicious act, it is witchcraft).

As a general statement and main idea, Mencej states that witchcraft is of social origin and she claims that it should be discussed as such. So, within this framework the notion of bewitchment is an explanatory strategy for

misfortune and malfunctioning social interactions. Mencej differentiates between three classes or types of witches and builds her book around them. Her first and main category is the "neighborhood witch," to whom she attributes the cases of "normal" bewitchment between people who are acquainted with each other. Her second category is the "village witch," who is accused of having committed acts of witchcraft or is acknowledged as a witch by the whole or a major part of the community. She notes that the people interviewed usually used these individuals as scapegoats who allegedly had caused harm to the whole village (for example, weather problems) and usually had distinctive physical signs (such as a limp, ugly features, eyebrows grown together, etc.), a bad family reputation, and a lower social and economic status. They were also believed to own magical objects (for example, magical books). As a third category, Mencej describes the "night witches," which was the least "personalized" category. The so-called night witches seem to more resemble figures from folk beliefs who cause people supernatural problems and often lose their way (for example, they walk around in familiar places or cannot find their way out of the bushes).

In the most intriguing sections of her work, Mencej introduces the smallest locality and narrowest kinship aspects of witchcraft (neighborhood witches) and dwells on its complex connections to everyday life. In doing so, she defines the most common forms of local conflict situations and their connections to economic interactions, family ties, and marital problems. She also considers the common objects or targets of witchcraft from the perspectives of their economic importance in the household (for example, crops and livestock, especially cows) and their vulnerability due to poor living conditions (for example, the health of children). Offering a colorful tableau of various acts of bewitchment, Mencej enumerates the magical practices and modes of malicious acts, separating them by the acts of *maleficum* (touching, looking, speaking, and other magical practices) and their other manners (for example, acts of speech such as praising or threatening). Her discussion of these practices and the beliefs concerning them offers insights into the social ambient of the communities and the manifold ways in which witchcraft narratives are constructed and the various functions they serve, which are neatly emphasized in the book.

Many of these acts are embedded in a historical context (see, for example, the discussion of the evil-eye: pp.142–48.) or are shown to have various parallels (for example, magical milking, etc.). All in all, the most captivating elements of

the presentation of these local beliefs and practices are the explanations of the functions, roles, and physical and psychological effects of witchcraft. Mencej describes many problems, for example, whether the acts allegedly committed are mere elements of the narratives constructed by the accusers or victims and exist only on the level of discourses. She points out that even the physically possible and explainable practices can be perceived and presented as supernatural. For example gathering dew or moisture with a sheet of linen can be seen as an act which causes damage to crops, though in the biological sense it really can do harm when it is done in the right time. Furthermore, even simple crimes committed out of envy (such as poisoning animals) can be described within the context of the witchcraft discourse, even if there are rational explanations. Like the witches are generally accused to turn into toads as shapeshifters and approaching houses and barns, and cause harm on many levels. But it is true that the phlegm of toads or salamanders can cause different conditions in animals and humans. However, Mencej also points out that it is possible that some of the practices are actually happening or could have happened, since some of the acts are even confessed or admitted, especially in case of counter acts (for example, killing the toad-witches and put them on the end of the forks near to borders), or generally perceived less harmful acts (for example, someone claim the she has an evil-eye). Mencej also includes an interesting discussion of mental disorders and psychosomatic diseases, which can be understood as responses to or repercussions of imagined bewitchments (for example, because of the severe depression of one family member, the general conditions of a household can worsen), and she explains how the consequences of diseases can fall back onto the actual accuser. And this is connected to accusations which are continuously being raised, since the alleged signs of bewitchment, acts committed in response to a perceived act of witchcraft, and even the ritual burning of evidence are constantly alternating between victims, accusers, witches, and their helpers, the "unwitchers," and sometimes these acts create physical evidence.

Mencej astutely observes that any attempt to capture, in a scholarly monograph, the entirety of witchcraft in a region is a complicated undertaking: it is rather difficult to write synthetically of the various aspects of witchcraft. She claims that the common idea behind these social acts is the notion of "othering," the belief that the deeds and persons perceived as malicious should be of another nature, and that this other nature differentiates these individuals from the majority and can explain all problems which arise in a community.

The difficulty of this task notwithstanding, Mencej's efforts to describe this composite system of beliefs and acts in one comprehensive work have been fruitful. Its complexity makes her book original, since she has not only written a book about witchcraft in a region of Slovenia but has also managed to provide a thick description of everyday life which offers a good example to scholars of other regions.

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The Habsburg Civil Service and Beyond: Bureaucracy and Civil Servants from the Vormärz to the Inter-War Years. Edited by Franz Adlgasser and Fredrik Lindström. Vienna: Austrian Academy of Sciences Press, 2019. 300 pp.

The historiography on the Habsburg Monarchy has undergone significant shifts in recent decades, including a reevaluation of the role nationalism played in society and a revision of the economic, social, and political disintegration of the empire prior to the Great War. *The Habsburg Civil Service and Beyond*, the result of a workshop organized in 2015 in Vienna, contributes to an understanding of these shifts and proposes new perspectives on the history of the civil service. The empirical case studies in the volume, assembled in a more or less chronological order, reflect on two key issues identified in the two introductory chapters (by Fredrik Lindström and Gary B. Cohen). One goal is to overcome "the dominance of nation-state centred historiography in East-Central Europe," which undermines "the foundation for a proper Habsburg historiography" (p.25). The problem of methodological nationalism is that national and nationalist historiography builds on an analytical category—the nation—that does not spring from scientific concerns but rather from ideological and political influence. Furthermore, the focus on the institutional framework of the Habsburg conglomerate state (multilayered both horizontally and vertically) allows the contributors to the volume to concentrate on the relationship between state and society. Three points stand out in this regard: governmental structures seem to have been more dynamic and adaptable than previously thought, there was a growing popular demand for new services on the part of the state, and the relationship between governmental authority and the citizenry fundamentally changed due to increasingly variegated civil society, political parties, and interest groups.

Many of the case studies adopt a social history perspective and describe recruitment patterns and professionalization tendencies in the civil service as well as the social origin, social status, and prestige of the bureaucrats themselves. The common rationale is to provide "biographical and collective biographical research on individuals and groups of civil servants," which is missing from the works of pioneers such as Waltraud Heindl and Karl Megner (p.7). The micro-level analysis of civil servants outlines considerable cultural and social commonalities in both parts of the Habsburg Monarchy in a manner that helps establish the Habsburg perspective beyond the currently dominant national frameworks. For

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instance, in terms of the connection between educational qualification, title of nobility, and career perspectives, legally trained civil servants *(Konzeptsbeamter)* in Moravia and Silesia (the chapter by Andrea Pokludová) produced patterns similar to the patterns which prevailed in the high civil service corps of the Hungarian ministries (the chapter by Julia Bavouzet). Accordingly, noble or aristocratic origin represented a valuable asset at the beginning of one's career, but the influence of social origin faded in senior positions, and work performance mattered more in career advancement. The relative importance of family background, family ties, and networks also made possible the survival of the pre-1848 elite in the era of the Dualist Monarchy, as Judit Pál points out in the case of Transylvania. The list of attributes attached to the impending nomination of a lord-lieutenant in Arad sums up the qualities associated with civil servants: "practical knowledge of public administration, excellent personal abilities, distinguished family and social ties, independent financial status, complete trustworthiness in politics and good sense in leading and handling public life" (p.162). Social expectations, nonetheless, put an often unbearable financial burden on the rank and file in the civil service (appropriate housing, clothing, keeping a servant, and so forth) and could create a financial barrier to entry into the profession, much as in the case of independent judges in the Austrian administration.

There were considerable non-bureaucratic actors at play in the evolution of the civil service on the micro-level. One, of course, was politics. For instance, the Young Czech party regularly tried to intervene to ensure favorable decisions concerning the president and higher officials of the supreme court in Bohemia. According to Martin Klečacký, the financial difficulties faced by lower level judges made them seek help wherever possible, and political parties welcomed these demands. Because of the rather vague promotion procedures, "judges became, more or less voluntarily, the hostages of political parties, their deputies, and ministers" (p.127). Non-state experts also interfered with the administrative apparatus, as Peter Becker observes. The complex interdependence among the government, the provinces, political parties, interest groups, and the populace made the administration seek expert opinions from non-state actors in a bid to fill gaps in the state's knowledge of itself. The debate on who the "lay persons" were according to civil servants reveals a great deal about the functioning of the state administration itself: the problem with technical experts was their assumed permeation of subjectivity in decision making and the perception that they lacked a sense of responsibility. This view rested on the notion of a strong link between objectivity and non-partisanship, each of which were reserved

solely for legally trained bureaucrats. Becker's conclusion is relevant for the whole volume: "The growing interdependence of social, economic and state stakeholders was a consequence of technological changes, the complexity of supply systems, the expansion of participation in the educational sector and the overall challenge of balancing a plethora of competing interests in the provision of public good." (p.256). Although civil servants pledged to be non-partisan and neutral bureaucrats, they remained part of the social and political networks.

The only shortcoming of *The Habsburg Civil Service and Beyond* is that it fails to provide a comprehensive account of developments in the Habsburg Monarchy. Some of the case studies are firmly embedded in their own national historiography and provide glimpses into the history of the civil service in a given region. Thus, the individual contributions together form a mere comparative history of state bureaucracy, an inapt approach given the theoretical standards set in the introductory chapter by Lindström. Still, the volume is a welcome contribution to Habsburg historiography. It provides a fresh look into the scholarship on the civil service in Austria-Hungary and successfully sets the agenda for further research.

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Az uradalom elvesztése: Nemesi családok a 19. századi Békés megyében [The loss of the estate: Noble families in Békés County in the nineteenth century]. By Adrienn Szilágyi. Budapest: Hungarian Academy of Sciences Research Center for the Humanities, Institute of History, 2018. 380 pp.

With this monograph, which draws heavily on basic research, Adrienn Szilágyi offers several insights and conclusions which represent an important step forward in the social history of county elites in Hungary. She uses an array of methodologies and approaches in her quest to determine where the nobility of the county in the southeastern corner of today's Hungary was recruited from and how a conglomerate of large estates in the hands of a single family functioned, in particular with regard to the needs of individual family members for credit. A question also relevant to the recruitment of the nobility concerns the kinds of marriage strategies that were typically used by the county nobility.

The volume opens with a three-pillar historiographical introduction which summarizes the main findings and insights (mostly from the scholarship bearing on Hungary) in the history of the nobility, the history of the institution of the noble estate, and historical demography, primarily of relevance to Hungary. The chapter entitled "A Study of the Certified Nobility in Békés County" begins on page 39. It is the first chapter which is not essentially introductory in its function. Szilágyi draws on sources from 1730 and, in particular, the period after 1790 to determine where the nobles who came to the county (357 people) heralded from. The second longer chapter, "The Estates and Large Estate Owners of Békés County," explains the genesis of Harruckern's "empire," which covered five sixths of the county. Szilágyi shows how the endeavors of the Harruckern family and the workings of the county were intricately intertwined and how this remained the case in the first half of the nineteenth century. From the point of view of the social history of the local elite, the distinction of being a member of a noble family of non-Hungarian origin was important. While the group of so-called "integrated" nobles took part in the life of the county (in particular the Wenckheim and Bolza families), the so-called absentee nobles resided in Vienna and profited off the incomes of their estates, but otherwise had few ties to the county (Trauttmansdorff).

In the third thematic section, entitled "Private Administration in Public Administration," Szilágyi presents the family networks and careers of the heirs. She offers two analyses which are important from the perspective of social history. She analyses the family gatherings of the Harruckern heirs in the period

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between 1776 and 1853. This is the first analysis in the secondary literature of the system used by the family to make decisions and, essentially, function, a system which was in use for decades. As the estates and sometimes residences were in Békés County, it seems perfectly likely that the sites where negotiations were held were also in Békés County, but as of 1808, the family archive was held in Pest, as "governance from a distance hampers effective administration" (p.127). The chapter also examines how the shared elements of the estates were administrated and how their incomes were used. In the interests of cutting costs on the estates, they used officers who were paid out of common funds (two fiscal officers, one treasurer, one archivist, one surveyor, and two liveried attendants). The incomes from the commonly owned livestock went into the family coffer, and these monies could be used by the members of the family as capital available as credit, or in other words, as a kind of family bank. Thus, the members of the family were able to avoid usurers, and though they paid six percent on their loans, at the family gatherings, no one actually paid strict attention to the payment of interest or installments, so most of the money actually simply went "missing" (p.162).

One of the other interesting findings presented in the book concerns the estate structure of the county. The resettlement and revitalization of Békés County in the eighteenth century was essentially connected to one large landowning family, the Harruckern family, and this had far-reaching consequences even in the first half of the nineteenth century. Instead of a real, complexly layered aristocratic society, in the case of Békés County, we find one large client-building estate that exerted a strong influence on the county administration. The personnel and staff of the Harruckern estate and the staff of the county administration were intricately intertwined. In the subchapter entitled "Leases, or Emolument Lands," Szilágyi offers a series of examples showing how members of the county administration could lease land from heirs as a kind of salary supplement, though these lands could be taken back at any time. As a result, there was widespread cronyism and nepotism, which, the sources suggest, may have been common knowledge, and other county members looked down on these office bearers because they were beholden to the Harruckern family.

In the fourth chapter, Szilágyi continues her discussion of this program. She presents the legal background of the sale of property in the late feudal system and then offers a history of a specific instance of indebtedness followed by sale. In the case she presents, the Stockhammer family of Moravia encumbered their estates in Békés County with all their debts. The Harruckern heirs protested

against this, but in vain. They had no money to purchase the debts, and the new legal order, which was often based on insider interests and which was considered stronger, triumphed over the old feudal order. As one consequence of this process, Móric Wodianer, a banker from Pest, came to the county as a new large-estate owner. But as an analysis of the circle of the smaller estate owners who purchased from the estates shows, these owners of smaller estates, as the followers of the families that were heirs to the Harruckerns, appeared at the family gatherings as estate attorneys, fiscal officers, and sometimes even creditors so that, as soon as the opportunity arose, they would be able to use their monopolies on information and buy themselves into the Stockhammer estates. From then on, they took part in these family gatherings, as the gains made by (for instance) Tamás Csepcsányi, Zsigmond Omaszta, Antal Szombathelyi, József Beliczay, János Hellebrandt, and Kajetán Simay illustrate.

In the last three chapters of the monograph, Szilágyi again uses more complex social history methods. While in the earlier sections of the book one of the strengths of her discussion is the thorough scrutiny to which she subjects of a body of sources which either had not previously been made the subject of study or which is simply difficult to gain access to, here her work merits praise for the manner in which she uses an array of very different kinds of sources. In the chapter entitled "The Estate Owners and Estate Relations of Békés County" she makes the prudent decision to draw on sources from the period after 1850, including for instance the 1895 statistics concerning agriculture. By doing so, she stretches the chronological range of her inquiry by another century and offers the reader a detailed portrait of the estate-owning elites of the county. In 1893, the order of the estate owners on the basis of the sizes of their estates, from largest to smallest, was the following: Wenckheim, Wodianer, Károlyi, Blanckenstein, and Almásy: "By the end of the century, essentially only the heirs to the Harruckern estate and the noble families with ties to this estate remained as large estate owners" (p.229).

In the next chapter, entitled "The Multi-positional Local Noble Elite in the County," Szilágyi offers an analysis from four perspectives: 1) county and estate positions on the basis of cash incomes, 2) social status as reflected by forms of address, 3) the sizes of estates, and 4) the incomes of the estates. She divides the county elite into four different groups. In harmony with the conclusions she has proposed so far in her discussion, here too she confirms that the county nobility was strikingly small from the point of view of its numbers, but the new individuals who were rising to the top were increasingly dominant.

In the last chapter, which is particularly exciting, Szilágyi examines "Marital Relations of the County Lower Nobility between 1790 and 1848." Her demographic and social history analysis persuasively refutes several conclusions which have become clichés in the secondary literature. While the earlier secondary literature suggested that there was very little exogamy in the feudal order, Szilágyi shows that in the case of Békés County, this was not the case. She examines 588 marriages, two thirds of which were held between 1830 and 1848. The marriages were usually held on site and "between nobles and non-nobles" (p.225). She summarizes her conclusion strikingly, according to which, in Békés County, "feudal exogamy and local endogamy" were common. Even in the case of the marriages among the elite in the county, only roughly half of these members of the elite had married into in the "network of relatives" (p.259).

The analyses offered by Szilágyi are consistently accompanied by useful summaries. The book also contains 29 charts, two illustrations, three maps, and a large illustration of the relationships of the family networks to the estates.

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Deszkafalak és potyavacsorák: Választói magatartás Pesten a Tisza Kálmán-korszakban [Plank walls and freebee dinners: Voter behavior in Pest in the era of Kálmán Tisza]. By Péter Gerhard. Budapest: Korall, 2019. 371 pp.

How do social circumstances or social background influence the choices people make when they vote? In his recent book, historian Péter Gerhard focuses on this question and other issues involving voting habits and trends. As one of the most relevant fields within political science and political sociology, clearly these concerns have not escaped the attention of scholars, but Gerhard raises these questions in the context of a period in the history of the Austro-Hungarian Monarchy when only a small percentage (6–7 percent) of the population could vote, and those who voted did so in open elections. According to the prevailing image of elections in the Dualist Era among laymen (an image which is based in no small part on depictions of the elections in works of contemporary literature), the process involved manipulation and corruption. Among historians, however, over the course of recent decades, numerous new perspectives have been taken into consideration, and a much more nuanced understanding of this image has emerged. Gerhard has contributed to this with his research, in which he has focused on Budapest and the elections to the national assembly in three of the voting districts of Budapest (Belváros, Terézváros, and Ferencváros-Kőbánya) in 1878, 1881, and 1884.

Gerhard's investigation, which draws heavily on the theoretical literature in political sociology and political science, seeks first and foremost to draw a map of the social status of voters and the party preferences of the various social groups and their attitudes towards the prevailing social relations. He also examines the roles of the people and authorities who represented (local) power.

One of the most strikingly innovative features of the monograph is the groups of sources on which the examination draws and the systematic way in which Gerhard compares them. The foundation of the discussion is a database which is built on three kinds of documents (voter registries, election records, and voting lists). Clearly, these sources made it possible for Gerhard to provide a quantitative analysis. He does not content himself merely with these sources, however, as a structural analysis will not capture individual decisions which, in the case of voting trends, necessarily add shades of nuance to the general image that emerges on the basis of statistics. Gerhard recognizes this methodological

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problem and complements his analysis with two case studies in which he draws on ego-documents (diaries, letters) and articles from the press at the time.

Gerhard essentially approaches the questions he raises from two methodological perspectives. First, drawing in part on tendencies in the sociological study of elections, he follows a tendency which began to emerge prominently in historical research in England in the 1960s, which used quantitative analyses to examine voting habits from the point of view of the social circumstances of the individual groups of voters. Second, he borrows from the trend in the historiography which takes into consideration the various "turns" and their relevance to the study of elections. These works tended to focus on the cultural turn and usually examined the symbols and the language used in political campaigns. In his discussion of the campaigns, Gerhard also uses the methodology inspired by the spatial turn.

The title of the book ("plank walls and freebee dinners") indicates one of Gerhard's basic premises, namely that campaigns had a decisive effect on voter behavior, as did efforts to mobilize voters and techniques used by those in power to exert influence. This idea also finds expression in the structure of the book. After having familiarized his reader with the theoretical framework of his investigation, Gerhard offers two chapters (the second and third) in which he provides a detailed picture of the legal and social context.

The fourth chapter offers narrative portraits of the individuals who ran as candidates in the elections in question, the distinctive aspects of the campaigns, and the events which took place on election day. Gerhard analyzes the campaigns and the efforts to mobilize voters from the perspective of uses of space. How did the authorities and the various groups of voters try to influence and monitor space? What roles did public and private spaces play in the course of the election campaigns? Gerhard comes to the conclusion that, with the exception of some events organized by the opposition, the events of the campaigns were limited largely to semi-public and private spaces. The "street," as it were, was not as important as a political space at the time. The explanation for the limitation of events to semi-public and private spaces lies in the fact that this allowed the representatives of power to maintain control over the events surrounding the elections, which included opportunities to give voice to political opinion. However, public spaces still played two important roles in the campaigns and elections. They provided sites for candidates to make symbolically important public appearances and they also served as places where mass support found expression, for instance in flags, posters, and processions.

In his discussion of these questions, Gerhard considers the issue of maintaining order on the day of the election, a task in which the police, the military, and even men chosen by the individual parties took part. In order to ensure that the elections could take place smoothly and confrontations and fights could be avoided (and non-voters could be kept distant), one of the most important tasks was simply keeping the different voting camps separate (with the construction of plank walls or barriers). In the course of the elections on which Gerhard focuses in his investigation (with the exception of one), there were no incidents of violence. This was thanks to the professional conduct of the authorities and the parties, which worked together with them.

Additional campaign elements were used, alongside the other factors which influenced the outcomes of the elections. The local representatives of the parties (so-called "honorációrok," or "honoraries") were responsible for the coordination of these efforts. These honoraries contributed to the campaign and the election process in several ways, ranging from the selection of the individual candidates (through the organization of the campaign) to participation in the electoral committees. Though the nuanced techniques used in political campaigns began to be emerge around the turn of the century, the people behind these efforts already had a wide range of tools to mobilize voters. They organized dinners, for instance, which were intended to sway voters in part by offering them food and drink.

The analysis of voter behavior in the fifth chapter is, in light of all this, understandable, as are the two case studies in the sixth chapter. Gehard examines the groups of voters from several perspectives (for instance profession, place of residence, and age), and he uncovers interconnections between the ways in which people voted and their social status.

With this examination, the book brings us closer to an understanding of the kinds of considerations which influence the ways in which people vote, a question which is of concern to many people today. More specifically, are people more swayed by what one might term "rational" considerations, or are they influenced by "emotional" factors? Are they swayed by social or political pressures, or do they sometimes seek simply to conform to the social circles within which they move? Since the elections were open, the last two questions can be discussed, as the analysis of the votes cast by office holders illustrates. Gerhard also offers insights into the ritual nature of the elections and their distinctive choreography, which made the whole process a kind of community event. According to Gerhard, those who refrained from voting both rejected

this ritual and refused to allow their political views to become a matter of public knowledge. Given this, one cannot help but find particularly interesting his conclusion that the least active people in this process were office holders of high status and members of the political and scientific elites.

The virtues of the Gerhard's inquiry notwithstanding, one cannot help but note a significant shortcoming. In a discussion of voter behavior, it would have been essential to have noted that the frameworks within which information concerning politics and political parties was communicated differed dramatically from the frameworks in the rest of the country, and these frameworks exerted an important influence on perceptions of both political issues and the individual parties.

Péter Gerhard's book constitutes a major contribution to our understanding of the political culture of the time by offering a rigorous look at the behavior of a segment of voters in the capital city during the Dualist Era. Furthermore, the book is interesting and enjoyable in no small part because of the excellent pictures, maps, and tables found in the appendix.

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Men under Fire: Motivation, Morale and Masculinity among Czech Soldiers in the Great War, 1914–1918. By Jiří Hutečka. Oxford–New York: Berghahn, 2019. 288 pp.

Jiří Hutečka's new volume contributes to the recent trend in the historiography of investigating the history of World War I from the perspective of the common man. He positions his work into a rather major gap in the historiography. It examines the combat experience of Habsburg soldiers from a gender perspective. Unfortunately, military history studies published in of about East Central Europe has focused for the most part on operational maneuvers and has neglected the war of the "common soldier." Only a handful of pioneering studies have focused on the gender aspects of the conflict, and these studies almost exclusively discussed the role of women in the conflict. In the historiography of the war from the perspective of the Habsburg forces, as Hutečka rightly remarks, "gender identities fall silent when the firing starts."

The main aim of this volume is to fill this gap and challenge the traditional oversimplified explanations of the behavior of Habsburg soldiers. It seeks to overcome the dual framework which interprets their actions in the duality of imperial loyalty and national identity. The volume analyzes, instead, how the Czech soldiers' gender identity influenced their attitudes, behavior, feelings, and morale during the war. To investigate this field, Hutečka uses published and unpublished memoirs, diaries, and letters, many of them have been only available in small, regional collections.

The book is divided into six major chapters. The first, entitled "Tournament of Manliness," discusses the mobilization of Austro-Hungarian soldiers in the Bohemian lands. The book provides a new explanation of the generally positive reaction of Czech recruits to the call of the Habsburg authorities in July 1914. It argues that people enlisted voluntarily in massive numbers because serving in the military was an integral part of the contemporary perception of masculinity. Fulfilling one's military duty could cement or even enhance a man's status in society, while remaining on the sidelines could endanger his position in the male hierarchy. Hutečka argues, for example, that industrial workers who stayed at home were losers in this tournament of manliness, while young student volunteers could achieve "full" adulthood earlier than in peacetime.

The second chapter, "Compromises of Manliness," discusses the experiences of common soldiers after they had entered military service. It argues that new recruits constantly had to reconcile their everyday experiences with their pre-

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war perceptions of their masculinity. Due to the nature of military service, these men constantly lost control over their lives, thus losing one of the most important characteristics of their understanding of masculinity. The soldiers' eating habits, lodgings, and everyday routines were all determined by their superiors. Meanwhile, on the home front, women took over many "male" roles, thus endangering the soldiers' positions in society.

The third chapter, entitled "Transformation of Manliness," examined the responses of the soldiers to these challenges. Hutečka argues that comradeship developed among the soldiers. This could also be interpreted as a means of resolving this conflict between hegemonic masculinity and the realities of war.

In the following section, "Degradation of Manliness," the book discusses how the different practices of the Austro-Hungarian army led to the deterioration of the soldiers' morale. It claims that oppressive practices used within the military hierarchy offended the Czech soldiers' notions of their masculinity more than it did their national identity. For example, corporal punishment and the distrust of Czech recruits threatened the masculine identities of these soldiers. This was especially disturbing, because the elite of the Czech lands perceived the Czechs as the most civilized people of the empire, a nation whose members should not be disciplined with barbaric means. Similarly, their warrior self-image was deeply offended by constant accusations of cowardice and treason.

The fifth chapter, "Venue of Masculinity," investigates how soldiers' masculinity was challenged on the home front. It highlights, for example, the ways in which economic problems at home also profoundly affected the masculine identity of the soldiers on the fronts. Men stationed far from their homes were not able to fulfill their primarily male role as providers for their families. They could not oversee their households, and as they were absent, they could not monitor their wives fidelity. Thus, their fundamental male role as father and husband conflicted with their identities as masculine warriors.

The last chapter discusses the combat experiences of the Czech soldiers on the frontline. It argues that soldiers did not universally embrace the concept of "glorious combat," but many of them perceived their first encounter with the enemy, "the baptism of fire," as a test of manliness. However, after four years of intense fighting, most of them rejected the masculine ideals of the propaganda. The most striking examples of this phenomenon were the large numbers of self-inflicted wounds. At the end of the war, soldiers were willing to hurt their own bodies (which were important symbols of their masculinity) to

escape the hardships of war. Hutečka argues that this act helped them to regain some measure of control over their destinies.

Hutečka concludes that the war which was wages in 1914–1918 was one "immense collective disappointment and shock" for the fighting men. At the beginning of the war, the enlisted soldiers were told that they would attain or retain their hegemonic masculinity status. In reality, the conflict profoundly undermined their position in society. This was true of all the Habsburg soldiers, but certain aspects (accusations of treason, being stationed far from home, etc.) effected the Czech soldiers particularly harshly. Thus, these people were lost by the Habsburg authorities not only as Czechs, but also as men.

Men under Fire is a well-written, thoughtful, and refreshing analysis. It applies a pioneering method and provides interesting and thought-provoking insights into the Habsburg soldiers' experiences during the war. The findings of the book are convincing and open new fields for further investigation.

There are a few minor points, however, with which one might take issue. First, the book aims to overcome the nationalist approach of the historiography, but it is only partly successful in this effort. While his book convincingly provides alternative explanations of the behavior of soldiers, it still mostly analyses their actions within a national framework. Thus *Men under Fire* does not tell us a universal story about the Habsburg soldiers but rather explains why and how Czech soldiers were different (or not different) from soldiers belonging to other ethnic groups of the empire.

Second, Hutečka had to confront the problems caused by the lack of adequate primary sources. Due to lower levels of literacy, fewer ego-documents (especially diaries and letters) were produced by the Habsburg soldiers than their British or German comrades. Moreover, as Hutečka observes, these documents have never been systematically collected. Consequently, the book, like most studies on the region, often has to rely on post-1918 recollections. Hutečka tries to use these sources carefully, but sometimes he had to base his interpretation on these admittedly unreliable texts.

Despite these minor points, Jiří Hutečka's recent volume is a very valuable and inspirational contribution to contemporary scholarship. His book is a must-read for historians interested in World War I in East Central Europe and scholars examining gender roles in armed conflicts.

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The Fortress: The Great Siege of Przemyśl. By Alexander Watson. Allen Lane, 2019. 333 pp.+index.

Last year saw the publication of a book by the British historian Alexander Watson, well known as an author of many academic articles and monographs on World War 1. This time, Watson has decided to write about the Siege of Przemyśl in 1914–1915. This topic has long merited discussion in a major academic publication. Watson has used a wide range of sources, analyzing materials and books in many languages, including German, Polish, Hungarian, Russian, and Ukrainian. Without a doubt, his use of books and documents in this array of languages has allowed him to present the whole context of the history of the fortress during World War I, including the challenges faced by its residents (civilians, its defenders and later liberators), the importance of the site to the army of the Central Powers, the goals and methods of the invaders (the Russian army), and the ways in which both sides used Przemyśl in their war propaganda.

The book is divided into seven chapters. The introduction shows that the town had long been a fortress with military functions and a place where "the East met the West." Watson presents the background of the construction of the fortifications on that site; he discusses how the economic situation influenced the ultimate decision to build a fortress in Przemyśl. He also tries to situate these considerations in the larger context, taking geopolitics into account. He argues that the pact of three emperors in 1873 posed a question about the necessity of the fortress. Still, at the end of the nineteenth century, Przemyśl as a fortified defense gate became very important again. Watson claims that the fortification of the town proved very expensive, but the stronghold still did not offer solid protection for the empire, because after 1906, all funds were allocated to reinforce the Austrian-Italian border. In the introduction, Watson provides information on how the militarization of Przemyśl was a factor in developing the town. He also reminds the reader of the specific multicultural nature of the community, which was home to many Poles, Ukrainians, and Jews.

Chapter one is entitled "Broken Army." This title perfectly describes the actual conditions of the Austrian army. After having suffered defeats to the Russian army, units were forced to withdraw westwards, leaving the garrison of the fortress under siege to its own devices. Drawing on Austrian sources, Watson describes the campaign, putting it in its tactical and military context, based on decisions made by the highest-ranking officials.

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Chapter two is entitled "The Heroes," and the article and noun are deliberately put in quotation marks in the actual table of contents, suggesting some measure of irony. The notion of heroism analyzed in Watson's discussion seems ambiguous at best. Watson presents the backgrounds of the garrisons' soldiers, showing differences among the members, and he provides a good portrait of the multi-ethnicity and multilingualism of the Habsburg army. The question seems to be the extent to which the soldiers' behavior could indeed be characterized heroic, especially with regard to their treatment of civilians. Watson gives examples of how civilians were treated, in particular those of Ruthenian origin. He cites numerous examples of people being arrested, interned, and even executed in accordance with verdicts reached by court martials.

Chapter three, "Storm," describes the actual "storm" that was to hit soon, namely the first siege of the Przemyśl Fortress. Watson begins with the perspective of Russian units, focusing on the tactics of Russian commanders. As an experienced narrator of soldiers' perceptions of war, Watson also takes the vantage point of the other side, i.e. of the garrison facing the "storm." He analyzes their wartime experiences, and he does not spare the reader graphic descriptions of what the soldiers faced, physically and mentally, and how they reacted to the unfolding events. He finishes the chapter with a discussion of how the battle shaped a heroic image of the Austrian army. The victory of the fortress garrison played a significant role in the propaganda, and it was widely used to boost the morale of the soldiers.

In chapter four, "Barrier," Watson shows how the fortress was not only a military barrier to the advancement westwards of the Russian army, but served above all as an impediment to influences, ideas, and systems from the Russian Empire. The confrontation between the civilizations of the East and West was very clear here, as Watson shows through the attitudes of the Russian army soldiers towards the people in occupied Galicia: the Jews, who had often been harmed by czarist Russia, but also the Ruthenians, whose Ukrainian identities the Russians sought to erase entirely through a process of Russification.

In chapter five, entitled "Isolation," Watson narrates the second siege of the fortress. This time, the title refers to the literal isolation in which Przemyśl found itself, both the garrison and the civilians. As a result, the front line moved westward, Przemyśl became "an island" among Russian occupying forces. Watson describes the equipment and provision in the fortress and the wartime routine of the civilians and the military. He offers an interesting study of the functioning of an isolated fortress, where there were shortages of everything.

Meanwhile, in some respects, Przemyśl was even more bustling than before 1914. Entertainment was provided in the railway station, and prostitution flourished in the fortress.

Chapter six, "Starvation," starts with a so-called Przemyśl joke about the difference between Troy and Przemyśl, where in the case of the former the soldiers were inside the horse and in the case of the latter, it was the other way round. This seemingly trivial comparison was actually a brutal truth about supplies in Przemyśl during the war. In the fortress, almost everyone was starving. The title thus conveys not only the literal meaning of suffering from lack of food; it is a symbol of the utter exhaustion of the whole crew and civilian residents, which was accompanied by brutal and inhumane scenes of war executions.

Chapter seven, "Armageddon," describes the last efforts of the physically and mentally broken garrison of the fortress, which had no choice but to surrender. They started to destroy the fortifications from the inside so that no structures would remain that could be used by the enemy. Certain unanswered questions come up in the reader's mind about how the civilians were expected to react. Were they expected to be happy to see the end of the apocalyptic siege and starvation? Or would they fear the Russian occupation? It would have been interesting to have seen some discussion of these question on the basis of the available primary sources, especially personal documents from Przemyśl.

Watson's study of the siege and surrender of the Przemyśl Fortress during World War I ends with an epilogue entitled "Into the Dark," in which he includes reactions to the fall of Przemyśl in the press and how the fall of the fortress was used in the propaganda on both sides of the conflict. What happened to the garrison and the civilian residents of the besieged Przemyśl? Both went "into the dark." The soldiers were to be sent into exile in the farthest corners of czar's Russia, where they would experience humiliation and the fate of prisoners of war. Civilians often faced a darker fate, including repressive measures already tested on the Ukrainians from occupied Eastern Galicia and attempts to Russianize them, while Jewish people were to be driven away. After the successful military operation at Gorlice–Tarnów, another chapter started for the town, and its residents faced subsequent wartime problems until 1918. In the epilogue, Watson skims over the history of the town during the German invasion of 1939, when Przemyśl was hit by another historical cataclysm.

Generally speaking, Alexander Watson's book is a valuable study of the fate of the Przemyśl Fortress during World War I, offering insights into the roles of different actors in war, including defenders, invaders, and civilians. What seems

to be lacking is a more extensive discussion of the work of medical and pastoral services in Przemyśl. After all, the fortress forces suffered both in flesh and in spirit. However, this observation is by no means intended as a substantial criticism of the author, who has done a very good job. The book will draw attention to this important historical event among English-reading audiences, and it also constitutes an important academic monograph. The biggest problem for non-Polish readers of the volume perhaps will merely be the proper pronunciation of the fortress' name.

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Tiltott kapcsolat: A magyar–lengyel ellenzéki együttműködés 1976–1989 [A forbidden relationship: Oppositional cooperation between Hungarians and Poles, 1976–1989]. By Miklós Mitrovits. Budapest: Jaffa, 2020. 304 pp.

The new book by Miklós Mitrovits, a historian with several volumes to his credit whose research until now has focused primarily on Poland in the postwar period and on Polish-Hungarian relations, explores unauthorized forms of cooperation between the oppositional forces in the two countries in the decade and a half leading up to 1989. Drawing on a wide range of documentary evidence, contemporaneous samizdat publications, and thirteen original interviews with key participants, *A Forbidden Relationship* covers different shades of political and cultural opposition in Hungary to propose a convincing if not entirely original thesis: the opposition in Poland had a significant impact on the formation and development of dissident and oppositional thought and practice in Kádár's Hungary, especially around the time of the "Solidarity crisis" in 1980–81.

Mitrovits studies political-ideological connections that went beyond the idea of a "traditional friendship" between the two peoples. He is primarily interested in the reception and impact of Polish developments in Hungary, especially among leading (male) members of the democratic, human rights-based opposition (Gábor Demszky, János Kis, Ferenc Kőszeg, Bálint Magyar, and others) as well as autonomous thinkers and writers (such as Sándor Csoóri and László Nagy), several of whom (Grácia Kerényi, Csaba Gy. Kiss, István Kovács) were also professionally into Polish Studies. In other words, Mitrovits employs a rather well-rehearsed concept of dissent and opposition and focuses primarily on actors who have already been canonized as leading participants in such initiatives. At the same time, Mitrovits' book also addresses the question of mutuality, transmitting the admittedly more modest resonances Hungarian trends had in Poland.

The nine chapters of the book evince an equal interest in experiences abroad and their reception "at home," political inspirations and technical learning, repressive measures and intellectual solidarity, adaptation attempts and societal differences between the two countries. They draw on meticulous original research and cover a host of relevant subjects, without however developing a clear and precise analytical language to distinguish different types and levels of impact and reception.

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Mitrovits combines an essentially chronological treatment with thematic intermezzos to explore the beginnings of a relationship in the mid- to late 1970s; the "Solidarity crisis" and its reception by and impact on the formation of a new type of Hungarian opposition; changes in these connections brought about by the implementation of martial law in Poland; the reactions of the Hungarian Socialist Workers' Party and Hungarian society (which admittedly slightly exceeds the scope of his core subject); the presence of the Hungarian opposition and the continued remembrance of the Hungarian Revolution of 1956 in Poland; discourses around the Central European idea; university students and especially their peace activism; and Polish-Hungarian connections on the eve of regime changes in 1989. These diverse chapters allow Mitrovits to cover practically all essential aspects of his subject, even if he does so at the price of several rather sudden shifts between different subjects and levels of analysis.

The opening chapter, entitled "Parallel Realities," contrasts the socialist regimes of Hungary and Poland in the 1960s and 1970s, at one point even calling the former socially inclusive and the latter exclusive (p.20). Mitrovits thereby aims to account for the fact that the opportunity structures for oppositional activities differed radically in the two countries. After all, the institutional foundations for political opposition, societal-worker resistance, and a high level of Catholic independence were all present in Poland, and this was hardly the case in Hungary. Mitrovits subsequently explains that numerous Hungarian dissidents were interested in programmatic articles published in Polish as well as the more mundane techniques of producing samizdat. These dissidents (Bálint Magyar and Gábor Demszky were perhaps the two most notable among them, and their stories and political affairs are covered rather extensively in the book) repeatedly visited Poland from 1977 onwards to experience a political awakening and learn its lessons. However, it was the meteoric rise of Solidarity in 1980–81 that added dynamism to the main flying university in Budapest, the so-called Monday Free University *(hétfői szabadegyetem)*, and catalyzed the launch of various Samizdat initiatives in the country.

Mitrovits is right to conclude in this first section of his book that the newly formed Hungarian democratic opposition, which consisted mostly of sociologists, economists, and philosophers, developed its own fora and conceived of practically all its initial political acts under the impact of recent developments in Poland. He is also correct to note that the involvement of workers in the Hungarian democratic opposition's activities remained miniscule, and this significantly distinguished it from its Polish counterpart. Put more bluntly, the

Hungarian democratic opposition may have seemed much like KOR but without the latter's crucial relationships to workers. It is rather telling, regarding context, timing, and scope, that *Beszélő*, the main Hungarian samizdat journal of the 1980s, which was indeed edited, published, and distributed in line with Polish conspirational methods, started to appear only around the time when Wojciech Jaruzelski introduced martial law, and even then, as was critically remarked by György Dalos at the time, no open expressions of "solidarity with Solidarity" could be recorded in Hungary (p.145).

The imposition of martial law in Poland strictly limited personal contacts between opposition members in the two countries. It was also a time to draw new lessons and debate oppositional prospects and strategies in Hungary. As Mitrovits shows, the example of Poland remained pivotal to participants in Hungary's democratic opposition well beyond December 13, 1981. Demszky's independent book publishing venture *AB* would soon release three volumes of Polish writings, and János Kis' analysis of the Polish and wider regional crisis inaugurated the first extended debate in the pages of *Beszélő*. However, as Mitrovits rightly notes in one of his rather occasional remarks regarding the history of political thought, such reflections and inspirations could not hide the fact that Hungarian contributors often rehearsed ideas already familiar in Hungary, for instance ideas concerning the need for a "third-way compromise" and the introduction of a new social contract (p.123).

Mitrovits shows that, despite the notable activities in Poland by the likes of Wacław Felczak and (Warsaw-based Hungarian) Ákos Engelmayer and despite some interest in subjects such as the activities of the Hungarian democratic opposition, the lives of Hungarian minority communities abroad, or the aspirations and unfolding of 1956 (which, unlike in Hungary, could be freely discussed and even commemorated in Poland), the relationship clearly remained asymmetrical. The case of Hungary simply did not emerge as a key subject among the much more numerous members of Polish oppositional circles. But translations of historical, literary, and cultural works assured a degree of cross-fertilization, and autonomous intellectuals in the two countries were brought closer via what Mitrovits calls their "legal cultural opposition," which was chiefly expressed through their "post-colonialist re-imagining" of the Central European idea. As Mitrovits shows, the Hungarian youth of the 1980s may have been vested in a host of new issues, but like its predecessors, it came under the impact of novel forms of Polish activism, such as those practiced by the Freedom and Peace *(Wolność i Pokój)* movement. This was especially true for university students

at the Bibó Special College *(Bibó Szakkollégium)*, who would soon play key roles in launching the Alliance of Young Democrats.

Mitrovits' closing reflections on 1989 reveal how intertwined and still how different the two countries' respective exits from their communist regimes were. While the establishment in Hungary of an independent trade union and the initiation of roundtable talks indeed appeared to have closely followed the "Polish recipe," when parts of Hungarian oppositional forces refused to compromise on fully free parliamentary elections and this intransigence sharply divided the local opposition, Hungarian developments quickly moved beyond their purported model. The foundation of Polish–Hungarian Solidarity and the visit to Hungary of several prominent Poles in 1989 could change little about the fact that Hungarians drew rather different conclusions. By 1989, Poland's impact may have been widely and profoundly felt, but it was less than decisive.

The monograph thus tells the story of a major foreign inspiration and catalyst behind Hungarian liberal democratization, a catalyst the impressive societal organization and specific political path of which its dedicated Hungarian sympathizers were ultimately unable to imitate. In other words, Miklós Mitrovits has written a book on the impact of Polish ideas, developments, and solutions on Hungary between 1976 and 1989 as well as the clear limits of their influence. Historians of East Central Europe with an interest in late communist regimes and oppositional activities will certainly appreciate Mitrovits' research, which, all in all, is perhaps more impressive for its abundant detail and precision than as an attempt to reconceptualize its subject.

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Dissidents in Communist Central Europe: Human Rights and the Emergence of New Transnational Actors. By Kacper Szulecki. London–New York: Palgrave MacMillan, 2019. 257 pp.

Dissidents in Communist Central Europe, the first monograph in a Palgrave book series exploring the history of social movements in the modern era, fits well into the recent historiography on dissident movements in East Central Europe, which has tended to strive towards more complex understandings of dissent and opposition and move beyond simplistic interpretations of the "communist monolith." By adopting a transnational perspective, Szulecki contributes to more recent historiographical trends which challenge the traditional understanding of communist regimes as isolated nation states by pointing toward the links, networks, and transfers which existed between the so-called "East" and "West."

What sets Szulecki's work apart from other studies on dissident movements in East Central Europe is the type of problem it addresses. It explores the meaning of the term "dissent" itself and the history of this term using theoretical insights from cultural sociology and political science. The word dissident, Szulecki points out, invokes certain meanings; his study traces what these meanings were and where they came from. Chapter 2 provides the conceptual framework of the monograph, while Chapters 3–9 offer empirical analyses of the emergence and development of dissidence in Central European states, more specifically Czechoslovakia, Poland, Hungary, and East Germany. Finally, drawing on an array of sources ranging from *samizdat*, *tamizdat*, memoirs, (auto) biographies, and interviews, Szulecki arrives at an analytical category which he dubs "dissidentism," an -ism which has been adopted and used in non-European contexts, so that today, as he points out, we hear about dissidents in Cuba, Russia, Iran, China, and Belarus.

Szulecki identifies three elements of the "dissident triangle" which he contends are essential to the rise of dissidentism. First, dissidence must be open and public and must find expression in legal and non-violent acts of dissent that risk sanction and repression. Thus, the first necessary condition for the emergence of dissidence was de-Stalinization. As Szulecki points out, dissent in Central Europe grew out of post-totalitarian roots and was not initially anti-Marxist. Moreover, Szulecki highlights that dissidence, unlike resistance, exists in a gray zone between legality and illegality. Instead of breaching the rules of the

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system, or employing violence, it works "within" the system, while concurrently challenging the status quo.

The second element of the "dissident triangle" is requisite domestic recognition. In Chapter 4, Szulecki examines the ways in which dissidents become known as names and faces. For instance, the leaders of the Prague Spring became renowned in the domestic scene and beyond. As Szulecki explains, the public activity of dissidents allowed the communist regimes to label them "foreign intruders" and enemies, which in turn seemed to confirm and strengthen the logic of the totalitarian systems. The "public enemy" was a role ascribed to figures like Václav Havel, Jacek Jan Kuroń, and Adam Michnik, and the imminent threat allegedly posed by a clear and present enemy also justified the presence of the secret police, one of the key institutions of a totalitarian society. Almost simultaneously, a "public enemy" at home became a "prominent dissident" abroad. Western recognition, the third element, was pivotal for dissidentism. Drawing on the insights from Michnik and Havel, Szulecki highlights that international attention, achieved through transnational contacts, transformed individual grievances into political activism.

These two elements became increasingly intense as dissenters employed the language of human rights and were given more and more coverage and attention in the Western media. By using the language of human rights, Eastern European intellectual dissenters were able to mobilize international support. Adopting the claim that the concept of dissident was utilized by the West for the non-Western "Other," Szulecki argues that transnational contacts and international recognition were crucial. In Chapters 5 and 6, he examines the ways in which human rights language was adopted as a lingua franca with which to articulate the goals of dissidents. By 1977, as he explains, all three elements of the "dissident triangle" were present, and it was the opposition in Central Europe that managed to connect them for the first time. A new, transnational actor appeared: the dissident, although being labeled a dissident did not depend solely on the public display of civil courage and self-sacrifice; rather, it was selective. Western newspaper editors and academics selected a few dissident thinkers and fashioned them into a transnational "pantheon" of dissidence which was also entirely androcentric.

One of the merits of the book is that it acknowledges the absence of women in the historiography of dissident movements in East Central Europe. As Szulecki observes, this was due not only to the persistent machismo within the opposition circles, but also to the fashioning of the dissident figure, which was

mainly constructed by the Western media, public, and scholars. Women, however, although absent from the constructed "dissident pantheon," enabled dissidence to function: Szulecki notes that due to their language skills, women were primary sources of information for the Western media outlets. Furthermore, Szulecki presents a nuanced narrative of the convergences and divergences that existed between the perceptions of dissidents in Central Europe and the Western media and public. Dissidents could at times reject the label "dissident" or could take advantage of it. In any case, the label was rather homogenizing, for it was applied to a diverse array of ideological positions that existed at the time within the democratic opposition in Central Europe. Szulecki highlights the complexities of these strategies, which involved various actors, including interpreters, mainly exiles in the West, who interpreted the ideas and stances of the dissidents and mediated between their home countries and the Western media and public.

On the other hand, because the study draws predominantly on sources which belong to the established traditional canon of dissidents' writings, such as Havel's *The Power of the Powerless* and Miłosz's *The Captive Mind*, it necessarily stays within the framework of the dissident historiography which it aims to revise. Furthermore, it would be beneficial if the study could engage more with its starting point, namely that the idea of the term "dissident," as we know it today, ought to be traced back to the Central European democratic opposition of the second half of the twentieth century. The study focuses on a "Central Europe" that includes the aforementioned non-Soviet states of the Eastern bloc. The study also refers to "Eastern Europe," encompassing Russia and state socialist countries in Europe (e.g. Bulgaria, Romania, Yugoslavia,) which, as Szulecki explains, had profoundly different contexts and practices of dissent from their Central European homologues. Yet, it would have served the study well—not least because the book's underlying claim is that the phenomenon of "dissidentism" is comparable across the world—if the monograph would have included these different contexts, even if asymmetrically. Not only would it serve better to explain the uniqueness of Central European dissidence, but it would also have helped clarify the reasons for which the notion of "dissidentism" travelled around the globe—something that makes the study of the history of social movements relevant in today's context, in which variations of "illiberal democracy" are now thriving around the world.

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Corn Crusade: Khrushchev's Farming Revolution in the Post-Stalin Soviet Union. By Aaron Hale-Dorrell. New York: Oxford University Press, 2019. 344 pp.

This book gives a detailed picture of the corn-planting movement which was implemented by Khrushchev to enhance the wellbeing of the population in the post-Stalin era. Aaron Hale-Dorell's aim is to analyze the influence of Khrushchev's corn policy on agriculture, society, and politics while avoiding the often schematic depictions of the era. Although the corn-planting movement constitutes the main focus of the book, the reader also gets a detailed picture of the problems faced by Soviet agriculture, the positioning of the leaders of the communist party, and the directorate of kolkhozes.

Hale-Dorell supports his argument with a broad range of sources. The analysis is primarily based on declassified materials from the Moscow archives of the Communist Party and the government (the Center for Preservation of Document of Socio-Political History of Moscow, the Central State Archive of Moscow Oblast, the Russian State Archive of Contemporary History, the Russian State Archive of Economy, and the Russian State Archive of Socio-political History), though he also draws on the archives of the local administrations in Vilnius (the Lithuanian Special Archive), Kiev (the Central State Archive of Social Organization of Ukraine), and Stavropol (the State Archive of Contemporary History of Stavropol Krai and the State Archive of Stavropol Krai). As Hale-Dorrell observes, these documents defined the policy and outlined the implementation of Khrushchev's agrarian reform. In the book, he includes issues that were not publicly addressed by officials but were nonetheless important in Soviet agrarian policy.

This book contains eight thematic chapters. These chapters engage with the ideals, goals, technology, organization, management, and wage systems that shaped the process of establishing new corn plantations and reflect Khrushchev's efforts to expand industrial farming. Hale-Dorrell offers reliably sourced information concerning why the implementation of Khrushchev's reforms failed. Chapter by chapter, the reader is given insights into rural policy after Stalin's death in 1953. The chapters discuss agrarian economic policy with regard to the corn crusade and situate corn technology within Soviet agricultural expertise. Furthermore, they investigate the implementation of corn policy in agriculture and its widespread propaganda coverage.

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In the first chapter, Hale-Dorrell offers a history of Soviet agriculture which includes discussion of the main problems faced by the kolkhozes and the living conditions of the kolkhozniks (members of the kolkhoz) during the Stalinist era. He contends that Khrushchev embarked on a program of reforms to solve problems such as the shortage of workers and the backwardness of the agrarian sector by integrating the rural parts of the country into the industrial economy. In the second chapter, Hale-Dorrell describes how the Soviet Union's agricultural policies were integrated into the larger framework of reforms. In this chapter, the study trips taken by experts in the field of agriculture in the Soviet Union to the United States (trips which contributed to the corn crusade and the modernization of agriculture in the Soviet Union) are discussed in detail. As Hale-Dorrell observes, Khrushchev was convinced that industrial farming was the solution to the Soviet Union's problems. Corn became the engine and the symbol of industrial farming, as Khrushchev considered corn a cheap source of the livestock feed that could be quickly and relatively easily produced. In other words, it would be precisely what was needed to ramp up meat and dairy output. In this interpretation, corn did not represent just a crop; it signified as the driver of the Soviet Union's wellbeing.

The third chapter focuses on corn politics and the disorderly implementation of the corn-planting policy. The lack of equipment, machines, the lack of clear instructions, the failures of the implementation process, combined with the disinterest of the kolkhoz and secretary leaders, made the corn yields fall short of even minimal expectations. The fourth chapter gives a detailed analysis of the mass media campaign in the corn crusade. Corn as "queen of the field" became a constant theme in the press, radio broadcasts, and newspapers. Corn came to play an important role in the All-Union Agricultural Exhibition as well. As Hale-Dorrell concludes from Khrushchev's speeches to mass audiences and the visual imaginary of the time, the entire era was pervaded by the idea that corn was something special, even exceptional. Publications attempted to integrate corn into readers' daily lives and culture.

The fifth chapter examines the role of the Komsomol in corn planting. The Komsomol corn-growing competitions involved mass participation in corn-planting activities, but the events were mismanaged by kolkhoz and local leaders. For example, in many cases, young people were forced to work in the fields without clear instructions. The sixth chapter outlines the changes in kolkhoznik life. Guaranteed wages, machines, chemicals, and other technologies made work easier and more productive. In one significant change, the introduction

of pensions revived rural people's interest in farming. Hale-Dorrell states that Khrushchev's labor reforms fell short of expectations because of poor management by local leaders, who misunderstood the kolkhozniks and their moral economy. The benefits of social statutes and regular wages did not make the kolkhozniks efficient corn growers. The seventh chapter shows how the Soviets adopted modern technology from the United States for planting, cultivating, and harvesting corn and other crops. But Hale-Dorrell highlights recurring problems: the necessity of using developed machinery, the hybrid seed program and the negative effects of slow production as well as mistakes in practices which resulted in low yields.

The eighth chapter analyses the roles and mistakes of local kolkhoz leaders in the corn crusade.

Hale-Dorrell's book is not just an analysis of the propaganda accompanying the popularization of corn planting. It is a detailed assessment of Soviet agrarian policies. It gives a nuanced picture of the mentality of Soviet leaders and workers as well as that of Khrushchev, who believed that his reforms, especially corn planting, would make the success of communism possible. As a result of Khrushchev's reforms, the kolkhozes lost many of their distinctive features, and kolkhoz workers became wage earners. In this period, industrial farming principles began to define practice. Mechanization and industrial-scale wheat farms, together with initiatives to put genetics, chemistry, and engineering into farming integrated industrialization into everyday agricultural activities. This reform was a part of the transnational agrarian movement.

Hale-Dorrell examines not just Khrushchev's mistakes in the implementation of the corn crusade, but also mistakes that had nothing to do with Khrushchev. The corn-planting project faced obstacles that remained from Stalin's era: the resistance of bureaucracy, the obstinacy of secretaries from the directorates in regions where corn planting was rejected, the people who cheated and fiddled the statistics to meet the quotas, the adoption of inappropriate agricultural practices, and the lack of concern for harvesting and fertilizing properly and in a timely fashion.

The importance of the book lies in its multifaceted analysis of corn policy. The book contributes to a rethinking of Khrushchev's agrarian reforms and discusses both its immediate results and the lasting consequences. The reader gets a picture of the corn crusade in the Soviet Union and Khrushchev as a leader, a man who was enthusiastic in his vision of corn as the driver of the Soviet Union's wellbeing.

Aaron Hale-Dorrell concludes that the corn crusade was not pointless, even if its permanent legacy was one of failure. The effects of the agrarian reform changed Soviet rural life and exposed Soviet agriculture to a worldwide movement. This book will be useful for historians of the Soviet Union, agrarian historians and non-specialists who are interested in broader issues of Soviet management, the state socialist modernization project, and the transformation of rural regions under state socialist regimes.

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