



THE

# Hungarian Historical Review

NEW SERIES OF ACTA HISTORICA  
ACADEMIÆ SCIENTIARUM HUNGARICÆ

*Environments of War*

VOLUME 7 NUMBER 3  
2018

Institute of History, Research Centre for the Humanities,  
Hungarian Academy of Sciences



# The Hungarian Historical Review

New Series of Acta Historica  
Academiae Scientiarum Hungaricae

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## *Environments of War*

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Special Editors of the Thematic Issue

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# Not Seeing the Forest for the Trees? Ottoman-Hungarian Wars and Forest Resources\*

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The present paper analyzes the relationship of the Ottoman wars to the loss of forests in the Carpathian Basin. An important thesis of twentieth-century scholarship was that the Ottomans were to be blamed for the crash of the so-called “traditional” landscape of the lowlands of the Carpathian Basin. The paper argues that this view needs serious reconsideration, especially in light of research into two interconnected aspects found in a Hungarian region, Transdanubia, that is the focus of the paper. First, we estimate the amount of woodland before and after the Ottoman occupation. Second, we quantify the role military fortifications may have played in wood consumption (and therefore potentially in deforestation). We focus on the central parts of the Transdanubian region. The counties to be examined in more detail (Vas, Veszprém, and Zala) were among those most significantly impacted by the continuous wars in the sixteenth and seventeenth centuries. This area arguably could be indicative of processes in other lowlands and hilly areas in the Carpathian Basin, though bearing in mind that forest regeneration may have been fundamentally different in the territories of lowlands, hilly areas, and mountain ranges.

Keywords: environmental history, Ottoman Hungary, forest cover, timber consumption, earth and wood fortifications

## *Introduction*

The political changes of the sixteenth century significantly transformed the spatial and economic structure of the Carpathian Basin. The Ottomans’ gradual occupation of the Great Hungarian Plain and the Transdanubian region (lands to the south and west of the Danube) in the aftermath of the battle of Mohács (1526) led to both settlement concentration and desertion. In this period, Hungarian humanist authors as well as folk songs and other literary sources frequently recall the time before, during the Middle Ages, when the land of

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\* The research done by András Vadas was supported by the ÚNKP-17-4 New National Excellence Program of the Hungarian Ministry of Human Capacities. The research done by Péter Szabó was supported as a long-term research development project no. RVO 67985939 from the Czech Academy of Sciences.

Hungary was rich and fertile. It is juxtaposed to the recent devastation of the country.<sup>1</sup> This narrative has proven to be a lasting one. Research conducted in the interwar era perceived the Ottoman period (which lasted until the end of the seventeenth century) as one of complete devastation or at a minimum a deep crisis of the land. The most important thesis was that the Ottomans were to be blamed for the crash of the so-called “traditional” landscape of the lowlands of the Carpathian Basin. Two prominent historians of the interwar period, Bálint Hóman and Gyula Szekfű, echoed this view in their *Hungarian History*. In Szekfű’s chapter on the seventeenth century, the Great Hungarian Plain was characterized in apocalyptic terms:

The running wild of the Hungarian landscape (...) is the direct consequence of the desertion of the areas south of the Győr–Budapest–Debrecen line. (...) Villages were destroyed, people and livestock left the area; they fled or were taken into Ottoman captivity. As we shall see, instead of twenty-five or thirty villages, only one mid-sized market town was left, the inhabitants of which possessed 2–300,000 acres of uninhabited wasteland [*pusztá*]. With people leaving, the reign of grasses started. Lands became covered in grass; here it became a sand dune, and there it turned into salt marsh. The whole plain became fallow, the remaining forest could no longer provide enough moisture, [and] with the loss of moisture the wasteland started to expand again, which the Hungarians of the previous centuries thought to have cast away for good from Hungarian soil. (...)<sup>2</sup>

The image of settlements being abandoned due to Ottoman plundering, and forests and plowlands becoming wastelands, was later criticized by ecologists, historians, and archeologists. Forestry experts were critical of this theory already in the interwar era.<sup>3</sup> In more recent literature, the period features not so much as one of crisis but more as a time of changes necessitated by the presence of the Ottomans. Nonetheless, because of the political situation and climatic processes (which included some of the harsher phases of the Little Ice Age), scholarship indirectly describes this period through a narrative of decline.<sup>4</sup> One of the cornerstones of this decline narrative is the loss of forests in the Great Hungarian Plain and Transdanubia and the expansion of marshes in the

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1 See e.g. Oláh’s *Hungaria*. Olahus, *Hungaria–Athila*. See also: Szilágyi, “Figures and Tropes.” (in preparation).

2 Hóman and Szekfű, *Magyar történet*.

3 Vági, “Van-e hazánkban;” Weidlein, “A dűlőnévkutatás;” and Kaán, *Alföldi kérdések*, 11–43.

4 E.g., Rácz, *Steppe to Europe*, 137–40 and 174–77.

lowlands. Referring to the loss of forests is especially prevalent in the context of the frontier zones of Ottoman-Hungarian wars, where in many cases the literature assumed total deforestation.

The literature traditionally used two kinds of evidence. Medieval sources, especially foreign narratives, almost always referred to the richness of forests in the Carpathian Basin. Nonetheless, this richness has to be considered in context. Most chroniclers came from Western Europe, especially from the northern parts of present-day France, the Low Countries, and present-day Germany.<sup>5</sup> Compared to these areas, the Carpathian Basin was relatively rich in forests. By contrast, accounts from the Early Modern Period refer to huge wastelands, probably exaggerating the devastation by the Ottomans. The low proportion of the forests in the Great Hungarian Plain that is evident in all historical material from the eighteenth century onwards coupled with the traditional anti-Ottoman viewpoint resulted in the attribution of a major loss of woodland to the Ottoman presence. Changes in the function of woodlands in this area are clear from a number of sources,<sup>6</sup> but changes in the extent of woodlands are hard to demonstrate based on the archival sources available for either the pre- or the post-Ottoman period. As a result, a comprehensive reevaluation of landscape changes in the areas affected by the Ottomans either by their constant presence or through occasional plundering remains to be done.<sup>7</sup>

Within the limits of the present paper, we cannot attempt to offer a complete evaluation of the consequences of the Ottoman occupation for Hungarian landscapes or even for forests. Instead, we will focus on two interconnected aspects in a single, spatially limited area. First, we will try to estimate the amount of woodland before and after the Ottoman occupation. Second, we will quantify the role military fortifications may have played in wood consumption (and therefore potentially in deforestation). We will focus on the central parts of the Transdanubian region. The counties to be examined in greater detail (Vas, Veszprém, and Zala) were among those most significantly impacted by the continuous wars in the sixteenth and seventeenth centuries. This area arguably could be indicative of processes in other lowlands and hilly areas in the Carpathian Basin, but one should bear in mind that forest regeneration may have been fundamentally different in areas of lowlands, hills, and mountain ranges.

5 On the foreign travelers in medieval Hungary, see: Nagy, "The Towns."

6 Vadas, "A River Between Worlds," 242–58.

7 Criticisms against this view arose due to several different aspects: Szakály, *Magyar adóztatás*; Bartosiewicz and Gál, "Ottoman Period." Most recently: Sárosi, *Deserting Villages*, 57–94.

### *Changes in Woodland Cover in the Ottoman Period*

The easiest way to assess the direct impact of the Ottoman occupation for woodland cover in the Carpathian Basin would be to compare solid quantitative data from the early sixteenth and the late seventeenth centuries. This, however, is not possible. Late medieval data, as we shall see, is highly fragmented and can be at most indicative of the general situation. At the other end, there are probably more data for the late seventeenth century, but these data remain unprocessed. The first reliable account of woodland cover in the Carpathian Basin is from the 1780s, almost a century after the Ottomans were driven out of the area.

For the Middle Ages, the best available sources to describe the proportions of different land-uses are the so-called estimations. An estimation was a legal procedure during which the lands of a noble landlord were appraised to establish their monetary value. Because different land-uses had different values, the resulting surveys included data on the amount of arable land, meadows, woods, pastures, vineyards, etc. within various administrative units. One of us compiled a database of late medieval estimations in the early 2000s.<sup>8</sup> This database contains material for approximately one percent of the territory of the Carpathian Basin. The database is undoubtedly in need of updating and with all medieval charters now available in a digital form (which was very much not the case when the database was originally compiled), probably significantly more estimations could be found. However, this additional work still remains to be done and for the present we have to make do with the existing database. At least some data are available for eight counties in Transdanubia (either partially or entirely): Veszprém, Zala, Vas, Esztergom, Baranya, Sopron, Komárom, and Tolna. There is no data for Somogy, Fejér, Pilis, Győr, or Moson counties. Taken as a whole, the data show that Transdanubia was 56% wooded before the Ottoman occupation (33,117 ha. of woodland out of a total of 59,573 ha. of land with data). And yet the actual woodland cover in the period and region likely has to be estimated downward because less wooded counties (e.g., Fejér, Győr, Komárom, Tolna) contributed little or no data to these high percentages. Most of the data comes from a handful of wooded counties, and the most wooded parts of those counties. Thus if we average the percentages recorded for separate counties, we end up with a figure of 39%.

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8 Szabó, *Woodland and Forests*.

If we turn our attention to the counties of Veszprém, Zala, and Vas, we see high percentages: 82% for Vas (18 settlements with data), 58% for Veszprém (16 settlements with data), and 47% for Zala (8 settlements with data). Even in the case of these three counties, which are relatively well covered by estimations compared to the other counties in Transdanubia, data is available for less than 5% of their territories. Nonetheless, the estimations suggest that Vas County was the most wooded. The county in the eleventh and twelfth centuries was defined by the frontier protection system usually referred to in the scholarly literature as *gyepű*.<sup>9</sup> This area was settled somewhat later than most lowlands of the Carpathian Basin, which may explain why there were more woodlands here than for instance in Veszprém County. However, more than three-quarters woodland cover may be somewhat exaggerated. This may stem simply from the fact that the few villages described by the estimations lay in more forested areas. Veszprém County had fewer forests, but that still meant almost 60%. Most of the county lies in a hilly region dominated by the forested slopes of the Bakony Mountains. Bakony was among the Royal Forests dating back to the Árpadian period. Until the late medieval period the Forest was scarcely settled because of its use as a hunting ground. From the fourteenth century onwards the administrative structures of the Royal Forest gradually disappeared and woodland cover probably decreased.<sup>10</sup> Zala was the least wooded of the three counties as suggested by the estimations. Its still significant woodland cover may be partly explained by the fact that until the twentieth century the county included large parts of the Bakony Mountains. In sum, the data provided by estimations are anything but precise. They indicate that the three counties under study were well-wooded, but this really only means the Bakony Mountains for certain, where most of the available data come from. Overall, woodland cover in the counties was most probably lower than percentages shown by the estimations, but it would be difficult to say by how much.

As mentioned above, the first comprehensive dataset about woodland cover in the Carpathian Basin originated in the 1780s, when most of the territory of the Habsburg Empire (including Hungary) was mapped for military purposes. The research potential of the sheets of the First Military Survey was amply demonstrated for example in the Great Hungarian Plain.<sup>11</sup> As the present study

9 Herényi, *A nyugati gyepű*.

10 On the Bakony Forest, see: Szabó, *Woodland and Forests*, 119–27.

11 Molnár, “A Duna-Tisza köze;” Bíró and Molnár, “Az Alföld erdei;” 169–206; and Pinke, “Alkalmazkodás és felemelkedés.” Based most likely also on the First Military Survey, Bartha and Oroszi (“Magyar erdők;”

focuses on Transdanubia, which lacks a similar study, we chose to analyze forest cover in the region including the three counties of Vas, Veszprém, and Zala. Altogether 1,453 sheets were prepared for Hungary, Transylvania, and the Temes region.<sup>12</sup> From these sheets 235 cover the territory of Transdanubia. The method we chose to estimate woodland cover is relatively simple. Each sheet was divided into a grid of 6x4, after which each grid was further divided into 3x3 smaller cells, resulting in altogether 216 cells per sheet. Each cell represents approximately 1 km<sup>2</sup>. We estimated whether forests or other land uses were dominant in each cell. The number of forested cells represented woodland cover for each map sheet. This is not the most sensitive or sophisticated method to estimate woodland cover, but the results can be considered reliable at the given resolution. The whole territory of Transdanubia consists of ca. 42,700 cells, of which approximately 15,000 cells comprised the counties of Vas, Veszprém, and Zala. Overall forest cover in Transdanubia in the 1780s appears to have been around 32%. The three counties analyzed here had somewhat more forests than the region as a whole (Vas 37%, Zala 38%, and Veszprém 39%). In general, lowland areas everywhere in the Carpathian Basin had fewer forests than uplands and mountain areas, hence the higher proportion of woodlands in these counties than for instance in the neighboring Somogy, Győr, or Moson counties.

When comparing late medieval and late eighteenth-century data, there is an apparent loss of woodland. For the whole of Transdanubia, late medieval estimations show ca. 56% woodland cover as opposed to 32% in the 1780s. For the three counties of Vas, Zala, and Veszprém, a similar decrease can be observed. It should also be noted that whatever differences existed between the three counties around 1500, they were gone three centuries later. It would be easy to interpret the above percentages at face value and ascribe the effect to the Ottoman occupation. However, there are good reasons to be cautious. As for Transdanubia as a whole, we have argued above that the ca. 56% woodland cover recorded in late medieval estimations was almost certainly too high, and a different interpretation of averages indicate a 39% woodland cover. This means that the actual difference in medieval and late eighteenth century woodland

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221–31) published an estimate of the forest cover in the 1780s for the whole territory of present-day Hungary. According to them, at the time woodland cover was 29.7%. Unfortunately the authors did not refer to the method or sources they used. In any case, their result seems too high. Forest cover on the Great Hungarian Plain, which covers almost 50% of present-day Hungary, was ca. 3.5% in the late eighteenth century. An overall 29.7% woodland cover for the entire country would have meant more than 50% for Transdanubia, which is highly improbable in light of our own results.

12 For overall numbers for the Carpathian Basin, see Szabó, *Changes in Woodland Cover*, 112–13.

cover was in all probability considerably less than 24%, and much closer to 10%. This holds true for Vas, Veszprém, and Zala counties as well. The other reason for caution is that the First Military Survey did not record the situation right after the Ottoman occupation but an entire century later. This century was a time of large-scale rebuilding and recolonization. Between 1711 and 1790, Hungary's population increased more than twofold, from ca. 4 million to ca. 10 million, and in the case of these three counties more than threefold.<sup>13</sup>

The two main processes that concern us in this paper are settlement abandonment and (re)colonization. It is beyond doubt that many settlements were abandoned during the Ottoman occupation, especially in the frontier zone between Hungary and the Ottoman Empire, where continual warfare made settled agriculture highly risky. That said, it would be difficult to estimate the rate of settlement desertion partly because of the difficulties in comparing Hungarian and Ottoman sources and partly because 'desertion' itself is a complicated term and what was referred to by this word had been widespread in Hungary already before the Ottoman period.<sup>14</sup> Nonetheless, at least in Transdanubia, settlement abandonment implied reforestation. Any piece of land left by human inhabitants quickly turned into scrubland and then into forest. This is typical of the hilly areas where woodland regeneration can take place easily, especially compared to the lowlands such as the Danube–Tisza Interfluve. The other process was (re)colonization after the Ottoman period. This concerned areas of former settlements as well as areas without former inhabitation. In these territories, forests had to be cleared to make space for people and arable lands.<sup>15</sup> There were at least three different forms of forest clearance to which seventeenth- and eighteenth-century Transdanubian sources refer. In areas with larger trees, the most effective form of clearance was cutting the trees with axes and then getting rid of the stumps and the remaining scrub with grub axes. This has been identified by research to have been present in many areas in Transdanubia. Another common form of forest clearance was ring-barking (in Hungarian *kerengetés* or *aszalás*). Settlement and place names as well as other sources attest to the existence this form of clearing also in Transdanubia.<sup>16</sup> The process itself was rather slow. The bark, cambium, and sapwood of individual trees were damaged in a circle to the extent that the tree could no longer transport enough water

13 Cf. R. Várkonyi, "a természet majd," 32.

14 See most recently: Nógrády, "Az elakadt;" and Sárosi, *Deserting Villages*.

15 Takács, *Egy irtásfalú*; idem, *Irtásgazdálkodásunk*.

16 Takács, "A régi gazdálkodás."

and nutrients in its tissues. This resulted in the drying out and eventual death of the trees. The quality of these trees was usually good, because the timber did not warp. The third and fundamentally different form used in Transdanubia for woodland clearance was burning.<sup>17</sup> This may have been used in a rather limited area as less income could be generated by the burning of the standing trees than by harvesting and selling them.

As an example of the resettling process, we will briefly discuss the above-mentioned Bakony Mountains. The area was very much affected by the Ottoman wars in the sixteenth and seventeenth centuries. After Székesfehérvár, in the center of Transdanubia, fell to the Ottomans in 1543, there were repeated Ottoman military campaigns and raids in and around the Bakony. Many of the settlements either shrank in size or were abandoned in the course of the sixteenth century. Unlike other regions that were under permanent Ottoman control, the area north of Lake Balaton experienced fewer military campaigns and raids in the seventeenth century. This resulted in an earlier resettling of the area. Resettlement was also more gradual than in areas that were under Ottoman control for one-and-a-half centuries. This is visible in the forms of forest clearance as well. The sources here do not mention clearance by burning, but often refer to ring-barking.<sup>18</sup> A number of new settlements emerged from the mid-seventeenth century onwards.<sup>19</sup> This was not unique to this area: similar processes may be identified, of course with some chronological differences, in other areas of the middle mountain range of Transdanubia. As has recently been shown, in the areas under permanent control by the Ottomans, i.e., the southern half of Transdanubia, the resettlement process started only after the Ottomans were expelled or only after the end of Rákóczi's War of Independence (1703–1711).<sup>20</sup> The examples from this region very clearly point to a loss of forests in the eighteenth century via systematic clearances.<sup>21</sup> The transformation of forests into arable land was a rather slow process. This was shown in the most detailed manner through the example of Várong, a small village in the hills of Tolna

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17 On the forms of forest clearance from the turn of the eighteenth century used in southern Transdanubia, see: Hofer, "Déldunántúl," 151–52; Máté, "A Mecsek-vidék," 153–55; and Máté, "Landscape." For Somogy County, see: T. Mérey, "Az erdőgazdálkodás," 133–34.

18 Hegyi, *A népi erdőkielés*.

19 For the Bakony Mountains and the Bakony Forest, see above: note 9.

20 Máté, "A Mecsek-vidék," and "Landscape Reconstruction," with reference to the existing literature.

21 Weidlein, "A dűlőnévkutatás;" Reuter "Földrajzinév-gyűjtések;" Takács, *Egy irtásfalu*; K. Németh and Máté, "Vázlat a pusztafalvak;" and Máté, "Landscape Reconstruction," esp. 117–19.

County in the southeastern part of the Transdanubia.<sup>22</sup> It took almost a century for the people who settled here to reintroduce the two- and three-field systems that had been widespread by the late medieval period. It took also surprisingly long for the settlement itself to settle on a fixed location. In addition to forest clearance through settlement, the rebuilding of the country's infrastructure—roads, bridges, embankments, water regulation works, etc.—required massive amounts of timber.<sup>23</sup> Nonetheless, and in spite of complaints to the contrary, until the end of the eighteenth century, wood was probably not a scarce resource in the areas that the Ottomans wars had previously affected.<sup>24</sup>

### *Military Defense and Timber Consumption in the Sixteenth and Seventeenth Centuries in Central Transdanubia*

One of the most prevalent motifs in discussions about the effects of the Ottoman occupation on Hungarian woodland is timber consumption for military purposes, especially for palisade fortifications. A number of works suggested that the construction of hundreds of new fortifications from the 1540s onwards as well as their maintenance for one-and-a-half centuries represented significant pressure on forests and was one, if not the most important, cause of deforestation. Other scholars voiced more cautious opinions.<sup>25</sup> Our main goal is to reconsider how much timber was used for the building and maintenance of the numerous fortifications and fortified watchtowers (also referred to in the literature as palisades, earth and wood fortifications, and *palankas*) that stood in the three analyzed counties of Transdanubia in the Ottoman period. We will attempt to achieve this goal by quantifying and comparing consumption (the number of fortifications and the amount of timber needed to build and maintain them) and production (the woodland area necessary to produce the given amount of timber).

Two basic types of sources are available to study timber consumption: written and archeological. As to the first type, Sándor Takáts published dozens of works on the history of the Ottoman period based on archival research he carried out

22 Takács, *Egy irtásfal*, 19–44.

23 For spheres of timber consumption at the time, see: R. Várkonyi, “a természet majd,” 37–43.

24 Cf. Magyar, “Az 1715–1720-as összeírások,” 232. Unlike Magyar, R. Várkonyi suggests that this resulted in a major environmental crisis: R. Várkonyi, “a természet majd.”

25 Rácz, *From Steppe, Ágoston*, “Where Environmental;” Ágoston and Oborni, *A tízenbetedik század*, 88–92; Szabó, “Erdők a kora újkorban;” and most recently, Sárosi, *Deserting Villages*, 35, 41, and esp. 55.

in Vienna at the end of the nineteenth and beginning of the twentieth century. In the absence of later systematic research on this issue, scholars ever since have used his data to demonstrate large-scale timber and fuel wood consumption during the Ottoman period in the fortifications of the border defense systems.<sup>26</sup> In addition to being highly scattered both geographically and temporally, the numbers provided by Takáts are difficult to use as they always describe wood consumption for one single fortification in a single year, which tells nothing about the details or breakdown of consumption. István Sugár followed a different approach in the 1990s. He studied the timber acquisitions of the castle of Eger, one of the most significant border castles on the northern edge of the Great Hungarian Plain, in the mid-sixteenth century. He looked at the supply zones for different types of wood. He showed that timber was usually brought to the castle from the neighboring forests, but the data also show the acquisition of wood from as far away as Maramureş, some 300 kilometers east of Eger. This latter piece of information cannot be taken as a sign of the lack of wood in the neighborhood as in most cases the castle was supplied from within a radius of a dozen kilometers.<sup>27</sup> Regarding archeological data, archeologist Gyöngyi Kovács and paleoecologist Pál Sümegi recently published a short but important study.<sup>28</sup> By examining the physical remains of palisades, they attempted to calculate the amount of timber needed to build such fortifications. In our view, the best approach to understanding the impact of the military constructions on forest cover is a combination of such archeological data with a reasonably comprehensive view on the number and types of fortifications.

Relatively little attention has been paid to palisade fortifications until recently, because they were believed to have been quite simple architecture,<sup>29</sup> and only a few of them had been properly excavated.<sup>30</sup> From the point of view of our goal, the most important question is the structure of the walls. When trying to estimate the amount of timber used to build and maintain various fortifications, one of the basic features is the number of logs used per meter of wall.

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26 R. Várkonyi, “Környezet és végvár,” 17–19; Ágoston, and Oborni, *A tizenhetedik század*, 90–91; Ágoston, “Where Environmental,” 74.

27 Sugár, “Az egeri vár,” 177–78.

28 Kovács and Sümegi, “Palánkvárak, fák, erdők.”

29 See the influential work of Pataki, “A XVI. századi várépítés.” A partly different view is reflected in: Takáts, “A magyar vár,” and Takáts, *Rajzok*, II, 1–132. For a more recent discussion of wooden fortification, see most importantly the works of György Domokos. See also: Tolnai, *Palánkvárak*.

30 For a short overview, see: Mordovin, “The Post-Medieval Fortifications.”

Before giving a brief overview of the fortification types it is important to note that there was no major difference between the building techniques used by the Ottomans and the Hungarians (Habsburgs).<sup>31</sup> The scholarly literature usually refers to three major types of fortifications. The first, the so-called *latorkert*, may have been the simplest solution to provide a building with at least some protection. It was basically a palisade created by logs driven in next to each other at small intervals and had a wattling to connect these logs. This did not require much technological knowledge from the builders and was used frequently to provide protection to watchtowers (the *górés*), manor houses, late medieval palace buildings, or churches. It was also used as an exterior defense line for more elaborate earth and wood fortifications. The amount of timber needed for these fences was relatively high compared to their limited defensive role, as the logs were driven in at narrow intervals.<sup>32</sup>

More elaborate types of wooden fortifications had logs driven into the ground in two parallel lines. The two lines were formed by logs at somewhat greater intervals than in the case of simple palisades. In order to strengthen the structure, the logs were joined by branches. The best type of wood for connecting the logs was probably willow, but it seems that all kinds of branches were used to strengthen the structure of the walls.<sup>33</sup> Earth was filled in between the two lines of logs, which gave considerable thickness and strength to the walls and provided much better protection than simple wooden palisades. The amount of earth likely required was a huge quantity, as in some cases the two lines of logs were relatively distant from each other, sometimes well over a meter. In some cases, as it has been recently demonstrated by the example of the fortifications of the town of Szécsény in the northern Hungary, besides the two lines of logs, there was a thick embankment erected that was also strengthened with logs.<sup>34</sup> The third type of fortification that has been identified in the scholarship is similar to the previous one, except that the logs in these fortifications were joined not only by branches but also by iron bands, making the fortification even more difficult to besiege.<sup>35</sup>

31 See: Takáts, *Rajzok*, II, 1–132 (for the Hungarian side) and Stein, *Guarding the Frontier*, 53 (for the Ottoman side).

32 For an overview of the types of fortification, see: Takáts, “A magyar vár,” and Tolnai, *Palánkvárak*.

33 Imre Szántó, “A végvári rendszer,” 6–7. See also: Bende, “A törökkori magyar,” 514.

34 Mordovin, “The Post-Medieval Fortifications,” 280. Similarly thick walls were identified by archeological excavations at Bajcsa and other sites as well.

35 See e.g. the building works of Kanizsa using iron bonds in 1558: Takáts, *Rajzok*, II, 21.

As a starting point in providing an estimate of the wood consumption of Ottoman-period fortifications in Vas, Veszprém, and Zala counties, a database of all the defensive structures had to be created. At least a few parameters had to be defined in order to calculate the timber needed for a specific fortification: first, its size and shape; second, its structure. It is to be noted here that the calculations provided below could not include the timber consumption related to buildings inside the various fortifications. These buildings inside the walls were also significant consumers of wood. However, partly because we lack comprehensive research on these buildings, any estimates would well exceed the uncertainties connected to calculating the fortification walls themselves. In any case, probably the most important consumers were the fortification walls, and these had to be maintained more regularly than the timber used in buildings. It should also be noted that in a number of cases, combinations of palisades and stone fortification existed: there was a palisade that encircled a large area, inside this perimeter there was an earth and wood defensive wall to protect the inner stone or brick castle. For instance, in the case of the castle of Kanizsa, one of the most significant fortifications in western Transdanubia, there were at least three parallel walls protecting the stronghold.<sup>36</sup>

Different numbers of logs were needed for a castle that stood for a decade compared to one that was in use for the more than 150 years of Ottoman presence in Transdanubia. Fortifications also had to be reconstructed on a regular basis because of the natural deterioration of the materials as well as damage from sieges, fires, and so on. It is challenging to estimate how long logs could last on average, how often the branches had to be repositioned, and how frequently minor earth filling works were conducted.

Some of these problems are easier to deal with than others. There is little chance of knowing what type of fortifications stood in different places. In some cases written evidence gives detailed insights into the structure and size of fortifications, such as in Körmend, Kanizsa, Győr, Pápa, Bajcsavár, and about a dozen others. However, there were many more small watchtowers and minor castles about which little is known apart from their approximate location. Similarly, the length of time fortifications were in operation is difficult to ascertain. In some cases there are precise data on the beginnings of the fortification in a certain place, on extensions during the wars, etc. In other cases, either because of the lack of research into a fortification, the loss of sources,

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36 Takáts, *Rajzok*, II, 21. See in more details: Méri, *A kanizsai várásatás*.

or simply because of its short existence, there are only a few references, or just single one, to a fortification. This is especially true for small fortifications similar to *górés* or small watchtowers surrounded by a wooden fence.

These points set a number of barriers to a reliable calculation of the timber consumption of the fortifications in Transdanubia, but our goal is to achieve a rough understanding of the scale of timber consumption in order to evaluate how important the Ottoman period and the military activities may have been in the change of forest cover in Transdanubia.

We had to make a number of methodological decisions and restrictions in order to arrive at some conclusions. We had to accept that it is impossible to collect all archeological and historical data on each of the fortifications as part of the present research. We had to find a way to make some generalizations. Three major tasks had to be accomplished to achieve this. First, we had to estimate the average perimeter of fortifications at different levels of importance; second, we had to decide whether to assume a single palisade or a more complex earth and wood fortification wall; and third, we had to estimate how long the timber of the fortifications lasted, i.e., approximately how often logs had to be replaced by new logs.

Thanks to the meticulous research of the past few decades, one can attain a relatively precise view of the size and perimeter of a number of fortifications and also the size of the garrisons that were ordered by the Ottoman and the Habsburg–Hungarian military administrations to man them.<sup>37</sup> In cases where scholarly literature referred to the size of the fortifications, our task was relatively easy. However, in the majority of the cases, only the size of the garrisons ordered in different years was available. In order to estimate the number of logs used for fortifications of unknown size, we looked at data on garrisons to gauge an average size for the fortifications. Our assumption is that the number of men in a garrison had some correlation with the size, but of course this was not always straightforward. Another problem, discussed below, was the fact that the same fortification had garrisons of very different size in different periods of the Ottoman wars, even though according to the present state of scholarship many of these fortifications themselves did not change much in size. Despite these not negligible shortcomings, our solution still appears best suited to estimate the scale of the perimeter of these fortifications.

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37 For the Hungarian fortifications, see most importantly: Pálffy, “A magyarországi és délvidéki végvárrendszer,” Pálffy, “A török elleni védelmi rendszer,” and Hegyi, *A török bádoltság*.

We also had to estimate the wood consumption of the three different basic types of fortifications. One meter of the wall in different earth and wood fortifications required different amounts of wood. We tried to estimate both the average consumption of simple fences and of the fortification that had logs palisaded in two parallel lines.

The former is relatively easy. The post holes at the different fortifications suggest that 20- to 30-centimeter diameter logs were prevalent in these constructions. Estimating using the smaller version and relatively limited, ca. 10-centimeter gaps between logs, a meter of these walls consumed ca. 3 logs. The log consumption of more complex fortifications is somewhat less evident. The logs used here were basically the same size, but their intervals varied more. Recent research has produced important results in identifying the number of logs used for building these earth and wood fortifications. Based on the examples of the fortifications of Barcs, Bajcsavár, and Szécsény, the interval between two logs may have varied between 40 and 60 centimeters.<sup>38</sup> Estimating similarly with the smaller, 20-centimeter logs, set at 40 centimeter intervals to identify the greatest possible consumption, each meter of earth and wood fortification needed 3.2 logs for the more complex fortifications that had the logs in two parallel lines (1.6 for both line of logs). Because of the fairly close results in the case of the log demand of fences and earth and wood fortifications, we chose to calculate with three logs per meter for all types of structures. Some fortifications had inner and outer walls, or at least an outer palisade in addition to an earth and wood wall, but this only modified the calculation in a few individual cases.

As noted above, the size of the garrisons stationed in the fortifications varied significantly in different years on both sides of the frontier. When data are available, we used numbers based on the sixteenth-century garrisons from the earliest sources published by Klára Hegyi on the Ottoman side of the frontier and the sources published mostly by Géza Pálffy, László Vándor, and József Kelenik on the Hungarian side. We tried to avoid the most important biases, the large garrisons during the Fifteen Years' War, as well as the slightly lower mid-seventeenth century numbers. We used the earliest possible data. Based on the garrisons of the fortifications, we identified three categories. The smallest fortifications had fewer than 50 men. The size of fortifications with a small but continuous presence of troops could, of course, differ significantly in wood consumption from a mere watchtower. Based on the size of well-

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38 Kovács and Sümegi, "Palánkvárak, fák, erdők," and Mordovin, "The Post-Medieval Fortifications," 278.

studied fortifications in Transdanubia (Csány, Főnyed, Szentgyörgy, Szenyér, and Tótfalu<sup>39</sup>), and assuming two logs from a single tree,<sup>40</sup> ca. 300 trees might have been enough to build the fortifications of a castle or watchtower of this scale. Castles with between 50 and 199 troops must have been larger based on the fortifications held by the Ottomans (Vál, Paks, Újpalánk, and Dombó<sup>41</sup>) and the Hungarians (Babócsa, Lenti, Fonyód, and Csákány<sup>42</sup>). The average number of trees required for these fortifications may have been ca. 600 trees. It has to be noted, however, that the numbers are not always straightforward; just to note one problem, some of the fortifications in the largest category, forts with more than 200 troops, were no larger or only slightly so than those with sometimes significantly smaller garrisons. The category with the most troops (200 and above) is more problematic than the smaller ones. They often housed not only troops but had significant civil populations as well. This makes the estimates less accurate, but because most fortifications in Transdanubia fell into the first and second categories, i.e., housed less than 200 troops, this problem does not significantly affect our calculations. Based on the size of some of the fortifications that fell into the third category, Berzence, and Paks<sup>43</sup> on the Ottoman side, and Körmend, Egerszeg, Kiskomár, and Bajcsavár<sup>44</sup> on the Hungarian side, we estimated that ca. 1,000 trees were required for their construction.

If precise data are available for individual fortifications, we of course used these data rather than the standardized sizes. In some cases the two are clearly different; one example is the town Keszthely, which had a relatively small

39 On Csány: Pálffy, "A magyarországi és délvidéki végvárrendszer," 170, Sági, "A zalacsányi török," 131–135, on Főnyed: Magyar and Nováki, *Somogy megye*, 48, on Szenyér: Vándor, "A zalai végvárrendszer," 95, on Szentgyörgy: Szatlóczki, "Szentgyörgyvár," 33–48, and on Tótfalu: Végh, *Egerszeg*, 156 and Baráth, "A Rába," 45.

40 Based on: Kovács and Sümegi, "Palánkvárak, fák erdők," 115.

41 On Vál: Hegyi, *A török bódoltság*, II, 614–26, and Terai et al., *Fejér megye*, 101–102, and 222, on Paks: Hegyi, *A török bódoltság*, II, 1153–61 and Miklós, *Tolna megye*, 293–94, on Újpalánk: Hegyi, *A török bódoltság*, II, 1162–66 and Gaál, "Turkish Palisades," 105–108, and on Dombó: Hegyi, *A török bódoltság*, II, 1216–24, Miklós, *Tolna megye várai*, 171–80 and Szabó, and Csányi, "Werbőczy."

42 On Babócsa: Pálffy, *A császárváros*, passim, Marosi, *XVI. századi*, 9 and Magyar, and Nováki, *Somogy megye*, 23–24, and later under Ottoman authority: Hegyi, *A török bódoltság*, II, 1312–19 and III, 1578–83, on Lenti: Marosi, *XVI. századi*, 16 and Végh, *Egerszeg*, 156, on Fonyód: Magyar, and Nováki, *Somogy megye*, 46–47, and on Csákány: Vadas, "Vízgazdálkodás," 220–21, and Baráth, "A Rába," 52.

43 On Berzence: Hegyi, *A török bódoltság*, II, 1320–26 and III, 1583–1589, and Magyar, and Nováki, *Somogy megye*, 38–39, and Paks, see above note 39.

44 On Körmend, see: Vadas, *Körmend*. See also: Kelenik, "A nemzetiségi megosztás," 108, on Egerszeg: Végh, *Egerszeg*, 30, on Kiskomár: Pálffy "A magyarországi és délvidéki," 149, and Róbert József Szvitek, "Kiskomárom," 45, and on Bajcsavár: Toifl, "Bajcsavár," 28.

garrison, around 100 people, but as the fortification surrounded the town's houses, it required significant amounts of wood. The area that the earth and wood fortification surrounded was ca. 400x500 meters.<sup>45</sup> The structure in this case was more elaborate than of just a wooden palisade: it had two parallel lines of logs with earth filled in-between them. Building this fortification probably required ca. 5,400 logs, i.e., 2,700 felled trees. There are examples of the opposite situation as well, when a large military population was ordered to defend a rather small fortification. This was possible because many of the troops did not actually live inside the encircled areas except during war conditions. A good example of this is the well-studied fortification of Bajcsavár. The fortification's size and shape is well documented. The pentagonal fortification, partly brick, partly earth and wood, required less than 800 trees or 1600 logs but housed as many as 550 men.<sup>46</sup>

A follow-up problem is to find out how often logs had to be replaced in fortifications. There are a number of sources on reconstructions, for instance, in the case of the fortifications at Körmend and Csákány. The reconstructions in lucky cases even refer to the number of logs used to replace the decomposing ones, but the data in the sources are usually not precise enough to create a clear picture of the speed of the decomposition process. The data available are also controversial. In the case of Körmend and Csákány, the reconstruction works probably were not very frequent, but when the fortifications were rebuilt and its logs were replaced, the sources refer to major quantities of material.<sup>47</sup> At Bajcsa the picture is somewhat different. Here, probably due to the unstable foundations, continuous re-building activities are suggested by the sources with sometimes huge quantities of logs.<sup>48</sup> At Kecskemét, a town in the central part of present-day Hungary, the local judge or his representative had to check the ditches and the earth and wood fortification four times every year by perambulating the town.<sup>49</sup> This probably is a good indication of how fast the material of wood fortifications could deteriorate. This does not mean, however, that almost all of the material of fortifications was replaced every once in a while. For Körmend and Csákány, sources also refer to works when only a few logs were replaced.<sup>50</sup>

45 Végh, *Birodalmak*, 56, and 124–25. See also: Pálffy, *A császárváros*, passim.

46 Kovács, and Sümeği, "Palánkvárak, fák, erdők."

47 In one case as much as 2,600 new logs are mentioned: MNL OL P 1314 No 19 237 (13 March 1641). For Körmend, see: Vadas, *Körmend* and Baráth, "A Rába," 35.

48 Toifl, "Bajcsavár," 28–34. See also: Kovács and Sümeği, "Palánkvárak, fák, erdők," 119–20.

49 *Kecskeméti*, 75–76 (no. 83). See also: Sárosi, *Deserting Villages*, 178.

50 See e.g. MNL OL P 1314 24 356. (7 March 1641). The source is also quoted by: Baráth, "A Rába," 45 note 120.

The sources suggest that generally such work was necessary on a regular basis not in order to replace the logs but to bring in new branches and an earth filling to strengthen the braid. Major rebuilding works at these fortifications probably took place only a few times during the Ottoman period. Similar conclusions were drawn by archeological observations and written sources at one of the most important fortifications in the frontier zone east of the Danube, in Szécsény. Here the excavations show that some of the logs were never replaced in the fortification during the entirety of the Ottoman wars, but there were a number of smaller maintenance works. One rebuilding is worth noting. The castle changed hands three times during the Ottoman period; it was in Ottoman hands for a short period during the Fifteen Years' War and then after 1663 and 1683.<sup>51</sup> After the second occupation the walls had to be rebuilt because the fortifications had been set on fire by the fleeing Hungarians. The data are somewhat controversial because some sources suggest that the rebuilding only required smaller works, but an Ottoman source suggests something entirely different. According to an order sent to the beylerbeyi of Eger on the materials needed for the reconstruction of Szécsény, quantities almost unheard of were mentioned, and these numbers are of interest even if the fortification itself is not in the geographical focus of the present work.<sup>52</sup> According to the estimate of the Ottoman janissaries, the beylerbeyi should have sent 10,000 logs for the inner and outer tower, a further 5,000 for the four sides, as well as 4,000 deck-planks for the foundations. In addition, for the rebuilding of a bridge that led to the castle, they required 1,000 special planks, along with 4,000 further bridge deck-planks. Although probably the quantities were intentionally over-exaggerated, they are nonetheless huge. This is difficult to reconcile with the data from Csákány or Körmend, for instance.

In the end we decided to calculate a 10-year cycle of reconstruction, which means that during the Ottoman period each log was replaced by a new one every ten years. Some logs probably lasted much longer than 10 years, but those affected by water had to be replaced almost annually.<sup>53</sup> This calculation probably overestimates the speed of replacement of logs in earth and wood fortifications, but as the aim is to understand the possible scale, it is better to use a relatively higher frequency than to underestimate the amount required.

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51 Mordovin, "The Post-Medieval Fortifications."

52 Fekete, *A bódoltság*, 290 (no. 252).

53 See e.g. the problems at Bajcsavár: Toifl, "Bajcsavár," 28–34.

The next step in the reconstruction was to find out how long the different fortifications were in operation in the Ottoman period. Some of them changed hands between the Hungarians and the Ottomans a number of times and were used by both parties. Some had short occupations and were probably in operation no more than a few years or a decade. Where we found references to the length of their operation, we obviously used that. In every other case we estimated that the fortification was in existence throughout the entire period discussed here. This leads to numbers higher than the reality, which nonetheless allows for the calculation of the upper limit of timber consumption, and can possibly compensate for fortifications for which no written or archeological data exist. We included each fortification in the list only once (either as Hungarian or Ottoman), even if it changed hands several times.

Based on this methodology, the approximate demand for timber in the different fortifications can be reconstructed with a large margin of error. Our aim, however, was to identify the scale of the use of forest resources rather than the precise number of trees or square kilometers of woodland that had to be managed for this purpose. The calculation offered here is by no means precise enough to argue for or against a change in the extent of woods in Transdanubia as a consequence of the Ottoman period, but it can be a step in identifying whether building a significant number of new fortifications could have consumed large quantities of woodland resources.

The database gathered in the three Transdanubian counties of Vas, Zala, and Veszprém includes 138 fortifications, castles, watchtowers, and fortified palaces on the Hungarian side and only about 8 on the Ottoman side (of which, with the exception of Kanizsa, none were in Ottoman hands for more than a few years; see Fig. 1). Because of the difference in numbers and the nature of Ottoman sources, the list may be more complete for Ottoman fortifications than it is for Hungarian ones. We did not systematically include fortified—walled—towns in the three counties. Some of the towns had stone walls dating back to the Middle Ages. These in some cases were also augmented by new outworks of timber, and the foundations of stone fortifications also used major amounts of wood.

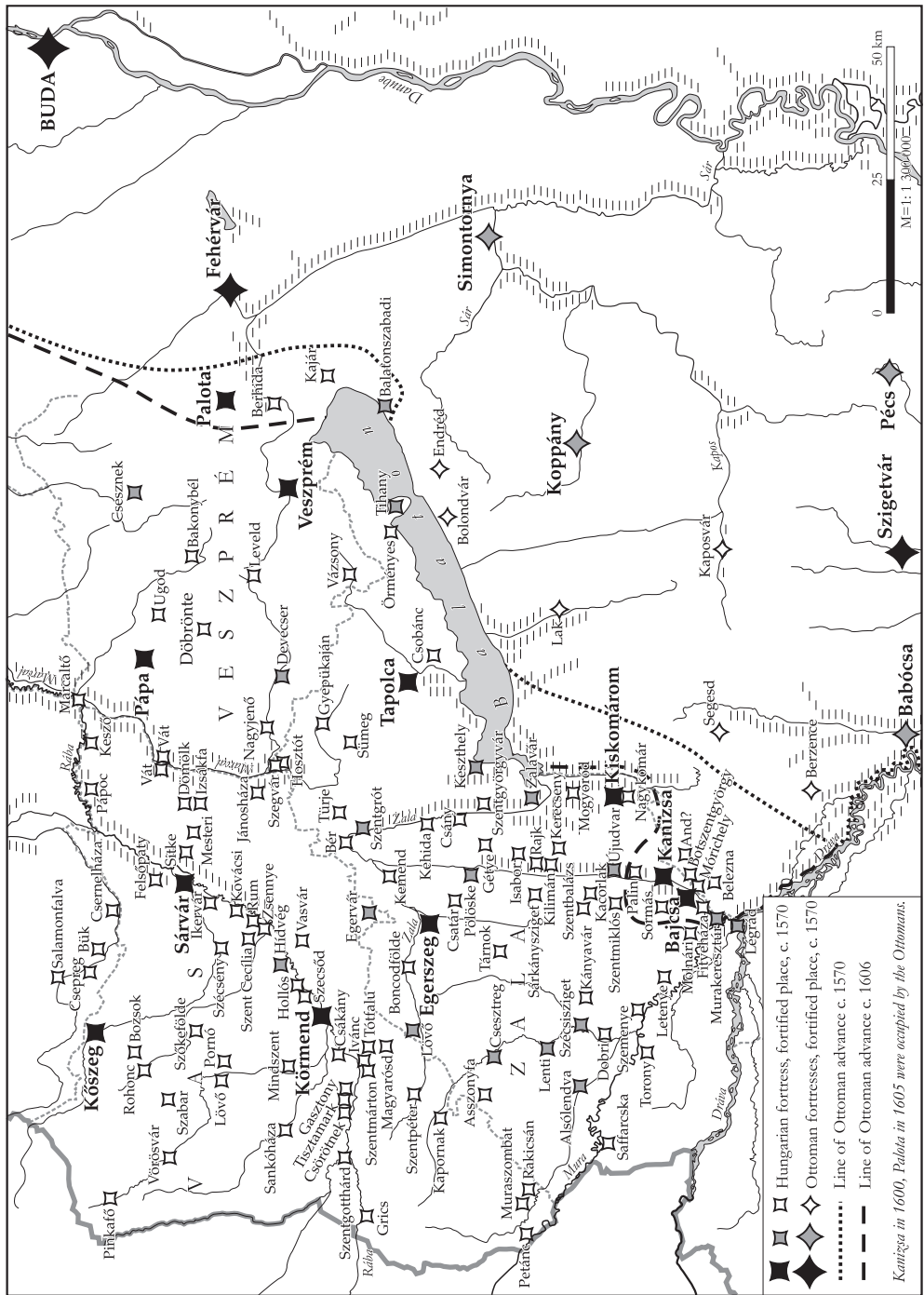


Figure 1. Ottoman-period fortifications in Vas, Veszprém, and Zala counties (drawn by Béla Nagy)

According to our calculations, the roughly 150 fortifications in Vas, Veszprém, and Zala counties needed yearly on average a few hundred trees for the Ottoman side and ca. 5,000 trees for the Hungarian/Habsburg side. In other words, fewer than two or three hundred and 10,000 logs, respectively, were needed in each year during the 150 years between 1541 and 1690. This adds up to ca. 25,000 and 750,000 trees, respectively, altogether. It is important to emphasize two things. First, these numbers represent only the amount consumed for constructing the walls of the earth and wood fortifications themselves; they do not include the amount used in castle buildings, fortified palaces, and various other buildings, such as stables, barns, storage houses, etc. Second, fortification works were not distributed evenly throughout the period of Ottoman presence in the area. The 1540s and especially the 1550s certainly brought a major rise in the demand for wood, and wood was probably consumed less cautiously in these periods than from the 1560s and 1570s onwards, when a more refined defense strategy came into effect. In the early years, probably many more than 5,000 trees were felled yearly to build fortifications in Transdanubia, while in the 1670s, for instance, there may have been a significantly smaller demand for timber.<sup>54</sup>

The most important question has yet to be answered: How much area was required to provide 5,000 trees annually? There is limited information on the yields of medieval forests, but there are many studies on nineteenth- and twentieth-century forest management that, of course with some restrictions, can be used for comparison. Nowadays, in intensive timber-oriented forests thousands of saplings are planted on every hectare. Most of these young trees perish through competition and targeted cuttings that leave only the most promising individuals. How many trees grow up into full-sized individuals depends on the species and location. For the purposes of this paper, we calculate using a relatively open stand where trees are spaced out 5 meters from each other. One hectare of such high forest provides 400 trees. This means that on an annual basis, 12.5 hectares of forest had to be clear cut to provide timber for the walls of fortifications in Vas, Veszprém, and Zala counties. Considering that the trees in these palisades were relatively young (20–30 centimeters in diameter, ca. 50 years old), the same woodlot could have gone through approximately 3 cycles during the 150 years of Ottoman wars. In sum, ca. 625 ( $[12.5 \cdot 150] / 3$ ) hectares or 6.25 km<sup>2</sup> of woodland had to be managed in order to build and maintain all the fences and outworks of the fortifications in the region. We can also consider coppice-

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54 Pálffy, “A török elleni,” 192–99, and Pálffy, “The Origins.”

with-standard management rather than high forests. In this management system, timber was combined with firewood. Average numbers of timbers are hard to calculate because of the high variability recorded in historical sources.<sup>55</sup> For the present, we can use 35 standards per hectare. This adds up to ca. 7,100 hectares of managed coppice woodland to provide 5,000 logs annually. These forests would have been organized primarily for firewood production with timber trees as a by-product.

These numbers are remarkably low. Even if the results are greatly underestimated—and because of a number of factors listed above they may be—and in reality ten times more woodland had to be managed to produce the trees necessary for the earth and wood fortifications, which we believe is unlikely, the forest area needed to supply the construction of palisades would have still been a relatively limited area compared to the territory of the three counties. This is surprising in view of existing scholarship, which in many cases refers to the newly built fortifications as one of the most important reasons for deforestation in the Ottoman period both on a regional scale and at individual sites as well.<sup>56</sup>

Although a systematic collection of the written evidence on the problem has yet to be carried out, we will mention some general observations which can strengthen our assessment of wood consumption. Source material originating from western Transdanubia—mostly Vas County—makes hundreds of references to the problem of water;<sup>57</sup> only a handful of sources refer in any way to the problem of forest resources. Although there is scattered evidence of bringing supplies of wood and timber from longer distances, both Hungarians and Ottomans in the frontier zone brought wood to the fortifications from short distances.<sup>58</sup> Ottoman and Hungarian sources refer frequently to the need for rebuilding the palisades and fortifications, but there is seldom a reference in these sources to a lack of timber.<sup>59</sup> Although data are limited, timber does not seem to have been an expensive material at the time. An example is the Ottoman fortification of Gradiška on the Sava River, even though its distance

55 Szabó, “Driving forces.”

56 See e.g. the suggested deforestations related to castle building in the Dráva valley: Kovács and Sümegi, “Palánkvárak, fák, erdők.”

57 Vadas, *Körmend és a vízgek*.

58 On Ottoman provisioning, see: Fodor, “Bauarbeiten.”

59 See e.g. the numerous references to the reconstruction of earth and wood fortifications in Ottoman sources: Fekete, *A bádoltság*, 228 (no. 38), 231 (no. 50), 261 (no. 154), 282 (no. 226), 290 (no. 252), 296 (nos. 274 and 275), 386 (no. 159), 398 (no. 194) 404 (no. 211).

from Transdanubia limits its relevance as a comparison. Nevertheless, during the construction of this fortification, almost four times as much was spent on the ropes that held the logs together than on the logs themselves.<sup>60</sup> All this, however, does not mean that there was never an occasional local shortage of timber in Transdanubia in the Early Modern Period. Such cases may have been connected to a specific species of wood or to timber suited to a certain use. Changes in the waterscape should equally be considered in the context of the Ottoman wars. The landscape in the surroundings of fortifications may not have been affected only by the use of trees close-by, but was also by the flooding of areas that surrounded these buildings.<sup>61</sup>

### *Limitation of the Results and Perspectives*

The data discussed here focused on Transdanubia. The validity of the results outside this region is an important issue. Central Transdanubia in the Ottoman period was probably the area with the densest network of fortifications. The forest cover at the beginning of the Ottoman period in Transdanubia was probably several times greater than that in the Great Hungarian Plain. In addition, ecological conditions are rather different in the two regions. Much of the Great Hungarian Plain belongs to the forest-steppe region where forest regeneration is a complicated process, which was certainly influenced by the significant upswing in extensive animal pasturing that was, at least partly, a consequence of socioeconomic changes brought about by the Ottoman occupation. This means that the validity of our data for the Great Hungarian Plain is far from self-evident. One should also keep in mind that pressure on forest resources needs to be interpreted within the context of availability. In areas with highly limited woodland resources, such as the central plain areas of the Carpathian Basin, spatiotemporally intense pressure could easily have created local wood shortages.

Furthermore, in evaluating the pressure the Ottoman presence in the Carpathian Basin exercised on woodlands, one should consider all fields of consumption. This of course would require a set of studies dedicated to other spheres of military consumption, such as roads, bridges, temporary camps, siege machines, mines, cannon founding, saltpeter production, etc. However, these issues are beyond the scope of this paper and quantifying them at this point

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60 Stein, *Guarding*, 53. See also: Fodor, “Bauarbeiten.”

61 Cf. Vadas, “A River Between Worlds.”

would be even more speculative than what has been presented above. The same holds true for the proportion of the wood consumption of the fortifications compared to other spheres of military and civic activities.

There is one sphere of consumption where we may offer brief quantitative data that can be compared to the timber consumption of fortresses: the general firewood consumption of the population. Three basic kinds of data are required to do so: population numbers, per capita consumption, and wood production. In the first case, there are relatively reliable data for the late medieval period (1494/1495), the late sixteenth century (1598), and the period of the reign of Joseph II (1780–1790).<sup>62</sup> Per capita annual consumption and per hectare wood production are of course less exact, but there is considerable literature that addressed the issue.<sup>63</sup> Applying an average of 1.5 m<sup>3</sup>/person of annual firewood consumption and 3 m<sup>3</sup> of firewood produced by one hectare of coppice forest

Year	Indicators	Vas	Veszprém	Zala	Sum	% of area to be coppiced
	area in km <sup>2</sup>	4482.99	4080.91	5881.64	14,445.54	
1494/5	population	49,675	33,818	87,938	171,431	
	firewood consumption in m <sup>3</sup>	74,512.5	50,727	131,907	257,146,5	
	woodland needed in ha	24,837,5	16,909	43,969	85,715,5	5.9
1598	population	84,000	30,000	78,000	192,000	
	firewood consumption in m <sup>3</sup>	126,000	45,000	117,000	288,000	
	woodland needed in ha	42,000	15,000	39,000	96,000	6.6
1787	population	227,174	140,789	228,415	596,378	
	firewood consumption in m <sup>3</sup>	340,761	211,183.5	342,622.5	894,567	
	woodland needed in ha	113,587	70,394.5	114,207.5	298,189	20.6

Figure 2. Estimated population and firewood consumption in relation to production in the three counties in 1494/1495, 1598, and 1787

62 For the late medieval period, see: Kubinyi, “A magyar királyság népessége;” for 1598, see: Szakály, “Tolna megye;” and Faragó and Őri, *Az 1784–1787 évi népszámlálás*, for the census during the reign of Joseph II.

63 Szabó et al., “Intensive woodland,” for Moravia (with references to further literature), Galloway, Keene, and Murphy, “Fuelling,” for London.

annually, in 1494/1495 less than 6%, in 1598 less than 7%, and in 1787 less than 21% of the territory of the three counties had to be managed as coppice forests (Fig. 2). These numbers need to be interpreted in relation to woodland cover. The first two suggests that only a small proportion of the woodlands had to be managed to provide firewood, but by the late eighteenth century the majority of forests were probably used for providing the population with firewood. When compared to the woodland needed to provide timber for fortifications, the differences are great: for example in 1598, 96,000 hectares were needed to provide firewood to the three counties, which is some 150 times greater than the average amount we estimated for provisioning fortresses with timber.

### *Conclusions and Outlook*

In the first half of this paper we have shown that woodland cover in Transdanubia was relatively high both in the Late Middle Ages and at the end of the eighteenth century. Overall, our results suggest that woodland cover decreased during the three centuries that separate the two datasets. However, this decrease cannot simply be attributed to the Ottoman wars. The decrease itself has been exaggerated because medieval percentages were biased in favor woodland and also because the post-Ottoman data are not from the immediate aftermath but includes the entire eighteenth century, which was a time of recolonization, significant population growth, and therefore woodland clearance too. This woodland clearance went on well into the nineteenth century. In order to test the prevalent assumption that the Ottoman period brought a decrease in forest cover in the frontier zone between the Ottoman Empire and the Kingdom of Hungary (and thus the entirety of Transdanubia), we examined the sphere of consumption. The construction of earth and wood fortifications is usually associated with the largest woodland loss. Our results show that these may have had a less significant impact on forests and forest cover than has been hitherto suggested. When arguing for the loss of woodlands due to the construction of these fortifications, Hungarian research has usually drawn attention to decrees and other documents that concerned the protection of forests from the Early Modern Period onwards, and attributed the appearance of these mandates to the scarcity of forest resources.<sup>64</sup> However, most of these documents, for instance, those published in the most important related source collection, the

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64 *Magyar erdészeti*, I, passim.

*Magyar erdészeti oklevéltár* (Cartulary of Hungarian Forestry), do not mention a lack of woodland, neither do they refer to a scarcity of firewood or timber.<sup>65</sup> Such documents were usually meant to regulate the use of local forests and should not be regarded as proof of resource scarcity. They rather documented an increasingly diverse forest administration.<sup>66</sup> The brief comparison of the timber consumption of fortresses with general firewood consumption by the population also suggests that military activities did not present an overly significant pressure on woodland resources. Nevertheless, it is clear that future research will need to discuss further aspects of wood consumption in Early Modern Transdanubia. Considering all the possible woodland uses connected to military activities may raise consumption in this sphere to much higher levels. One must take into account, however, that the many spheres of military as well as civic consumption are rather difficult to quantify. Previously neglected sources may shed more light on woodland consumption and the land-use patterns in Early Modern Transdanubia.<sup>67</sup> Though a precise quantitative reconstruction of woodland cover and consumption for the sixteenth and seventeenth centuries is still far from being complete, our study has uncovered a general trend in Transdanubia that rebuts the idea of forest scarcity and which might even have reverberations in other parts of Hungary.

## *Bibliography*

### Archival sources

Magyar Nemzeti Levéltár Országos Levéltára (Hungarian National Archives State Archive) A herceg Batthyány család levéltára. Missiles (Archive of the Batthyány family. Collection of letters) [MNL OL]

### Printed sources and secondary literature

Ágoston, Gábor, and Teréz Oborni. *A tizenhetedik század története* [History of the 17<sup>th</sup> century]. Budapest: Pannonica, 2000.

<sup>65</sup> The instructions of Ferenc Nádasdy to the stewards at Lockenhaus, Deutschkreutz, and Klostermarienbergr (part of Mannersdorf an der Rabnitz), January 20, 1597. Edited in: *Magyar erdészeti*, I, 270–71 (no. 182).

<sup>66</sup> See, e.g., the decree of Sopron from 1541: Házi, *Sopron*, II/2, 280. See also on this: Csapody, “Sopron város.”

<sup>67</sup> See, e.g., town and siege views on Czech examples: Matoušek and Blažková, “Picture and reality,” or defters. Cf. for the latter in the context of Western Transdanubia: Szepesiné Simon, “A magyarországi hódoltság.”

- Ágoston, Gábor. “Where Environmental and Frontier Studies Meet: Rivers, Forests, Marshes and Forts along the Ottoman–Hapsburg Frontier in Hungary.” In *The Frontiers of the Ottoman World*. Proceedings of the British Academy, 156, edited by Andrew C. S. Peacock, 57–79. Oxford: Oxford University Press, 2009.
- Baráth, Zsolt. “A Rába mint védelmi vonal a 17. században: Védelmi munkálatok és létesítmények a folyó Vas megyei szakaszán” [The Rába as a defense line – protection measures and constructions in the Vas County section of the river]. *Vasi Honismereti és Helytörténeti Közlemények* no. 1 (2014): 31–53.
- Bartha, Dénes, and Sándor Oroszi. “Magyar erdők” [Hungarian forests]. In *Pannon Enciklopédia: Magyarország növényvilága* [Pannonian encyclopedia. Flora of Hungary], edited by Magda Járainé Komlódi, 221–31. Budapest: Dunakanyar 2000 Könyvkiadó, 2000.
- Bartha, Dénes. “Történeti erdőhasználatok Magyarországon” [Historical uses of forest in Hungary]. *Magyar Tudomány* 48 (2003): 1566–1577.
- Bartosiewicz, László, and Erika Gál. “Ottoman Period Animal Exploitation in Hungary.” In *Archeology of the Ottoman Period in Hungary*. *Opuscula Hungarica*, 3, edited by Ibolya Gerelyes, and Gyöngyi Kovács, 365–76. Budapest: Magyar Nemzeti Múzeum, 2004.
- Bende, Lajos. “A törökkori magyar végvárakról” [On Ottoman-period Hungarian frontier fortifications]. *Hadtörténelmi Közlemények* 18, no. 3 (1971): 501–27.
- Bíró, Mariann, and Zsolt Molnár. “Az Alföld erdei a folyószabályozások és az alföldfásítás előtti évszázadban” [The forests of the Great Hungarian Plain in the century before the river regulations and the reforestation]. In *Környezettörténet: Az utóbbi 500 év környezeti eseményei történeti és természettudományi források tükrében* [Environmental history: The environmental events of the last 500 years in light of historical and scientific data]. *Környezettörténet*, 1, edited by Miklós Kázmér, 169–206. Budapest: Hantken Kiadó, 2009.
- Csapody, István. “Sopron város (és volt úrbéres községei) erdeinek története (XII–XX. század)” [History of the forests of the town of Sopron (and its belonging villages), 12<sup>th</sup> to 20<sup>th</sup> centuries]. *Erdészettörténeti Közlemények* nos. 3–4 (1968): 3–16.
- Faragó, Tamás, and Péter Óri. *Az 1784–1787 évi népszámlálás II: Az Alföld, a Délvidék és a Dunántúl népességi adatai* [The census of 1784–1787. II: The population data of the Great Hungarian Plain, the Southern Frontier and Transdanubia]. Budapest: [n. p.], 2008. Accessed July 7, 2017. [http://real.mtak.hu/2144/1/46348\\_ZJ1.pdf](http://real.mtak.hu/2144/1/46348_ZJ1.pdf).
- Fekete, Lajos. *A bódoltság török levéltári forrásai nyomában* [In pursuit of the archival sources of the Ottoman period]. Budapest Oriental Reprints, Ser. A 6., edited by Géza Dávid. Budapest: MTAK, 1993.

- Fodor, Pál. “Bauarbeiten der Türken an den Burgen in Ungarn im 16–17. Jahrhundert.” *Acta Orientalia Academiae Scientiarum Hungaricae* 35 (1981): 55–88.
- Gaál, Attila. “Turkish Palisades on the Tolna-County Stretch of the Buda-to-Eszék Road.” In *Archeology of the Ottoman Period in Hungary*. *Opuscula Hungarica*, 3, edited by Ibolya Gerelyes, and Gyöngyi Kovács, 104–8. Budapest: Magyar Nemzeti Múzeum, 2004.
- Galloway, James A., Derek Keene, and Margaret Murphy. “Fuelling the City: Production and Distribution of Firewood and Fuel in London’s Region, 1290–1400.” *The Economic History Review* NS 49 (1996): 447–72.
- Házi, Jenő. *Sopron szabad királyi város története. II. rész, 2. kötet, Végrendeletek, közgyűlési jegyzőkönyvek, polgárkönyvi feljegyzések és különféle számadások 1400-tól 1541-ig* [History of the free royal town of Sopron. II/2. Last wills, town council minutes, town book entries and different account books]. Sopron: Székely és Társa Könyvnyomdája, 1931.
- Hegyí, Imre. *A népi erdőkiélés történeti formái (Az Északkeleti-Bakony erdőgazdálkodása az utolsó kétszáz évben)* [Historical forms of peasant forest clearance (Forestry in the northeast Bakony in the last two hundred years)]. Budapest: Akadémiai, 1978.
- Hegyí, Klára. *A török bódoltság várai és várkatonasága*, 3 vols [Castles and garrisons of Ottoman Hungary]. *História Könyvtár. Kronológiák, adattárak*, 9. Budapest: História and MTA Történettudományi Intézet, 2007.
- Herényi, István. *A nyugati gyepei erődítményei: erődítmények, várak Nyugat-Magyarországon* [Constructions of the western gyepe: fortifications and castles in Western Hungary]. Budapest: Heraldika, 2007.
- Hofer, Tamás. “Déli-dunántúli településformáinak történetéhez” [On the history of settlement forms in the southern Transdanubia]. *Ethnographia* 66 (1955): 125–86.
- Hóman Bálint, and Gyula Szekfű. *Magyar történet* [Hungarian history] (Budapest: Királyi Magyar Egyetemi Nyomda, 1928). <http://vmek.oszk.hu/07100/07139/html/0002/0005/0001/0001-1cc.html> Accessed: March 28, 2017.
- K. Németh, András, and Gábor Máté. “Vázlat a pusztafalvak tájtörténeti kutatásához a Kapos menti Enyőd példáján” [Outlines of a research project on the landscape history of deserted medieval villages, based on the example of Enyőd]. *Történeti Földrajzi Közlemények* 5 (2017): 44–58.
- Kaán, Károly. *Alföldi kérdések: Erdők és vizek az Alföld kérdéseiben* [Questions about the Great Hungarian Plain: Forests and waters in the questions of the Great Hungarian Plain]. Budapest: Stádium, 1939.
- Kecskeméti szabályrendeletek 1659–1849* [Kecskemét town statutes], edited by Tibor Iványosi-Szabó. Kecskemét: Bács-Kiskun Megyei Levéltár, 1991.

- Kelenik, József. “A nemzetiségi megoszlás, a veszteségek és a fluktuáció mértéke. Tizennégy Kanizsa elleni végvár helyőrségében (1633–1640)” [Ethnic composition, the losses and the scale of fluctuation. Based on the example of the 14 garrisons against Kanizsa castle]. In *A végvárok és régiók a XVI–XVII. században: Tudományos tanácskozás előadásai-Noszvaj, 1991. okt. 17–18.* [Borderline castles and regions in the 16<sup>th</sup>–17<sup>th</sup> centuries. Proceedings of the conference held at Noszvaj, 17–18 October 1991]. *Studia Agriensia*, 14, edited by Tivadar Petercsák, and Jolán Szabó, 101–21. Eger: Heves Megyei Múzeumok Igazgatósága, 1993.
- Kovács, Gyöngyi, and Pál Sümegi. “Palánkvárak, fák, erdők: Régészeti és környezet-történeti adatok a török kori palánkvárak faanyag-felhasználásához” [Earth and wood fortifications, trees, and forests: Archeological and environmental history data about the timber consumption of Ottoman-period fortifications]. In *Várak nyomában: Tanulmányok a 60 éves Feld István tiszteletére* [On the trail of castles: Studies in honor of István Feld on his 60<sup>th</sup> birthday], edited by György Terei et al., 113–20. Budapest: Castrum Bene Egyesület, 2011.
- Kubinyi, András. “A magyar királyság népessége a XV. század végén” [The population of the Kingdom of Hungary at the end of the 15<sup>th</sup> century]. In *Magyarország történeti demográfiája (896–1996)* [Historical demography of Hungary], edited by József Kovacsics, 93–110. Budapest: KSH, 1997.
- Magyar erdészeti oklevéltár* [Cartulary of Hungarian forestry], 3 vols, edited by Károly Tagányi. Budapest: Pátria, 1896.
- Magyar, Eszter. “Az 1715–1720-as összeírások forrásértéke a 18. századi erdőszűlség kutatásában” [The source value of the 1715 and 1720 conscriptions in the study of 18<sup>th</sup>-century forest cover]. *Levéltári Szemle* 30 (1980): 227–39.
- Magyar, Kálmán, and Gyula Nováki. *Somogy megye várai a középkortól a kuruc korig* [The castles of Somogy County from the Middle Ages until the kuruc period]. Kaposvár: Somogy Megyei Múzeumok Igazgatósága, 2005.
- Marosi, Endre. *XVI. századi váraink* [16<sup>th</sup>-century castles in Hungary]. Budapest and Miskolc: Hungária-Európa Alapítvány and Borsod-Abaúj-Zemplén Megyei Levéltár, 1991.
- Máté, Gábor. “A Mecsek-vidék tájtörténete: Táj és ember viszonyának változása háromszáz év tükrében” [The landscape history of the Mecsek region: The history of the relationship of landscape and man in the last three hundred years]. PhD diss., Pécsi Tudományegyetem, 2013.
- Máté, Gábor. “Landscape Reconstruction of the Southern Transdanubian Pusztas (1683–1735) Based on 18<sup>th</sup>-Century Border Litigations.” *Acta Ethnographica Hungarica* 62 (2017): 105–34.

- Matoušek, Václav, and Tereza Blažková. "Picture and reality: Studies of the modern landscape in vedute of Thirty Years's War's battlefields in Bohemia." In *Human Nature. Studies in Historical Ecology and Environmental History*, edited by Péter Szabó, and Radim Hédl, 52–61. Brno: Institute of Botany of the ASCR, 2008.
- Méri, István. *A kanizsai várásatás* [The excavations of the castle of Kanizsa]. Budapest: Műszaki, 1988.
- Miklós, Zsuzsa. *Tolna megye várai* [Castles of Tolna County]. Budapest: Históriaantik Könyvesház Kiadó, 2007.
- Molnár, Zsolt. "A Duna-Tisza köze és a Tiszántúl növényzete a 18–19. század fordulóján I: Módszertan, erdők, árterek és lápok" [Vegetation of the Danube–Tisza Interfluvium and Trans-Tisza Regions at the turn of the 18<sup>th</sup> and 19<sup>th</sup> centuries, I: methods, woodlands, floodplains, and fens]. *Botanikai Közlemények* 95 (2008): 11–38.
- Mordovin, Maxim. "The Post-Medieval Fortifications of Earth and Timber in Hungary." In *Études de castellologie médiévale: Château et frontière*. Château Gaillard, 26, edited by Peterr Ettel, Anne-Marie Flambard Héricher, and Kieran O'Connor, 273–82. Caen: Presses Universitaires de Caen, 2014.
- Nagy, Balázs. "The Towns of Medieval Hungary in the Reports of Contemporary Travellers." In *Segregation – Integration – Assimilation: Religious and Ethnic Groups in the Medieval Towns of Central and Eastern Europe*. Historical Urban Studies, edited by Derek Keene, Balázs Nagy, and Katalin Szende, 169–78. Farnham: Ashgate, 2009.
- Nógrády, Árpád. "Az elakadt fejlődés" [Hindered development]. In *Keresztesekből lázadók: Tanulmányok 1514 Magyarországról* [From crusaders to rebels: Studies on the history of Hungary in 1514], edited by Norbert C. Tóth, and Tibor Neumann, 11–30. Budapest: MTA BTK Történettudományi Intézet, 2015.
- Olahus, Nicolaus *Hungaria – Athila*. Bibliotheca Scriptorum Medii Recentisque Aevorum. Saeculum 16, ed. Colomanus Eperjessy, and Ladislaus Juhász. Budapest: K. M. Egyetemi Nyomda, 1938.
- Pálffy, Géza. "A magyarországi és délvidéki végvárrendszer 1576. és 1582. évi jegyzékei" [The registers of the Hungarian and Croatian–Slavonian border fortresses of 1576 and 1582]. *Hadtörténelmi Közlemények* 108, no. 1 (1995): 114–85.
- Pálffy, Géza. "A török elleni védelmi rendszer szervezetének története a kezdetektől a 18. század elejéig (Vázlat egy készülő nagyobb összefoglaláshoz)" [The history of the anti-Ottoman defense from the beginnings to the early 18<sup>th</sup> century (Sketch of a larger overview in progress)]. *Történelmi Szemle* 38 (1996): 163–217.
- Pálffy, Géza. "The Origins and Development of the Border Defence System Against the Ottoman Empire in Hungary. (Up to the Early Eighteenth Century)." In *Ottomans, Hungarians, and Habsburgs in Central Europe: The Military Confines in the Era*

- of the Ottoman Conquest. The Ottoman Empire and its Heritage, Politics, Society and Economy*, 20, edited by Géza Dávid, and Pál Fodor, 3–69. Leiden, Boston and Cologne: Brill, 2000.
- Pálffy, Géza. *A császárváros védelmében: a győri főkapitányság története, 1526–1598* [In defense of the imperial city: the captainship of Győr, 1526–1598]. Győr: Győr–Moson–Sopron Megye Győri Levéltár, 1999.
- Pataki, Vidor. “A XVI. századi várépítés Magyarországon” [Castle-building in 16<sup>th</sup>-century Hungary]. *A Bécsi Magyar Történelmi Intézet Évkönyve* 1 (1931): 98–133.
- Pinke, Zsolt. “Alkalmazkodás és felemelkedés – modernizáció és leszakadás: Kis jégkorszaki kihívások és társadalmi válaszok a Tiszántúlon” [Adaptation and rise – Modernization and decline: Little Ice Age challenges and social responses in the Trans-Tisza region (Hungary)]. PhD-diss., Pécsi Tudományegyetem, 2014.
- R. Várkonyi, Á. “‘a természet majd az értelemmel...’ Történelmi ökológia és a XVIII. századi Magyarország környezeti válsága” [“nature with reason...” Historical ecology and the environmental crisis of 18th-century Hungary]. In *Környezettörténet: Az utóbbi 500 év környezeti eseményei történelmi és természettudományi források tükrében* [Environmental history: The environmental events of the last 500 years in light of historical and scientific data]. *Környezettörténet*, 1, edited by Miklós Kázmér, 21–54. Budapest: Hantken Kiadó, 2009.
- R. Várkonyi, Ágnes R. “Környezet és végvár: Végvárrendszer és a történelmi ökológia kérdései a 16–17. századi Magyarországon” [Environment and borderline castles: The border defense system and questions of historical ecology in 16<sup>th</sup>–17<sup>th</sup>-century Hungary]. In *A végvárak és régiók a XVI–XVII. században: Tudományos tanácskozás előadásai-Noszvaj, 1991. okt. 17–18.* [Borderline castles and regions in the 16<sup>th</sup>–17<sup>th</sup> centuries. Proceedings of the conference held at Noszvaj, 17–18 October 1991]. *Studia Agriensia*, 14, edited by Tivadar Petercsák, and Jolán Szabó, 7–27. Eger: Heves Megyei Múzeumok Igazgatósága, 1993.
- Rácz, Lajos. *The Steppe to Europe: An Environmental History of Hungary in the Traditional Age*. Cambridge: White Horse Press, 2013.
- Reuter, Camillo, “Földrajzinév-gyűjtések a Baranyában végzendő régészeti és településtörténelmi kutatások szolgálatában” [The collection of geographical names for the purpose of archeological and local history research in Baranya County]. *Janus Pannonius Múzeum Évkönyve 1964* [1965] 225–39.
- Sági, Károly. “A zalacsányi török kori várak” [The Ottoman period castle of Zalacsány]. In *A Göcseji Múzeum jubileumi emlékkönyve 1950–1960* [Jubilee volume of the Göcsej Museum]. *A Göcseji Múzeum Közleményei*, 8, edited by Imre Szentmihályi, 131–35. Zalaegerszeg: Göcseji Múzeum, 1960.

- Sárosi, Edit. *Deserting Villages – Emerging Market Towns: Settlement Dynamics and Land Management in the Great Hungarian Plain 1300–1700*. Series Minor, 39. Budapest: Archaeolingua, 2016.
- Stein, Mark L. *Guarding the Frontier Ottoman Border Forts and Garrisons in Europe*. London and New York: I. B. Tauris, 2007.
- Sugár, István. “Az egri vár építőanyagának beszerzési helyei 1548–1564” [Origin of the building materials of the castle of Eger from 1548 to 1564]. In *Végyvár és környezet: Tudományos tanácskozási előadásai – Noszvaj, 1993. okt. 14–15*. [Borderline castles and the environment: Proceedings of the conference, Noszvaj, 14–15 October 1993]. *Studia Agriensia*, 15, edited by Tivadar Petercsák and Ernő Pető, 175–82. Eger: Heves Megyei Múzeumi Szervezet, 1995.
- Szabó, Géza, and Viktor Csányi. “Werbőczy két Tolna megyei vára: Dombó és Döbrököz az újabb régészeti megfigyelések tükrében” [Two castles of Werbőczy in Tolna County: Dombó and Döbrököz in light of archeological observations]. *A Wosinsky Mór Múzeum évkönyve* 34 (2012): 179–212.
- Szabó, Péter. “Driving Forces of Stability and Change in Woodland Structure: A Case-Study from the Czech Lowlands.” *Forest Ecology and Management* 259 (2010): 650–56.
- Szabó, Péter. “Changes in Woodland Cover in the Carpathian Basin.” In *Human Nature: Studies in Historical Ecology and Environmental History*, edited by Péter Szabó, and Radim Hédl, 106–15. Brno: Institute of Botany of the ASCR, 2008.
- Szabó, Péter. “Erdők a kora újkorban: történelem, régészet, ökológia” [Forests in early modern times: History, archeology, ecology]. In *Környezettörténet: Az utóbbi 500 év környezeti eseményei történelmi és természettudományi források tükrében* [Environmental history: The environmental events of the last 500 years in light of historical and scientific data]. *Környezettörténet*, 1, edited by Miklós Kázmér, 137–56. Budapest: Hantken Kiadó, 2009.
- Szabó, Péter. *Woodland and Forests in Medieval Hungary*. Archaeolingua – Central European Series, 2 = BAR International Series, 1348. Oxford: Archaeopress, 2005.
- Szabó, Péter, Jana Müllerová, Silvie Suchánková, and Martin Kotacka. “Intensive Woodland Management in the Middle Ages: Spatial Modelling Based on Archival Data.” *Journal of Historical Geography* 48 (2015): 1–10.
- Szakály, Ferenc. *Magyar adóztatás a török hódoltságban* [Hungarian taxation in Ottoman Hungary]. Budapest: Akadémiai, 1981.
- Szakály, Ferenc. “Tolna megye negyven esztendeje a mohácsi csata után, 1526–1566” [Forty years of Tolna County after the battle of Mohács]. *Tanulmányok Tolna megye történetéből* 2 (1969): 5–85.

- Szántó, Imre. “A végvári rendszer kiépítése Magyarországon” [Formation of the borderline defense in Hungary]. *Acta Universitatis Szegediensis: Acta historica* 38 (1971): 3–44.
- Szatlóczki, Gábor. “Szentgyörgyvár a török időkben” [Szentgyörgy Castle in the Ottoman period]. In *Szentgyörgyvár története* [History of Szentgyörgy Castle] (Zalai Kismonográfiák, 7), edited by Róbert Müller, 33–48. Zalaegerszeg: [N. p.], 2002.
- Szepesiné Simon, Éva. “A magyarországi hódoltság és hódoltsági peremvidék kataszteri iratainak (tapu defter) feldolgozása (OTKA K 108919). Szakmai beszámoló a negyedik évről (2017).” [The study of the cadastral sources of the peripheries of the Ottoman Empire and Hungary (tapu defter) – research program: OTKA K 108919. Overview of the 4<sup>th</sup> year of the research] *Catastrum* 5, no. 1 (2018): 59–64.
- Szilágyi, Emőke Rita. “Figures and Tropes of Voluntary Exile. Miklós Oláh in Brussels.” (forthcoming).
- Szvittek, Róbert József. “Kiskomárom végvár építéstörténete” [The building history of the borderline fortification of Kiskomárom]. *Castrum Bene* 14 (2011): 41–55.
- T. Mérey, Klára. “Az erdőgazdálkodás Somogy megyében (1700–1879)” [Forestry in Somogy County (1700–1879)]. *Agrártörténeti Szemle* 5 (1963): 133–34.
- Takács, Lajos. *Egy irtásfalú földművelése* [Farming of a clearance village]. Budapest: Akadémiai, 1978.
- Takács, Lajos. *Irtásgazdálkodásunk emlékei: Irtásföldek, irtásmódok* [Remains of clearance farming in Hungary: clearances, clearance techniques]. Budapest: Akadémiai, 1980.
- Takács, Sándor. “A régi gazdálkodás emlékei földrajzi neveinkben (Az Aszó, Aszáló értelmezéséhez)” [The memory of old farming techniques in geographic names of Hungary (In regard to the explanation of *Aszó*, *Aszáló*)]. *Magyar Nyelvőr* 93 (1969): 120–23.
- Takács, Sándor. “A magyar vár” [Hungarian castles]. *Századok* 41 (1907): 726–41, and 815–37.
- Takács, Sándor. *Rajzok a török világból*, 4 vols [Sketches from the Ottoman world]. Budapest: Magyar Tudományos Akadémia, 1915–1917.
- Terei, György, Gyula Nováki, Zsolt Mráv, István Feld, and Sebestyén Sárközy, *Fejér megye várai az őskortól a kuruc korig* [The castles of Fejér County from prehistory to the *kuruc* period]. Magyarország várainak topográfiája, 3. Budapest: Castrum Bene Egyesület and Cívertan Bt., 2011.
- Toifl, Leopold. “Bajcsavár története a stájer levéltári források alapján” [The history of Bajcsavár in light of archival data from Styria]. In *Weitschawar/Bajcsa-Vár. Egy stájer erődtípus Magyarországon a 16. század második felében* [Weitschawar/Bajcsa-Vár. A Styrian fortification in Hungary in the second half of the 16<sup>th</sup> century], edited by Gyöngyi Kovács, 27–40. Zalaegerszeg: Zala Megyei Múzeumok Igazgatósága, 2002.

- Tolnai, Gergely. *Palánkvárak Magyarországon* [Earth and wood fortifications in Hungary]. Budapest: Martin Opitz, 2011.
- Vadas, András. “Vízgazdálkodás és háborús védekezés: Csákány és a Vas megyei Rába-mente a kora újkorban (1600–1658)” [Water management and border protection at Csákány and along the Rába in Vas County between 1600 and 1658]. In *Víz és társadalom Magyarországon a középkortól a XX. század végéig* [Water and society in Hungary from the Middle Ages to the end of the 20<sup>th</sup> century], edited by Gergely Krisztián Horváth, 207–45. Budapest: Balassi, 2014.
- Vadas, András. “A River Between Worlds: Environment, Society and War Along the River Raab/Rába (c. 1600–1660).” In *Man, Nature and Environment Between the Northern Adriatic and the Eastern Alps in Premodern Times*, edited by Peter Štih, and Žiga Zwitter, 242–58. Ljubljana: Ljubljana University, 2014.
- Vadas, András. *Körmend és a vizek: Egy település és környezete a kora újkorban* [Körmend and the waters: A settlement and its environment in early modern times]. (ELTE BTK Történelemtudományok Doktori Iskola. Tanulmányok – konferenciák, 5). Budapest: Történelemtudományok Doktori Iskola, 2013.
- Vági, István. “Van-e hazánkban ezeréves puszta, vagy azt a török hódoltság okozta? Megváltozott-e a Nagy-Alföld éghajlata a török hódoltság miatt aszályosabb irányban, továbbá a talajok is alig javíthatóan megromlottak-e a valóságban?” [Was there a millennial puszta in Hungary or was it caused by the Ottomans? Did the climate of the Great Hungarian Plain become as a consequence of the Ottoman Empire and were soils indeed devastated to a barely amendable state?]. *Erdészeti Lapok* 73 (1934): 670–82.
- Vándor, László. “A zalai végvárrendszer a 16–17. században” [The frontier fortification system of Zala County in the 16<sup>th</sup>–17<sup>th</sup> centuries]. In *Zala megye ezer éve: Tanulmánykötet a magyar államalapítás milleniumának tiszteletére* [Millennium of Zala County: Studies in honor of the millennium of the Hungarian state foundations], edited by László Vándor, 89–96. Zalaegerszeg: Zala Megyei Múzeumok Igazgatósága, 1996.
- Végh, Ferenc. *Birodalmak határán – Balaton partján: Keszthely végvárváros a XVI–XVII. században* [At the border of empires – by the Lake Balaton: Keszthely the fortified frontier town in the 16<sup>th</sup>–17<sup>th</sup> centuries]. Disszertációk a társadalomtudományok köréből, 1. Budapest: Históriaantik Könyvesház, 2007.
- Végh, Ferenc. *Egerszeg végvár és város a 17. században* [The borderline fortification of Egerszeg and the town in the 17<sup>th</sup> century]. Zalaegerszegi füzetek, 10. Zalaegerszeg: Millecentenáriumi Közalapítvány: 2010.
- Weidlein, János. “A dűlőnévkutatás történeti vonatkozásai” [Historical applications of research into field names]. *Századok* 69 (1935): 665–92.

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