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RESEARCH METHODOLOGY OF THE MEDIEVAL AND EARLY MODERN SETTLEMENT TOPOGRAPHY OF THE OCCUPATION AREAS ON THE EXAMPLE OF THE COUNTIES OF BÁCS, BODROG AND SOLT

Thesis of Dissertation

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1. Reasons for the choice of topic

The southern areas of the medieval Kingdom of Hungary suffered extensive destruction due to the Ottoman expansion in the 15th-16th centuries. The process of decay extended not only to the population but also to the built heritage, the interior of the settlements, and the borders. The written sources available from the mid-16th century onwards reveal a *topographical uncertainty* in the areas of the Ottoman Conquest, especially in the southern part of the Great Plain (P. ENGEL 1996). With the disappearance of the medieval Hungarian population after the Battle of Mohács and the arrival of the Balkan population, this process intensified, and the remembrance of medieval administration (at the county and settlement level) faded considerably. From the 18th century onwards, the reorganization of the administration in the areas destroyed during the Ottoman occupation began. However, the settlement network that emerged in the modern period, especially in the southern counties, differed considerably from that of the medieval counties. (I. PÁNYA 2019).

Historical geographical - topographical research, which started in the 19th century, generally covered the collection of data on medieval villages and the point-by-point recording of their locations (D. CSÁNKI 1896, I. SZABÓ 1937, E. ICZKOVITS. 1939, É. H. BALÁZS 1939, ZS. JAKÓ 1940, GY. GYÖRFFY 1963). The fact that they were conducted with different methods, depth, sophistication, and detail make it difficult to compare and summarise their results. Topographical research, focusing on the inner areas and major buildings of medieval settlements, has been attempted in recent decades mainly by archaeologists (Tolna County: A. K. NÉMETH 2015A-B, Bács-Kiskun County/Sand Ridge: SZ. ROSTA 2014, Fejér County: M. STIBRÁNYI 2015, Nagykunság and its surroundings A. PÁLÓCZI HORVÁTH 2022). The most significant results have undoubtedly been obtained from the studies related to the unfinished series on the Archaeological Topography of Hungary (MRT – Magyarország Régészeti Topográfiája). From the 1960s to the present day, the work carried out county by county, district by district, has undergone a kind of organic development, with newer disciplines and procedures gradually being incorporated into the investigations. However, no methodological summary of this complex interdisciplinary research has been produced.

The published studies show that intensive archaeological topographical research in the area of the former area of the Ottoman Conquest (mainly in the Danube-Tisza Interfluve Region) has been not carried out. Furthermore, there is a lack the investigation of primary sources (medieval charters, defters, documents of early modern family archives, etc.), the delineation of the boundaries of settlements and wastelands, the morphological analysis of

inhabited localities, and the identification of their main features (church, streets, plots, manor house, monastery, etc.). There has been no complex, holistic, micro-level reconstruction of the former counties in the area of the Ottoman Conquest, nor there has been created any data collection, atlases, or maps based on field research. There is also a lack of methodological literature: besides the few theoretical writings, there are no applied works based on practical field/data studies.

My research focused on the methodological aspects of the analysis of the medieval-early modern settlement network. The literature review reveals that the need for interdisciplinarity has been expressed since the beginning of the 20th century, but that the studies have been severely limited by the available possibilities, methods, and resources. At the beginning of the 21st century, technological advances (Geographical Information System, GPS technology, remote sensing, the use of drones, etc.), the mass availability of digital content (archival and contemporary aerial/satellite photographs, maps, charters, etc.) and the methods already known and published have made the mapping and modeling of the once existing settlement network faster, simpler and more accurate.

The timeliness of my research is demonstrated by the fact that several countries across Europe have completed or are in the process of reconstructing their medieval settlement networks, inventorying their cultural heritage, and publishing the data online or in the form of printed data repositories/atlases (e.g.: England: ROBERTS, B. K. - WRATHMELL, S. 2002, WRATHMELL, S. 2012).

2. The main questions of the research

My analyses have primarily covered the part of the Kingdom of Hungary between the Danube and the Tisza River that came under Ottoman occupation in the 16th century. My main aim is to formulate a modern methodology based on remote sensing, GIS, primary sources, and field research, and its possible application to the study of the areas of the Ottoman occupation in Hungary and neighboring countries (Croatia, Serbia, Romania). The advantages and disadvantages of the different sources and methods are illustrated using the example of three medieval counties (Solt, Bodrog, and Bács) (I. PÁNYA 2017C-D, 2021C). This sample area extends for about 300 km from the present-day Dunavarsány (Hungary) to Titel (Serbia) at the confluence of the Danube and Tisza and covers an area of approximately 12,500 km^2. It provides an excellent cross-section of the area of the Ottoman Conquest, the settlement network, and the medieval-early modern changes in settlement continuity.

In the course of my work, I only touched tangentially on the settlement relations and administration of the period up to the end of the 11th and 13th centuries. Due to the extremely poor written sources of the Árpád period, it would be possible to determine the settlement relations of the period with the help of in-depth archaeological research and intensive fieldwork, which I did not have the opportunity to do in my research (I. PÁNYA 2021D).
In the course of my investigations I sought answers to the following questions:
- In what way can the boundaries of the deserted medieval settlements be delineated?
- What are the methods for identifying the interior parts of the destroyed medieval settlements and how can their main features (streets, tofts, crofts, plots, important buildings) be defined?
- Is there any regularity in the geographical distribution of morphological types in the sample areas?
- How can the continuity of settlements be demonstrated? How can the connection between the present interior and the medieval-early modern interior be justified?
- In other areas of the Ottoman Conquest, which elements of the methodology outlined above could be used to study the settlement network?
- For what purpose can the data collected in the course of the research be used, is there a social/economic benefit in the historical (settlement) geographic analysis of a given area/region?

3. Material and method

My research was based on intensive, structured data collection, in the framework of which I examined the content of museum repositories/archives and online databases, and selected the written/imaged data necessary for topographic reconstruction. As a result of the settlement topographic work, a unique written/image/map database was created, which served as the primary stage and modeling environment for subsequent settlement topographic studies. In the framework of the work, several thousand medieval documents (MNL OL DL-DF database) were examined, and more than half a thousand of these documents, containing geographical data (boundary description, land division, natural features, etc.), which had not been published before, were translated and evaluated. In addition, thousands of manuscripts and printed historical maps from national and county archives (MNL National Archives, Pest County Archives, Tolna County Archives, Bács-Kiskun County Archives, Jász-Nagykun-Szolnok County Archives) have been collected and georeferenced.

The research of the data from archives and the subsequent spatial data processing provided sufficient insight into the source endowments of the sample areas. This revealed that there is a fairly large amount of medieval, early modern, and modern data available on the sample areas, but that it is geographically fragmented. It was possible to identify several areas for which extensive medieval documentary material has survived (e.g. the north-western half of Bodrog County, the settlements of the Töttös-Várday manor and their surroundings), and some areas for which little topographic data is available (the eastern half of Bodrog County, the southern part of Solt County, the part of Kalocsa in the Sárköz). This is mainly due to the miserable fate of the private/ecclesiastical/state archives in Hungary, which have been destroyed several times.

During my work, I conducted field research within the research area of the Katona József Museum in Kecskemét, within the borders of Bács-Kiskun County. The introduction of community archaeology into the methods used was an innovation. The field research, the knowledge of the landscape, and the archaeological phenomena to a certain extent are very important elements of topographical research. With the involvement of civilian metal detectorists and museum enthusiasts, the number of known medieval sites (villages, field towns) has increased dramatically, and the finds collected (coins, cloth seals, etc.) have made it possible to deduce the occupation and importance of the settlements. The latter data, together with medieval and early modern written sources, made it possible to establish the timeline of a settlement (Figure 1).

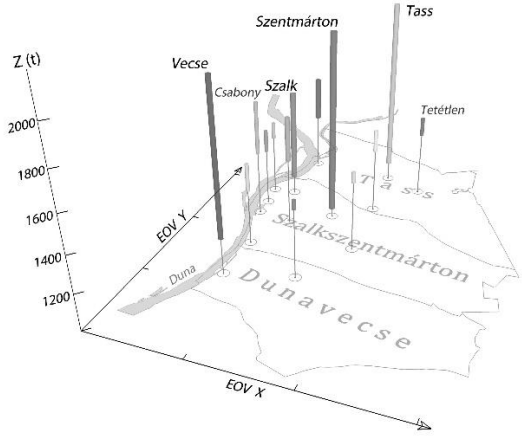

Figure 1 Timelines of settlements between Tass and Dunavecse (own editing)

Field archaeological observations were not possible in Bácska, Serbia, and instead, the settlements were investigated using remote sensing and archival methods tested and verified in the Hungarian sample areas.

The process of the settlement topographic analysis followed the following steps:
Data collection and geospatial database creation: using the Esri ArcGIS geospatial application, a scalable geospatial framework was created, which can be extended with any amount and type of raster and vector data, and which can be used for a variety of needs, from comparing information to producing figures for publication. Its main elements are raster data, historical maps, and archival/modern aerial/satellite imagery (in EOV projection, ecw format), which have been of primary importance in the search for medieval boundaries and former settlement sites (internal areas) (I. PÁNYA 2017A).

Settlement data repository: this process started with the enumeration of the inhabited settlements and wastelands of the selected counties, and the collection and organization of historical data. The resulting dataset includes the names of settlements and places known from sources dating from the 11th to 17th centuries, data of particular topographical importance, and archival and bibliographical references to the mention of settlements to track changes in the settlement network over time (destruction, depopulation, relocation). The effects of the major medieval/early modern and modern cataclysms (1526 - Turkish withdrawal after the Battle of Mohács, 1529 Turkish campaign, Long Turkish War or Thirteen Years' War, 17th-century military campaigns, as well as the last wars of liberation, modern fires) which caused a wave of settlement destruction have been traced at the settlement level. I also carried out a comparison of local traditions, local history literature, and the results of previous archaeological research.
The combined use (and continuous improvement/addition/extension) of the GIS database and the settlement database has made it possible to sketch the medieval and early modern settlement patterns in the sample areas and to model and trace changes to some extent.

In the course of my research, I classified the settlements that existed in the sample area into four groups in terms of continuity:
Continuously inhabited settlement
It was inhabited from the Middle Ages to the New Age (with more or fewer interruptions), the ancient settlement core can be detected to a greater or lesser extent in the structure of today's settlement (Apostag, Dunavecse,

Kalocsa, Solt, Tass). Archaic settlement forms (street, plot system) can be deduced from historical maps. In the case of these settlements, the interior remained mostly unchanged between the Middle Ages and the New Age.

Moving settlement with a permanent population
The inhabitants of these localities have abandoned their original residence and moved to another place, usually very close, where their community has retained its original name. Many such cases are known along the Danube, some villages during the Turkish occupation and others during the 18th and 19th centuries. During the 16th century they changed places (Szeremle, Kiskunlacháza - including Lacháza and Pereg, Érsekcsanád).

Settlements with permanent locations and changed population
This group included those places whose original population had moved/disappeared and were replaced by Hungarian / German / Slovak / South Slavic inhabitants in the early modern period or the modern age (Jánoshalma, Baja, Hercegszántó, Sombor). In addition to the deserted villages and market towns (in English literature DMV), this group is the second largest in the three sample areas.

Deserted settlements
To the best of our knowledge, this is the most populous group of all, with approximately 300 such sites in the entire sample area. The time and the reason for their destruction can vary widely (13th century Tartar invasion, settlement depopulation/abandonment in the late medieval period, the desertion during the period of Ottoman occupation, etc.). Most (known) localities have fallen victim to Turkish expansion.

County history: in parallel with the former, the research on higher-level administration was launched. This is of great importance for tracing the county affiliation of localities/towns. It is important to underline that most of the counties that existed in the area of the Ottoman Conquest have not yet been the subject of in-depth historical summaries based on data research. This is why the published studies on the history of public administration in the Counties of Solt and Bodrog are of particular importance (I. PÁNYA 2017B-C, 2021C). The data studies have shed light on the internal structure of the counties, the functioning of the authority (sedria), the location of the various important centers (places of authority, market, fairgrounds, castles, etc.), and their role in the subdistrict/county/region. In addition, the minor and major changes in the boundaries of the counties can also be traced.

Mapping of the interior (built-up) areas: this work phase was an important stage of the mass data processing mentioned in the methodology, as all available aerial photographs, satellite images, and historical maps were georeferenced and evaluated for all known settlements. This has resulted in the creation of a settlement-level catalog of topographically valuable images and map extracts of the villages and market towns. The amount of data is reflected in the fact that only ~1020 georeferenced satellite image fragments (Google Earth) were produced for the surveyed settlements in the Serbian Bačka region.
Using the collected data, it was possible to determine the location, extent, periods, and main features (street/church/monastery/yard-house, etc.) of the medieval settlement traces. This was combined with field research and monitoring (aerial photography, geophysics, fieldwalking, etc.) in the sample area in Hungary (Bács-Kiskun County). In the Serbian areas, the pattern types detected in the satellite images were interpreted based on the Hungarian experience.

Reconstruction of settlement boundaries: based on written sources and historical maps, the boundaries were defined in a geographic information environment. The first step in this process was the virtual creation of a theoretical sketch based on the available medieval boundary description. In a second step, the topographical data (boundary mounds, boundary ditches, natural features - hills, valleys, forests, fields, meadows, etc.) were spatially analyzed and compared with the modern boundaries.
It is important to stress that the exploration/processing of data sources was a continuous process throughout the research, and therefore the phases of work listed here did not linearly follow each other, but were carried out in parallel and with varying intensity.

4. Results
I gave the following answers to the scientific questions formulated at the beginning of the research.

4.1. The first question was about the method of outlining the boundaries of deserted settlements. A thorough examination of the sample areas revealed that continuity can be observed to varying degrees in the three counties. On the border of Solt and Bodrog Counties, a line can be drawn roughly east-west, from the north of which - almost in the whole territory of Solt County - the landscape and settlement continuity can be shown. This line went from the direction of Érsekcsanád - Dusnok towards Jánoshalma, from there to

the south, towards Szabadka/Subotica (SRB), from where it reached the Tisza River to the east.
South of the boundary line, landscape continuity can only be demonstrated to a variable extent, in patches in some areas (eg the surroundings of the Island of Mohács) (PÁNYA I. 2020A). Based on the written sources, it is clear that the medieval Hungarian population by the turn of the 17th-18th centuries had survived nowhere in Bács County and some places along the Danube in Bodrog County (Érsekcsanád, Szeremle). A significant part of the settlement population became South Slavic, and numerous inland areas remained in use (Baja, Hercegszántó, Dávod, Czoborszentmihály / modern Zombor / Sombor, Berek / modern Béreg / Bački Breg, Küllőd / modern Küllőd / Kolut, Szond / modern Szond / Sonta, Titel / modern Titel).
It is clear that in the areas where landscape and settlement continuity can be demonstrated (most of Solt County), the careful and moderate use of manuscript historical maps of the 16th century can be used to draw the boundaries of most of the late medieval - early modern inhabited settlements and uninhabited wastelands (*Figure 2*). The border inspections that have survived in medieval sources can be used to refine the image sketched based on historical maps. Of course, there is also uncertainty in these areas due to the destruction of resources, so we do not have enough topographic data on many settlements and wastelands.
In the areas where the landscape continuity cannot be detected or is very small (the largest area of Bodrog, the whole area of Bács County), the medieval boundaries of the settlements and wastelands can be drawn with lower accuracy based on the data of the original medieval charters. Nevertheless, the medieval (and early modern) conditions could be reconstructed much more accurately in the area of Bodrog County than on the map of Pál Engel (ENGEL P. 2001, FÓTI M. – PÁNYA I. 2022).
As a result of the social transformations that took place in the first third of the 16th century, with the sudden disappearance of the Hungarians, the toponyms and settlement names in the medieval source material were partially or completely forgotten by the region during the occupation. They were replaced by place names given by the moving South Slavs (and to a lesser extent by the Vlahs and Turks). Therefore, little or no relationship can be detected between the toponymic material of the two periods. The boundary conditions preserved by these new settlers have been captured on modern manuscript maps, but they are not identical to medieval boundaries based on a comparison of medieval and modern sources. Based on the investigations, it seems that in the southern part of the Danube-Tisza Interfluve Region, the 16–17. The population of the Balkans, who moved in

the 16th century, treated the area of medieval settlements and wastelands differently from the Middle Ages, essentially redistributing it.

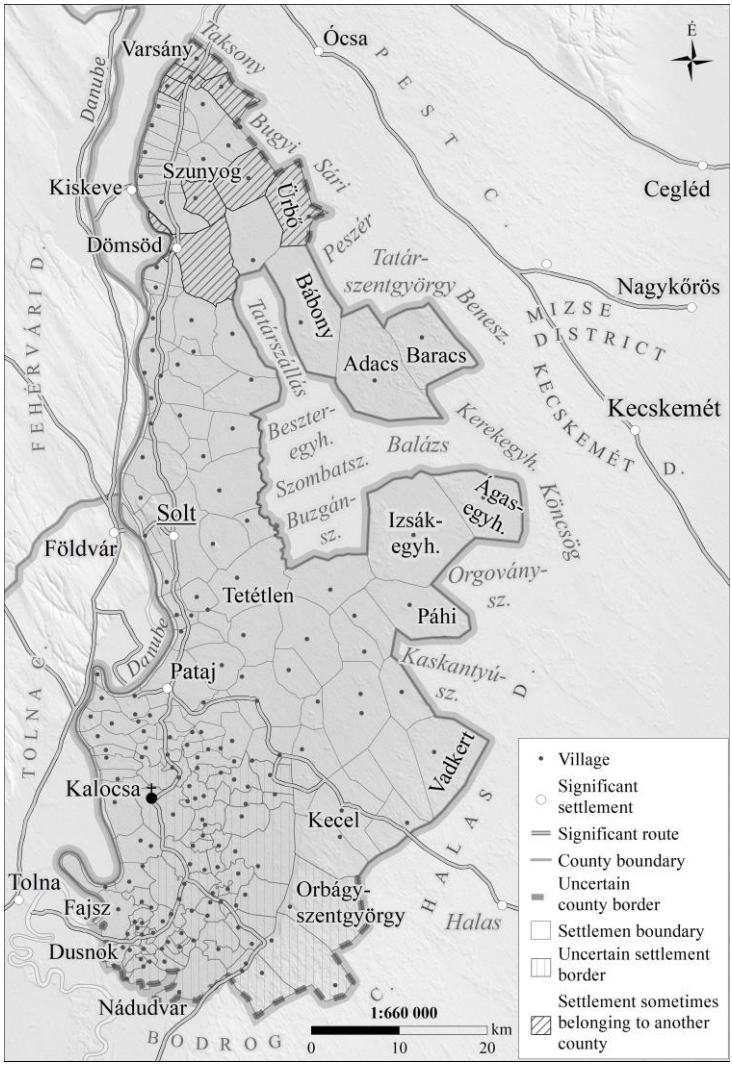

Figure 2 Settlements of the Solt County at the end of the 15th century (own editing)

4.2. The second question concerned the exploration of the interior of medieval settlements and the definition of its main features. The interior can be examined with different methods and accuracy depending on whether it is deserted (lying in the open) or continuous (covered with buildings).
In the case of undeveloped interiors in the open, remote sensing (satellite images, archival and contemporary aerial photographs, low-altitude drone images) and 18-19. century manuscript maps provide information on the location of medieval settlements (*Figure 3*). Satellite and aerial photographs can provide detailed settlement structure data. The exact determination of the settlement morphology also requires field research, during which the topography and other landscape elements can be examined together.
The main characteristics and basic morphological features of the former destroyed interior areas located in a free, agricultural area - the direction and number of streets, plots/rows of houses, the location of a church, and a manor house - can be read with high accuracy from remote sensing. It is important that the images taken during the vegetation period may show phenomena that are not or hardly visible on the plowed surface, but the plants can indicate them (foundations, walls, ditches, pits, piles, cellars, etc.). A complex study based on several data sources (fieldwork, radar research, etc.) increases the accuracy of observations.
Two groups of medieval settlements in built-up areas can be distinguished: on the one hand, villages and market towns with a continuously inhabited settlement core since the Middle Ages (Tass, Szalkszentmárton, Dunavecse, Apostag, Solt, Dunapataj, Kalocsa, Uszód, Fajsz, Foktő, Bátya, Baja, Herceg Küllőd, Sombor, Szond, Titel, etc.), on the other hand, the settlements that existed in the built-up parts of today's settlements (Dunapataj – Szelid, Öregcsertő – Csorna) can be classified here.
On-site research of these two variants is greatly hampered by structural changes due to buildings, today's infrastructural elements, often thick (several meters) modern age embankments, and modern conflagrations, therefore the field investigation allows very limited observations for these sites (*Figure 4*). However, based on medieval charter data and modern maps, in many cases, it is possible to deduce continuous details, medieval settlement cores, ancient main streets, etc. The continuity of the interior of the settlements can be proved by examining local traditions, primarily historical and archaeological sources, as well as by analyzing historical maps.

4.3. The third question was whether there was a difference in the geographical distribution of morphological types in the sample areas. Morphological data on the structure of a total of 182 settlements in the

counties of Solt, Bács, and Bodrog could be collected from written sources, manuscript and printed maps, and aerial photographs (*Table 1*). Of these, 63 were villages or market towns with a spindle structure and 78 with a simple linear morphology. In the case of 41 settlements, it is not possible to determine clearly to which version it may have belonged. There are settlements with a special floor plan, usually adapted to some natural formation (height, river, lake bed), with a special structure (*Figure 5*).
There are no data on the conglomerated settlement form from the Middle Ages in the sample areas, it is probable that in the period before the occupation this structural variant was very rare in the Danube-Tisza Intefluve Region (I. SZABÓ 1969, F. MAKSAY 1971). The examination of the settlements shows that in the first half of the 16th century, in the decades following the battle of Mohács, the influx of the population into more protected places („Three Cities" > Kecskemét, Nagykőrös, Cegléd, villages/market towns along the Danube) started. As a result of this process, the plots of the inner areas became fragmented over time, and smaller plots/streets formed. The previously arranged image of the settlement gradually became aggregate.

County	Estimated settlement population at the beginning of the 16th century (pcs)	Known layout (%)		Unknown layout	Layout type		
		pcs	%		street /row settlement	spindle structured settlement	uncertain liner settlement
Solt	172	55	32,0	117	36	1	18
Bodrog	194	27	13,9	167	10	4	13
Bács	300	100	33,3	200	32	58	10
					78	**63**	**41**

Table 1. Distribution of settlement types in the sample areas (own editing)

4.4. The fourth question concerned the demonstration of the continuity of settlements and the relationship between the Middle Ages and the present interior. It is necessary to create a database based on interdisciplinary research, based on which the timelines of the settlements can be constructed, and the destruction and relocation of villages and market towns can be observed. It is important to monitor the effects of the major cataclysms that caused a great wave of settlement destruction (the Turkish exodus after the

battle of Mohács in 1526, the Turkish campaign of 1529, the 15-year war, the campaigns of the 17th century, and the last liberation wars) at the settlement level. In addition, it is necessary to compare local traditions, local history literature, and the results of previous archaeological research to see if reliable, probative data is available on the history of the given settlement.

4.5. The fifth question concerns possible directions for moving forward. The methodology presented in the dissertation could be applied with great efficiency in the topographic reconstruction of the settlements of the three counties that existed in the occupied area. Even though in Bodrog County the drawing of the borders and the identification of the medieval tofts and crofts were problematic by region, it was possible to reconstruct the medieval and early modern conditions much more accurately than the map of Pál Engel (ENGEL P. 2001, FÓTI M. – PÁNYA I. 2022). In the future, on the one hand, more precise results could be achieved by refining the methodology and extending the examination of the primary medieval written data (see the previous question). On the other hand, as described in the first question, the study could be extended to other parts of the Ottoman Hungary (Szerém, Valkó, Csongrád, Arad, Békés, Csanád, Krassó, Temes, Torontál and Szörény Counties). The listed counties were located in the southern part of the Kingdom of Hungary. In the case of the counties occupied by the Ottomans and located in the central part of the country, the historical-topographical works of the settlements were completed in several places, which examined the medieval settlement network of the given region with varying methodology, accuracy, or approach (STIBRÁNYI M. 2015., K. NÉMETH A. 2015A-B, ROSTA SZ. 2014., PÁLÓCZI HORVÁTH A. 2022). Based on these works, the methodology described in the dissertation could form a better and more accurate picture of the settlement network of other parts of the occupation and the morphology of the localities. In addition, the presented methodology may be suitable for the study of the medieval settlement network that existed in the territory of the Kingdom of Hungary, Transylvania, and the Partium.
On the one hand, it is necessary to adapt the methodology to the given region, to focus on local peculiarities and uniqueness when exploring the sources and applying the methods. We also find destroyed settlements in the western and northern and eastern parts of the Kingdom of Hungary, but their number does not approach the values of the deserted settlements of Bodrog, Bács, and Csongrád Counties.

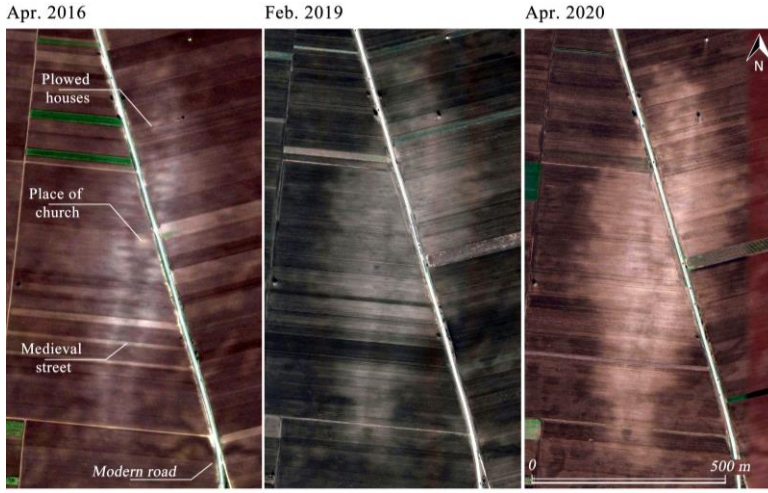

Figure 3 Traces of a ruined medieval settlement with a spindle structure on a plowed surface (South of Kiszács / Kisač SRB, based on Google Earth satellite imagery)

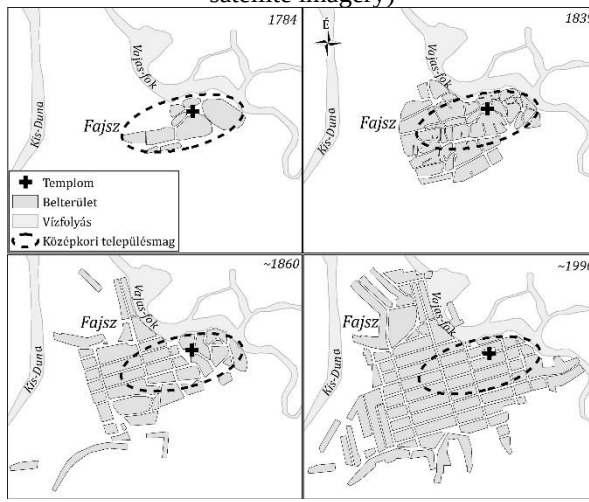

Figure 4 Location of the medieval settlement core of Fajsz (own editing)

4.6. The sixth question concerns the social/economic benefits of research results. I believe that the significance of the methodology presented in my dissertation lies in the fact that it provides an opportunity for the modern, GIS-based examination of areas/counties that have been left out of the forefront of Hungarian historical topographic research. In addition, the parts of the Carpathian Basin that suffered less destruction during the Ottoman occupation, and thus the continuity and the resources are favorable at the landscape and settlement level, can be examined with good efficiency.

The results of previous historical/geographical/archaeological studies can also be greatly refined based on the experiences of Solt, Bodrog, and Bács counties. An example of this is the work of András Kubinyi presenting the settlement network of the Great Plain, which the author created from archival and literature sources (A. KUBINYI 2000). Kubinyi determined the hierarchical classification of settlements partly based on the geographical position of the settlements and their role as road junctions. As he did not know the conditions of the Danube-Tisza Interfluve Region, he did not depict many settlements on his map, and in many cases, he misdefined their location and the roads associated with them, so we have to criticize the scores assigned by Kubinyi to the settlements. Clarification and supplementation of this work are also important because it is one of the basic works that are referenced and used in many historical and geographical kinds of research. Pál Engel's GIS-based database was also published in 2001 as a work based mainly on archival research and manuscript maps (P. ENGEL 2001). Both Engels's and Kubinyi's work lacked field research, and the consequence of this is that we can find inaccuracies and typographical errors in the areas of Ottoman occupation. I think that the modernization of Engel's work, its replacement with a more accurate and detailed database, especially in the areas of occupation, can be done effectively based on the method presented in my dissertation.

In addition, it is time to perform a new topographic reconstruction covering the Carpathian Basin with the detail presented in the dissertation. This could be a continuation of the volumes published during the National Atlas of Hungary project. It would be beneficial for libraries, schools, and universities to make it available in printed form so that it would be accessible to anyone in public education. However, due to the continuous growth of the data and the more and more accurate reconstruction, there is a need for an online, map database, which could be updated and expanded with the data of the partner institutions and experts (ecologists, archaeologists, historians, geographers, ethnographers) participating in the research at specified intervals.

Finally, it is important to mention that the studies/repositories/atlases/maps resulting from the application of the methodology described here can be used for several purposes. From the point of view of local history and public education, these future publications may be of key importance in reviving a certain degree of regional / county/settlement identity. In the case of industrial investments, it is extremely important to delimit the traces of settlements and reduce the costs of archaeological excavations. At the same time, in the case of tourism developments, the knowledge of the place and chronology of medieval antecedents may be important in the development of historical-themed attractions (memorial sites, memorial parks, visitor centers, etc.).

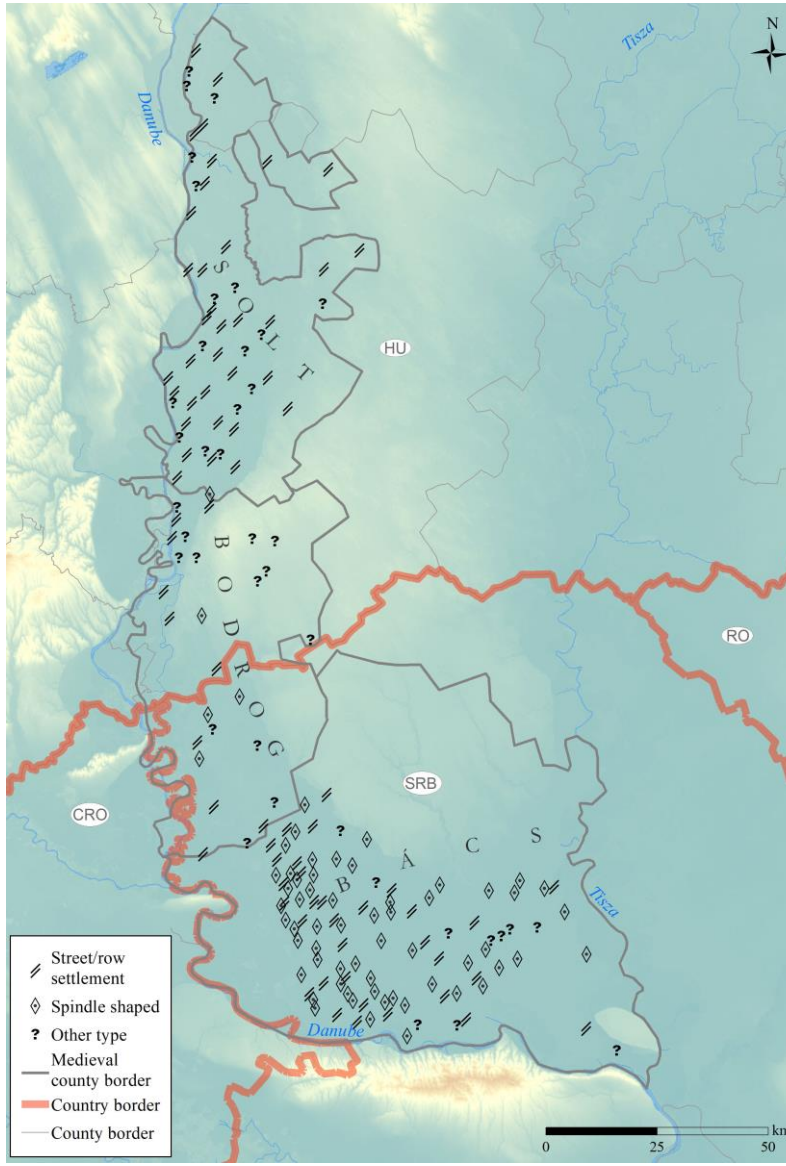

Figure 5 Medieval settlements of Solt, Bodrog, and Bács counties with known morphology (own editing)

Publications used for the dissertation

PÁNYA I. 2017a: Történeti Településföldrajzi kutatások Bács-Kiskun megyében 2011–2016. – Településföldrajzi tanulmányok pp. 91–107.

PÁNYA I. 2017b: A solti szék történeti földrajza. – Történeti földrajzi közlemények pp. 84–95.

PÁNYA I. 2017c: Fejér megye solti székének történeti földrajza. – Alba Regia 45. pp. 135–180.

PÁNYA I. 2019: Possibilities and methods for the reconstruction of the settlement structure of medieval Bodrog County. – Banatica 28., pp. 321–352.

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