Where Environmental and Frontier Studies Meet: Rivers, Forests, Marshes and Forts along the Ottoman–Hapsburg Frontier in Hungary

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It has been fashionable in the generalist literature to argue that the Ottomans lacked knowledge in European geography and politics. In several of my recent studies, I have demonstrated that Istanbul possessed a multi-layered information-gathering system that provided the Ottoman government both in the centre and in the provinces with sufficient information about their adversaries.1 In this chapter, I first offer some comments regarding Istanbul’s understanding of geography and environment in the context of Ottoman strategy and frontier warfare. Then I proceed with a short overview of the importance of rivers, marshlands and mountains with regard to the formation of the opposing Hapsburg and Ottoman defence systems in Hungary. The last part of the chapter deals with the relationship between landscape, climate and fortifications and offers some preliminary results and tentative observations regarding deforestation and marshlands. In the absence of specialised studies on the subject, one cannot do more. Nevertheless, these are important, as they underline the interconnected nature of landscape and frontiers, and the significance of such studies for Ottomanist historians, for whom both modern military and environmental history are new disciplines. The chapter also shows that we do in fact possess a wide array of both data and sources that, used in novel ways, could shed light on hitherto neglected aspects of Ottoman military, economic and social history.


With regard to the Ottomans’ understanding of geography, the available evidence suggests that Ottoman policy-makers not only understood geography but clearly were capable of thinking in larger strategic terms. As examples one can point to the gradual and systematic conquest of the Black Sea coast and the Danube Delta up to the 1480s, and the capture and construction of strategically important forts along major river routes, such as the Danube, the Tigris and the Euphrates. The Ottomans recognised the importance of the Danube as early as the late fourteenth century and occupied all strategically vital fortresses along the river during the next 150 years. These included the forts at Kilia (Ott. Kili, 1484), Silistra (Ott. Silistre, 1388), Ruse (Ott. Rusçuk, 1388), Nikopol (Ott. Niğbolu, 1395), Vidin (1396), Severin (1524), Orşova (1522), Golubac (Ott. Güvercinlik, 1427, 1458), Haram (1483), Smederevo (Ott. Semendire, 1439, 1459), Zemun (Ott. Zemin, 1521), Belgrade (1521), Petrovaradin (1526), Buda (Ott. Budin/Budun, 1541), and its twin city Pest (Ott. Peşte 1541), Vác (Ott. Vaç, 1543), Visegrád (Ott. Vişegrad, 1544), and Esztergom (Ott. Estergon, 1543) (see Figure 3.1).

The possession of these forts proved instrumental for the Ottomans to control the Danube, the major watercourse in their European theatre of war. Belgrade and Buda became Ottoman administrative centres following their conquests, also acting as major logistical bases during Ottoman campaigns against Hapsburg Hungary in the sixteenth and seventeenth centuries. The Ottomans established naval arsenals at Rusçuk, Niğbolu and Vidin, and smaller shipbuilding sites at Güvercinlik, Semendire, Belgrade, İzvornik (Serb. Zvornik), Alacahisar (Serb. Kruševac), Pojega, Mohács (Hu. Mohács), Buda and Esztergom. Semendire and İzvornik were each capable of constructing some 200 to 250 river boats for the Hungarian campaigns of Süleyman I in the 1540s and 1560s. These forts and their hinterland were also responsible for providing for bridge-building material and pontoon bridges.²

The Danube played a crucial role in Ottoman campaign logistics.³ Ordnance and ammunition, especially heavy stone cannon balls, were transported on special ships, called gun ship (top gemisi) and stone ship (taşgemisi). For the transport of gunpowder the Ottomans used special ‘covered’ (örtülü) boats. However, the Danube was not fully navigable. During campaigns against Hungary and the Hapsburgs, the Ottomans used the waterway only from Rusçuk (or Belgrade) up to Buda (or Esztergom); thus cannon, ammunition and victuals shipped from Istanbul via the Black Sea to Varna were transported on carts from Varna to Rusçuk (or to Belgrade), where they were again loaded

Figure 3.1. Major Ottoman campaigns in Hungary in the sixteenth century.
Securing crossing points on the Danube and its tributaries, and building bridges and pontoon bridges were essential for campaign logistics and for the arduous and dangerous business of river crossing. The failure to provide bridges and pontoons and other infrastructure of river crossings often resulted in disasters and/or mutinies.5

Apart from the conquest and securing of major rivers, other obvious examples for the Ottomans’ strategic thinking include the sixteenth-century Don–Volga and Suez Canal projects.6 The idea of connecting the Don and Volga rivers at their closest point was first conceived in 1563 under Süleyman the Magnificent. With the help of the planned canal the Ottomans hoped to check Muscovy’s expansion in the north Caucasus, by dislodging them from the lower Volga, and especially from Astrakhan, captured in 1555 by Tsar Ivan IV’s (r. 1547–84) forces. However, the plan did not get support from the sultan, whose strategic interest lay in the Mediterranean (Malta, Cyprus) and Hungary. In 1568–9, following Süleyman’s death and the accession of Selim II, Grand Vizier Sokollu Mehmed Pasha revived the plan. With the canal, the grand vizier planned to transport Ottoman warships carrying siege cannons, ammunition and provisions from the River Don to the Volga. It would have enabled the Ottomans to block Russian relief forces coming downstream on the Volga, and to capture Astrakhan with the flotilla and the accompanying Ottoman and Crimean Tatar land forces. In July 1569, the Ottoman flotilla ascended the Don from Azak (Azov) and stopped south of the River Ilovlya, tributary of the Don, somewhere opposite present-day Volgograd (formerly Tsaritsyn and Stalingrad). They attempted to dig a canal at what seemed to be the two rivers’ closest point. However, the rivers were still some 50 kilometres apart and the ground was hilly. The assertion by some historians that the Ottomans did dig about one-third of the estimated 50–kilometre-long canal is unsubstantiated. Because of insurmountable physical obstacles, the Ottomans abandoned the plan shortly after their arrival and sent the flotilla back to Azak with most of the siege artillery. Although Ottoman and Tatar land forces reached Astrakhan by mid-September, having only light field pieces and perhaps as few as two siege cannons, they failed to capture the fort. Ending the siege after just ten days, the army reached Azak by 23 October, after a devastating one-month-long march during which hundreds died of hunger and thirst. Although Kasım Bey, the governor of Azak and the commander of the expedition, wanted to renew the operation next spring, Istanbul was already preparing for the Cyprus campaign, which demanded all available troops and resources. Thus ended the Don–Volga canal project, with which Sokollu Mehmed Pasha hoped to dislodge the Russians from Astrakhan and the Lower Volga, and, by

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transporting the Ottoman Black Sea fleet on to the Caspian Sea, attack Safavid Persia from the north, conquering the province of Shirvan. Moreover, Ottoman control of the steppes and forests of the lower Volga 'would have strengthened the empire's ecological portfolio, providing grain, horses and timber in abundance', and thus would have further enhanced the Ottoman strategic position on this frontier and in general.

With the Suez Canal, Istanbul wanted to transport its main Mediterranean navy on to the Red Sea and the Indian Ocean to check Portuguese expansion there. Ottoman attempts to dislodge the Portuguese from the Indian Ocean had failed spectacularly under Süleyman I. Although the expedition launched from Suez by the governor-general of Egypt, Süleyman Pasha, in 1538 secured Aden and Yemen, it never met the Portuguese navy. Another expedition in 1552, led by Piri Reis (c.1470–1554), the renowned Ottoman corsair, marine and cartographer and author of the famous naval manual (Kitab-i Bahriye, or Book of Seafaring/Maritime Matters) and maker of the first Ottoman map of the New World, ended in failure, and cost Piri Reis his life in 1554. Another attempt launched from Basra by Seydi (Sidi) Ali Reis in 1554 had the same unfortunate end. The idea to deploy part of their Mediterranean fleet in the Indian Ocean was revived by Sokollu Mehmed Pasha in 1568. In a decree (ferman) written in January 1568, Sultan Selim II ordered the governor-general of Egypt to investigate the feasibility of such a canal. The beylerbeyi had to dispatch knowledgeable local architects and engineers who would, in their turn, study the possibility of the construction of a canal between the Mediterranean and the Red Seas. The governor was also to report on the length and width of the prospective canal. As in earlier attempts, the underlying concern behind the decree was the threat that Portuguese expansion meant for the Holy Cities of Mecca and Medina and for the Muslim pilgrims coming from India. However, nothing materialised from the plan.

A third ambitious project was the Sakarya–İzmit canal plan. This would have connected the Black Sea with the Sea of Marmara through the Sakarya River (the third largest river of present-day Turkey after the Kızılırmak and Euphrates) that empties...
into the Black Sea and Lake Sapanca, an elongated lake some 17 kilometres long and 6 kilometres wide that lies some 5 kilometres to the west of the river. From the latter another canal would have led to the Bay of İzmit. The project would have enabled the Ottomans to bring timber from the forests of the sancak of Kocaeli to the Istanbul Naval Arsenal as well as firewood to the capital via canals, rivers and lakes, rather than using more expensive and cumbersome overland transportation. The idea was first conceived under Süleyman the Magnificent, who commissioned Mimar Sinan and a Greek architect to undertake the work. Although the project was launched and allegedly some 15 kilometres of canal was built, Süleyman's land campaigns diverted attention and resources from the project. The plan got new support in 1591, when Istanbul pondered large-scale fleet construction in order to strengthen the Ottoman navy, which had deteriorated in the relatively peaceful years after the Battle of Lepanto in 1571. However, the scheme was abandoned in 1593 when a renewed war with the Hapsburgs in Hungary demanded all available resources. Istanbul revived the plan in the seventeenth, eighteenth and nineteenth centuries, but every time without success, due largely to infighting and intrigues within the Ottoman elite.11

While none of the above-mentioned canal projects materialised, they point to the strategic thinking of the Ottoman leadership. On the other hand, they also reveal the lack of detailed knowledge with regard to the topography of remote lands, especially in the case of the Don–Volga canal project. We should not forget, however, that such ambitious projects also failed elsewhere in Europe. In 1697, Peter the Great (r. 1682–1725) also attempted to connect the Volga and Don rivers by a canal between their tributaries, the Kamysyn and Ilovlya, in order to gain access to the Black Sea, but the obstacles proved insurmountable for his richer and strategically better-suited empire too. The project did not materialise until Soviet times. The construction of the Volga–Don Ship Canal south of Volgograd started in 1948 and was completed in four years. Another example is the Rhine–Maas canal. First attempted by the Spanish Hapsburgs in 1626–9 and again by Napoleon in 1804, this ambitious project also ended as a costly failure.12

11 İsmail Hakki Uzunçarşılı, ‘Sakarya Nehrinin İzmit Körfezine Aktülmasıyla Marmara ve Karadenizin Birleştirilmesi Hakkında’, Belleten, 4/14–15 (1940), 149–74, esp. 150–7; Caroline Finkel and Aykut Barka, ‘The Sakarya River–Lake Sapanca–İzmit Bay canal project: a reappraisal of the historical record in the light of new morphological evidence’, Istanbuller Mitteilungen, 47 (1997), 429–42; Pál Fodor, ‘Between two continental wars: the Ottoman naval preparations in 1590–1592’, in idem, In Quest of the Golden Apple: Imperial Ideology, Politics, and Military Administration in the Ottoman Empire (Istanbul: Isis, 2000), 189. Recently, the project has been revitalised by young Turkish environmentalists in the form of an ambitious second ‘strait’ plan, submitted to the International Environmental Project Olympics (INEPO, Fatih College, Istanbul, Turkey), aimed at students aged 13 to 19. This suggested second ‘strait’ would follow the old Sakarya–Sapanca–İzmit canal, in order to divert the traffic of oil tankers from the Bosphorus, and thus diminish the environmental hazards and pollution there.

Like their arch-rivals, the Spanish and Austrian Hapsburgs, the Ottomans also attempted mapping their empire and frontiers, although the techniques and forms by which the Ottomans collated, stored and displayed the relevant information were somewhat different from those used in Europe. In addition to a ‘General Visitation’, ordered by Philip II in 1559 to gather information about his dominions in Italy, the king also commissioned cityscapes and maps of the Iberian Peninsula. On Philip’s order, in the 1560s, the Flemish court painter Anton van den Wyngaerde travelled extensively in Spain and North Africa, preparing a series of topographical views of towns, of which sixty-two finished ones survive. It seems that Philip planned to have them engraved and published, but the cityscapes became scattered in Vienna, London and Oxford and were rediscovered only in the nineteenth century. A more ambitious project involved the mapping of the entire Iberian Peninsula. In the 1570s and 1580s a team of cartographers surveyed the whole peninsula, some 500,000 square kilometres, presenting their results in an atlas of twenty-one detailed and remarkably accurate maps on a scale of 1:430,000. While the Escorial ‘Atlas of Spain’ remained, along with the planned description of Spanish America to be based on the comprehensive questionnaires of the *Relaciones topográficas*, incomplete and unpublished, the maps were unique in their time, for no other European state in the sixteenth century had anything similar to them.\(^\text{13}\)

In the Ottoman Empire, the most valuable information acquired from ‘mapping’ was collated and stored in the land or revenue surveys, known as *tahrir defterleri*, which were undertaken regularly and systematically in the fifteenth and sixteenth centuries. These surveys afforded the Istanbul government and its provincial administrators a detailed database regarding the size, composition and economic conditions of the population of various *sancaks* and provinces (*beylerbeyilik*, *vilayets*, or *eyalets*). In frontier provinces, these *tahrirs* were often used to delineate borders and solve frontier disputes. The most famous of such surveys along the Hapsburg–Ottoman frontier were the very first Ottoman *tahrirs* of the *sancaks* of the province of Buda, compiled by Halil Bey in 1546 and known in contemporary Hungarian parlance as Halil Bey’s *defters*. All concerned parties regarded villages that had been included into Halil Bey’s survey as settlements under Ottoman rule and taxation. Naturally, in later years Ottoman officials tried to include further villages in these *defters*, against which the Hungarian and Hapsburg authorities protested vehemently, considering such attempts as an unlawful broadening of the Ottoman frontiers.\(^\text{14}\) Controversies that surrounded Halil Bey’s *defters* remind us that we should not limit Ottoman ‘mapping’ to cartographical undertakings, although these were not unknown to the Ottomans either.


Sultan Mehmed II’s keen interest in maps as tools of military reconnaissance and intelligence is well documented. The existence in the archives of the Topkapı Palace, the empire’s administrative centre, of military maps and siege plans, such as those of Kiev (from the time of Sultan Bayezid II, 1481–1512), Belgrade (1521?), Malta (1556), Szigetvár (1566), Vienna (1683), Van in Asia Minor, Adakale (1738), and diagrams of the battles of Haçova/Mezőkeresztes (1596) and Prut (1711), to name only the best-known ones, illustrate the employment of map-makers during Ottoman campaigns and the use of cartographical representations in military communications. The mid-seventeenth-century regional map, drawn on eight double-folio sheets of paper, that charts the Euphrates and Tigris Rivers and indicates important sites, roads and mountains along the rivers or the map of the region to the north of the Black Sea (1768–9), shows Ottoman interest in mapping waterways and roads for both commercial and military purposes. Ottoman corsairs and marines also gathered valuable information on ports and port cities. While many of the topographical illustrations in Piri Reis’s Kitab-ı Bahriye are schematic and inaccurate, his personal observations are evident with regard to ports, harbours and harbour fortifications which—like those at Ragusa/Dubrovnik, Ancona and Venice—are carefully portrayed. As a former corsair, Piri Reis showed special interest in harbours, and it has been suggested that the depiction of the lagoon fortifications of Venice along with that of the Venetian arsenal in the Kitab-ı Bahriye might have been based on the work of a spy or renegade.

A new interpretation of the town views in Matrakçı Nasuh’s (d. 1564) works argues that the Ottomans were also keen to map their new territorial acquisitions and the geographical extent of their empire. Matrakçı Nasuh’s Beyan-i Menazıl-i Sefer-i Irakeyn-i Sultan Süleyman Han (The Description of the Stages of His Imperial Majesty Sultan Süleyman’s Campaign in the Two Iraqs [modern Iraq and western Iran], usually known by its shorter title Mecmua-i menazıl), and his Tarih-i Feth-i Siklós, Üstürgön ve İstolnî Belgrad (History of the Conquest of Siklós, Esztergom and Székesfehérvár), which narrate and illustrate Sultan Süleyman’s conquests during his eastern and Hungarian campaigns in 1534–5 and 1543, respectively, have been studied extensively, not least because of their splendid town views which, while resembling contemporary European bird’s-eye views, represent a specifically Ottoman genre. However, it has only recently been noticed that all the prominently displayed towns in double-folio city plans in the Mecmua-i Menazıl—those of Tabriz and Sultaniye in western Iran, Baghdad in central Iraq, Najaf, Karbala, and Hilla in lower Mesopotamia—were newly conquered frontier...

15 Franz Babinger, ‘An Italian map of the Balkans, presumably owned by Mehmed II, the Conqueror (1452–53)’, Imago Mundi, 8 (1951), 8–15.
towns which effectively defined the Ottoman–Safavid frontier in 1535. The same pattern is observable in Matrakçı Nasuh’s other works, where the most prominently described towns are those on the Empire’s Hungarian and eastern frontiers.\textsuperscript{18}

Awareness of geography worked differently in global and local contexts. Close familiarity with topography during imperial campaigns and smaller military undertakings was indispensable for identifying possible river crossings and drinking-water sources for soldiers and animals alike. Ottoman campaign journals, chronicles and geographical descriptions not surprisingly make frequent references to river crossings, as well as to local road guides (kilavuz). The employment of kilavuzes was instrumental especially in regions where climate and vegetation were hostile. Such a frontier was Hungary, which, contrary to general belief, was far from being the western extension of the large waterless Eurasian steppe. Without excellent knowledge of the region’s geography, vegetation and climate, communication and military undertakings were unthinkable in this country, where entire regions were dominated by swamps and marshes and where forests had extended over areas much wider than they do today. The fact that the Ottomans hired road guides as late as 1697 when marching from Nis to Belgrade, a familiar terrain and a usual campaign route along the Morava River, underlines the importance of up-to-date knowledge of topography and illustrates the difficulties and hazards associated with moving large forces even in familiar territory.\textsuperscript{19}

As in other parts of the Muslim–Christian divide, the Ottoman–Hapsburg border in Hungary was also a cultural and linguistic frontier that made information gathering more difficult. However, local societies provided the personnel who possessed the necessary language skills and acted as mediators between the two sides of the frontier. Since few Ottomans knew Latin or German, and perhaps even fewer Hapsburg officials knew Ottoman Turkish, Hungarian became the language of diplomacy and information gathering along the frontier, replacing Slavic, which had played the same role up until the early sixteenth century. The Hungarian interpreters of Ottoman beylerbeyis and sancakbeyis played a crucial role in this regard, and in the Austrian and Hungarian archives there are hundreds of letters written in Hungarian that provide precious information concerning daily life along the frontier.\textsuperscript{20} Governors and commanders in Hungary employed spies and informants to gather information about the other side of the frontier. They certainly felt that they knew a great deal about their enemy. In 1561, when the sancakbeyi of Istolni Belgrad (Hu. Székesfehérvár), Hamza Bey, was threatened that a large Hapsburg army would be sent against him, he reminded the Hungarian king, Ferdinand I of Hapsburg (r. 1526–64), that he could not possibly have


\textsuperscript{19} For the 1697 campaign, twenty road guides (kilavuzan) were hired. See BOA, Maliyeden Müdevver Defterleri (MAD) 2731, 92.

enough soldiers at his disposal for the undertaking. Had Ferdinand had enough soldiers, Hamza would have been informed,

because I have had a spy living in Vienna for six years, whose wife and child are there, a man who can say mass if he wants, or be a scribe, or a German, a Hungarian, or a good improviser, a soldier, a man with a limp, or someone who walks as steady as you do with a good knowledge of every language.21

With the help of their informants living in castles and villages in Hapsburg Hungary, Ottoman officials closely monitored the Hapsburg frontier. The detailed and surprisingly accurate Ottoman map of the Hapsburg border fortresses around Kanije (Hu. Kanizsa) is an example of such activity. The map was commissioned by Üveys Pasha, beylerbeyi of Buda (1578–80), and sent to Istanbul. It identified all the forts and castles, as well as major river crossings of this recently reorganised section of the Hapsburg frontier around Kanije in Transdanubian Hungary.22

Information coming from the provinces was assessed in Istanbul with the help of the Sublime Porte’s renegade interpreters, who being Germans, Italians, Greeks or Hungarians, were familiar with Europe’s geography and had access to European maps and atlases. While research regarding the relationship between European and Ottoman cartography is in its infancy, sporadic evidence suggests that Istanbul was more aware of European cartographical knowledge than previously thought. In 1573, one of the Porte’s renegade interpreters, Tercuman Mahmud (alias Sebold von Pribach of Vienna), ordered from Vienna two copies of Abraham Ortelius’ (1527–98) *Theatrum Orbis Terrarum* (*Theatre of the World*), the first modern atlas that contained uniform maps and supporting text. Mahmud was surprisingly up-to-date, for Ortelius first published his map-book in 1570.23

**River Systems, Terrain and Fortifications**

As in other parts of the world, border defence systems along the Ottoman–Hungarian/Hapsburg frontier often followed major rivers and used river systems, marshlands,

22 In Istanbul, Üveys Pasha’s map was copied and its inscriptions translated into Italian for Joachim von Sinzendorf, Hapsburg ambassador to Istanbul (1578–81), who sent it back to Vienna, indicating that the Hapsburg ambassadors, too, were efficient in counter-intelligence. The Italian copy of the original Turkish map is to be found in the Viennese Archives (Österreichische Staatsarchiv, Haus-, Hof- und Staatsarchiv Turcica Karton 43. Konv. 2. fol. 50) and has been published in facsimile by Géza Pálffy, *Európa védelmében* (Pápa: Jókai Mór Városi Könyvtár, 2000), facsimile III.
mountains and other natural defensive features that geography offered. The Danube played a crucial role as a natural border of empires from Roman times. The medieval Hungarian kingdom (1000–1526) built, from the late fourteenth century on, its anti-Ottoman defence system along the Danube and Sava Rivers. This defence line successfully halted Ottoman advance for 150 years, until it collapsed in the 1520s (see Figure 3.1).24

Ottoman authorities also studied the defence line of the countries they wanted to conquer. During their 1541 Hungarian campaign, which ended with the capture of Buda, the capital of the medieval Kingdom of Hungary, the Ottomans prepared a ‘plan of conquest’ that listed some of the strategically important Hungarian castles whose capture, according to the unknown author, was especially warranted. The document listed the forts according to their owners, the most prominent aristocrats and politicians of Hungary. It also gave the location of the castles, accompanied by short comments regarding their immediate past.25

By the 1550s, the Ottomans controlled the Danube as far as Estergon. Most of the former Hungarian castles between the Danube and Lake Balaton in Transdanubia, the forts in the Novigrad (Hu. Nográd) Mountains north of Ottoman Budun (Hu. Buda), and all the major castles along the River Tisza and its tributaries in the eastern parts of the country had also been in Ottoman hands. The Ottoman authorities repaired, strengthened and rebuilt these recently captured castles and forts when they thought them suitable for defence, or demolished them when they considered them useless.

The Hapsburgs for their part responded to these Ottoman conquests by organising their own border defence system. This crescent-shaped new defence line, established from the mid-sixteenth century onward, stretched some 1,000 kilometres in length from the Adriatic Sea to northern and north-eastern Hungary and comprised 120 to 130 large and small forts and watchtowers. Not surprisingly, it followed the mountains of Transdanubia and northern Hungary, that is, the only possible natural defence line offered by the geography of the region after the collapse of the former defence system that had relied on the Danube–Sava Rivers. Since Vienna lay just 180 to 200 kilometres from the major Ottoman garrisons in Hungary, the Hapsburg administration rebuilt and modernised the key fortresses of the Croatian and Hungarian Military Border according to the state-of-the-art standards of fortress building (trace italienne). In the 1570s and 1580s, some 22,000 soldiers guarded this border, of whom 15 per cent were

German, Italian and Spanish mercenaries, stationed in the key fortresses, whereas the rest of the guards were comprised of Hungarians, Serbs and Croats.26

The number of forts and the size of the garrison forces defending Ottoman Hungary in the second half of the sixteenth century were comparable to that of the Hungarian/Hapsburg defence line. In their two Hungarian provinces, Budun and Temeşvar, the Ottomans had about 120 to 130 castles and smaller forts which were guarded by some 18,000 garrison soldiers and 7,000 cavalrymen remunerated by military fiefs (timarlı sipahi). Ottoman pay registers and other archival sources indicate that the Ottomans closely monitored the Hungarian/Hapsburg frontier and adjusted the size and composition of their garrisons accordingly. The majority of Ottoman forts in Hungary were captured from the Hungarians. The Ottomans also built new forts and altered the inherited ones when their defence strategy so required. Moreover, their conquests and the organisation of new provinces and sub-provinces show that they took into consideration environmental and strategic considerations (see Figure 3.2). The establishment of a defensive ring of forts around Buda/Budun, the administrative and logistical centre of the first Ottoman province in Hungary by the same name (vilayet-i Budun), illustrates this strategic thinking. Estergon was the most important fortress that guarded Budun from Hungarian and Hapsburg attacks from the west. Since it also controlled both river and overland communication routes, Estergon received special attention from the Ottoman authorities. They not only reinforced Estergon proper by building several new bastions both in the fortress and in the ‘Lower Castle’ and a gunpowder work (baruthane), but also erected two new forts, mainly palisades, known as parkan in Ottoman Turkish and parkány in Hungarian: Tepedelen (Hu. Szent Tamás-hegy), right next to Estergon, and Cigirdelen (Hu. Párkány), on the other side of the Danube.27 In the Danube bend, Vízegrad and Vaç guarded Budun from the north/north-west, whereas Hamzabey Sarayı and Korkmaz/Cankurtalan at the southern tip of Csepel Island near Adony, secured the city from the south. From Vaç, the protecting ring defending Budun from the north followed the line of the Novigrad Mountains, where most of the Hungarian castles, such as Drégely, Szécsény, Hollókő and Buják (Ott. Diregel, Seçen, Holloka and Buyak) were captured in 1552. South of Buyak, the Ottomans built a new fort at Hatvan (1544), and made it the centre of a newly established sancak, for it controlled both the Zagyva River, a tributary of the Tisza, and the royal route (via regia) coming from Budun. The capture of Siklós


(Ott. Šikloš), Pécs (Ott. Peç) and Fehérvár (Ott. Istolni Belgrad) in Transdanubia (west of the River Danube) in 1543 helped to connect Budun with Ottoman-held Sirem (Serb. Srem/Cr. Srjem; between the Sava and Danube Rivers in present-day Croatia and Serbia). All these forts were reinforced and became sancak centres. The
conquest of Ozora, Tamási (Ott. Tomaşin) and Simontornya (Ott. Şimontorna) in
1545 secured Ottoman communication and transport along the right bank of the
Danube.  

The 1551–2 campaigns are significant, for several of the forts occupied during these
campaigns secured important river routes and crossings. In September 1551, Sokollu
Mehmed Pasha, governor-general of Rumeli, the European parts of the empire, cap-
tured Becse (Ott. Beçe) south of Szeged (Ott. Segedin or Seged) on the River Tisza,
which after Szeged (conquered in 1543), became the Ottomans’ second major port and
river crossing point on the lower Tisza, especially during their campaigns and raids
against the castles of the region of Temesvár (Ott. Temesvár / Rom. Timișoara). From
Becse, Sokollu proceeded south-east, taking Becskerek (Ott. Beçkerek) on the River
Béga, a tributary of the Tisza. His other conquests proved short-lived: Csanád (Ott.
Canad), whose rectangular fortress with corner bastions guarded a crossing point on
the River Maros (Rom. Mureş), a tributary of the Tisza, and Lippa (Ott./Rom. Lipova),
east of Csanád on the left bank of the Maros, with an elaborate defence sys-
tem, were both retaken by Hapsburg and Hungarian forces within a month. Sokollu
also failed to conquer Temesvár, the most important fortress in south-eastern Hungary
on the River Temes (Rom. Timiş), a tributary of the Danube, whose defences were
strengthened just before the 1551 siege.

Not surprisingly, the campaigns of 1552 also targeted some of the most important
castles that commanded the river routes of the Trans-Tisza region in south-eastern
Hungary. At the end of July, after a siege of more than a month, Temesvár fell to
second vizier Kara (‘Black’) Ahmed Pasha, by which the Ottomans secured the River
Temes. Lippa soon followed, as did Arad, both on the Maros River, and several other
castles along the Maros and Temes Rivers. Then Ahmed Pasha turned to the north,
and in early September he conquered Szolnok (Ott. Solnok), which controlled the
confluence of the Tisza and Zagyva Rivers, and the only permanent bridge over the
Tisza.  

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28 Regarding the Ottoman fortress system (its development, military force etc.) in Hungary see Klára Hegyi’s three-
volume definitive work: A török hödoltság várai és várkatonái (Budapest: História, 2007), which, however, was
unavailable at the time of the writing of this chapter. See also her earlier studies in English: Klára Hegyi, ‘Balkan
garrison troops and soldier-peasants in the Vilayet of Buda’, in Gerelyes and Kovács (eds.), Archaeology of the
Ottoman Period in Hungary, 23–40; Hegyi, ‘The Ottoman network of fortresses in Hungary’, in Dávid and Fodor
(eds.), Ottomans, Hungarians, and Habsburgs, 163–93; Hegyi, ‘The Ottoman military force in Hungary’, in Géza
Dávid and Pál Fodor (eds.), Hungarian-Ottoman Military and Diplomatic Relations in the Age of Süleyman the

29 The Ottoman campaigns of 1551–2 have been the subjects of numerous detailed studies, and the history of many
of the aforementioned castles is discussed in separate monographs, which cannot be listed here. On Ottoman build-
ing activities in the province of Temesvár see Ferenc Csortán, ‘Ottoman architecture in the Vilayet of Temesvár’,
That the conquests of 1551–2 were the result of careful planning and knowledge of geography is apparent from the fact that the aforementioned ‘conquest plan’ of 1541 also identified these forts as important targets. In 1541, the concern was the defence of the Ottoman northern frontier in Sirem. ‘Until the fortresses called Lippa, Temesvár, Becskerek and Becse have been taken Sirem province will not be free from evildoers’, commented the unknown author of our source.\footnote{Fodor, ‘Ottoman policy towards Hungary’, 150.}

The strategic significance of these forts is illustrated by the fact that in 1522 Temesvár became the centre of a new province, the second beylerbeylik established in Hungary. Beç-Beçekerek, Çanad, Arad and Lipova all became sancak centres, belonging to the new province of Temesvár, and their first tahrir surveys were promptly completed in 1554.\footnote{Gyula Káldy-Nagy, A csanádi szandszák 1567. és 1579. évi összeírása (Szeged: Csongrád Megyei Levéltár, 2000), 7.}

The Ottomans used their forts in Hungary for both defensive and offensive purposes. During the long Hapsburg–Ottoman war at the turn of the century (1593–1606), the Ottomans endeavoured to capture Vienna again; by occupying Veszprém (Ott. Bespirim), Palota, Tata, Győr, Szentmárton (Pannonhalma), Pápa and Tihany (Ott. Tihon) they came very close to attaining their goal. However, in the second phase of the war, because of the counter-attacks of the Hapsburg and Hungarian forces, the Ottomans lost all their recent conquests, except for Palota. Still, by occupying Eger (Ott. Eğri, 1596) and Kanizsa (Ott. Kanije, 1600), they further expanded their realm in Hungary. Further serious border changes took place only in the middle of the seventeenth century. The occupation of Várad (Ott. Varad, Rom. Oradea) in 1660 ceded control of the Sebes-Körös River (Rom. Crişul Repede), and thus of Transylvania. The occupation of Érsekújvár (Ott. Uyvar, Sl. Nové Zámky) in 1664 drove a wedge into the Hungarian defensive ring around Vienna and, as the unsuccessful Hapsburg siege of Buda in 1684 proved, Uyvar significantly increased the protection of Ottoman Budun.

Terrain also influenced the composition of garrisons. Whereas cavalrymen usually dominated garrisons on both sides of the border in Hungary, in and around Kanije, which was surrounded by swamps and marshlands, infantry comprised the majority of the forces, for they could move around more easily in swamps than cavalry. In Ottoman Kanije in the 1650s, the infantry–cavalry ratio was 60:37. It is hardly surprising that in the fourteen smaller Hungarian/Hapsburg border forts charged with the task of opposing Ottoman Kanije—known as Gegen Canischas werts Liegenten Granizten—both the size and the distribution of the garrisons were comparable with that of Kanije: 59–64 per cent of the soldiers being infantry, and only 36–41 per cent cavalry.\footnote{Gábor Ágoston, ‘The costs of the Ottoman fortress-system in Hungary in the sixteenth and seventeenth centuries’, in Dávid and Fodor (eds.), Ottomans, Hungarians and Habsburgs, 202–3; József Kelenik, ‘A Kanizsa elleni
The most characteristic landscape-forming transformations in Hungary in the sixteenth and seventeenth centuries were deforestation and the spreading of marshes and swamps. While the causes, the extent and the consequence of these changes require further research, the simplistic and biased views regarding the negative effects of the ‘Turkish conquests’ on landscape and population put forward by Gyula Szekfű, the most influential historian in inter-war Hungary and the father of the Hungarian Geistesgeschichte school, are hardly tenable. Known for his pro-Hapsburg and anti-Turkish views, indeed for his Turkophobia, Szekfű blamed the Turks not only for the general dislocation of the country’s historical evolution, economic and social decay, depopulation and changing ratio of Magyar to non-Magyar populations, but also for the destruction of environment and changes in climate. In his view, ‘the pusztá [semi-desert] character of the Great Hungarian Plain, the pusztá-vegetation, the arid pusztá-climate in which extreme heat waves alternate with severe cold weather, the lack of trees and water are all the results of the Turkish era, that is, the consequences of the Turkish conquest.’ While his multi-volume Magyar History (1928–34), co-authored with his noted medievalist colleague Bálint Hóman, has enjoyed startling popularity in the past two decades and his pro-Hapsburg views got a new spin with Hungary’s joining the European Union, his theses regarding landscape were challenged as early as 1940. Pál Teleki and his colleagues refuted Szekfű’s views, by pointing out that the pusztá-character of the Great Hungarian Plain was not created by the Turks, but was instead the result of the major drainage projects of the nineteenth century.

It is also clear that deforestation was not unique to Hungary and that its causes were similar to those observable elsewhere in Europe. Around 1500, Europe had substantially more forests and wooded areas than today. However, the growth in Europe’s population from about 1500 and the resulting expansion of agriculture led to forest
clearings, whereas mining and smelting, war-related industries (cannon casting, salt-petre and gunpowder production), fortress building, and the construction of ever-growing navies, all brought about by the so-called early-modern ‘gunpowder/military revolution’, required substantially more fuelwood, charcoal and timber, and resulted in deforestation.

Geographers and environmental historians have identified several causes of deforestation in the early modern period, of which clearing for agricultural expansion (because of population increases), fuelwood consumption, shipbuilding, charcoal and iron making are usually ranked as the most important activities that contributed to deforestation.\(^\text{36}\) Since the population of Hungary, unlike that of Western Europe, remained stagnant or increased only modestly thanks mainly to warfare and its impact,\(^\text{37}\) domestic fuel consumption probably did not rise substantially. Agricultural clearing, on the other hand, must have intensified. The sixteenth century was the golden era of the Hungarian cattle trade, associated with the upsurge of increased meat consumption of a booming European population and with the nature of a frontier economy. In war zones people preferred investment in movable assets, such as cattle, which could be saved more easily than grain or wine, whose transport depended on road conditions and the availability of the means of transportation. By the 1570s, total annual cattle exports from Hungary could have topped 140,000–150,000 head, of which two-thirds were sent to Austria and Upper Germany and the rest to Venice. By this time a new breed, known as the Hungarian ‘white-and-grey’ cattle, weighing up to 500 kg as compared to 200 kg of the smaller peasant cattle, dominated the market. All this required new pasture lands and the clearing of forests. In addition, tens of thousands of cattle and sheep grazed in woodlands, causing irreparable damage. Indeed, literature on woodlands and forests has named cattle and sheep breeding as the number one cause for deforestation in the Great Hungarian Plain, which, contrary to general belief, was covered amply by forests in the sixteenth and seventeenth centuries.\(^\text{38}\)

It seems that in the mid-sixteenth century there were still plenty of wooded areas around castles and fortifications to meet their need for timber and fuelwood. However, after construction works in the major forts gathered pace from the mid-1550s onwards, less and less wood was available in the vicinity of these fortresses. The account books of the castle of Eger (northern Hungary) show that most of the timber in the 1550s came from the neighbouring forests situated at a distance of 10 to 15 kilometres around

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\(^\text{37}\) Recent studies estimate the population of Hungary at 3.1–3.5 million around 1500, at 3.5–4 million in the 1570s–1590s, and at 4 million around 1720. See the essays by András Kubinyi, Géza Dávid, Vera Zimányi and Teréz Oborni, in József Kovácsics (ed.), *Magyarország történeti demográfiaja, 896–1995* (Budapest, 1997); see also Géza Dávid, *Studies in the Demographic and Administrative History of Ottoman Hungary* (Istanbul: Isis, 1997).

Eger, whereas lumber, wood lath and shingles were purchased from some twenty-nine villages in the neighbouring Gömör county. Similarly, according to the decrees of the Hungarian Diet of 1563, the forests of the Csallóköz were designated to meet the timber need of the fortresses of Komárom and Győr in north-western Hungary. The decision seemed logical, for the forests of the Csallóköz—a large island in north-western Hungary (present-day south-western Slovakia) between the main branch of the River Danube and the Little Danube, known formerly as the Csalló River—lay in the immediate vicinity of the two forts. Meeting the timber and fuelwood needs of the two fortresses, however, must have taken severe toll on the Csallóköz forests, especially after major rebuilding started in earnest in Komárom and Győr in the mid-1550s. Thus, the Diet of 1600 allowed the cutting of trees in the remote forests of Hungary’s northernmost counties (Turóc, Liptó, and Árva), along the borders of Poland, some 120–250 kilometres north of Komárom.

Increased defence- and war-related activities on both sides of the frontier all drew heavily on forests. The account books of the Upper Hungarian Chamber show that the Hungarian garrisons under the command of the captain-general of Upper Hungary, that is the eastern parts of northern Hungary, used 24,542 cartloads of firewood during the winter of 1674. This would have equalled 41,741 cubic metres of wood, or some 14,600 metric tons of pine and 25,000 metric tons of oak, which seems a lot given that the number of soldiers in the forts of Upper Hungary could not have been more than 2,800 and was perhaps much less. While estimates regarding per capita per annum fuelwood consumption in pre-industrial Europe vary significantly, our figure is still two to ten times higher than available estimates for Northern Europe and

40 From administrative and military-administrative points of view the Viennese and Hungarian authorities divided northern Hungary into two parts along the line stretching from the western borders of Gömör-Kishont (or Szepes) county through the Tisza River. Territories to the west of this line (and thus closer to Vienna, the point of reference) were called Lower Hungary, while those to the east Upper Hungary. Counties under the command of the captain-general of Upper Hungary included (from west to east) Szepes, Gömör-Kishont, Torna, Borsod, Heves, Sáros, Abaúj, Zemplén, Szabolcs, Ung, Bereg, Ugocsa and Szatmár. See Pálffy, ‘The origins and development of the border defence system’, 68.
41 The closest data I could find for cartloads used for transporting wood is from Veszprem and comes from 1696: 1 cartload = 1.7 cubic metres. See István Bogdán, Magyarországi úr-, térfo-gat-, sály- és darabmértékek 1874-ig (Budapest: Akadémiai Kiadó, 1991), 421. This seems reasonable. Calculating with the conservative 350 kg per m³ for seasoned and dry pine and 600 kg per m³ for oak, one cart would be between 595 kg and 1020 kg, which compared with other data is more than plausible. Of course, these figures could have been much higher depending on the types of pine and oak wood, and their moisture content could also influence the calculation.
42 Unfortunately, we do not know the number of soldiers stationed in these forts. In 1670, their number on paper was 2,817. However, according to the ‘decree of reduction’ of 1671 this number had to be reduced to 1,000 soldiers. According to an official report dated 10 October 1675, the king still paid 1,562 soldiers (1,168 hussars and 394 hajdús) in the Upper Hungarian castles. See István Czigány, Reform vagy kudarc? Kísérletek a magyarországi katonaság beillesztésére a Habsburg Birodalom haderejébe (Budapest: Balassi Kiadó, 2004), 125–7.
Germany. This can only be explained if we consider the following possible reasons: (1) The total number of people living in these fortresses usually exceeded those on the regular payroll. (2) Fortresses consumed substantially more firewood than average villagers or city dwellers, for they employed an array of wood-burning trades (gunpowder-makers, smiths, founders, potters, bakers, and so on). (3) For many of these trades they needed charcoal rather than firewood, which considerably increased their firewood needs, for contemporaries used five to ten kilograms of wood to make one kilogram of charcoal. (4) Winters in the early 1670s were colder than usual. Since soldiers on the royal payroll in the Upper Hungarian forts constituted only about 25 per cent of the total garrison forces deployed by the Hapsburgs along the Hungarian Border Defence Line in the seventeenth century, the fuelwood need of all the garrisons under Hapsburg command could have reached 166,964 cubic metres per winter. However, if we add to this the fuelwood consumption of the Ottoman garrisons (whose size in the 1660s was about twice that of the Hungarian/Hapsburg forces) we arrive at a staggering amount of 500,892 cubic metres of fuelwood burned by the opposing military garrisons along the Ottoman–Hapsburg frontier in Hungary per winter. Depending on the type of wood, this would equal the annual yield of 7,012 square kilometres of pine and 12,000 square kilometres of oak woodland.

Fuel-hungry iron forges, saltpetre and gunpowder works put an additional strain on the forests of the frontier. The manufacturing of an estimated yearly amount of 108 metric tons (roughly 2,000 kantars) of gunpowder in Ottoman Hungary's two most important Ottoman powder works (Budun and Temesvár), required some 81 metric tons of saltpetre, 13.5 metric tons of charcoal and the like amount of sulphur (not counting the loss during production). To produce this amount of saltpetre, the powder works had to burn some 1,300 metric tons of firewood. It took an additional 67.5 to 135 metric tons of wood to make 12.5 metric tons of charcoal used in these
gunpowder works. The two together would consume the annual yield of almost 58 square kilometres of woodland.

Another activity that took a serious toll on woodlands was deliberate destruction of forests and villages. The ‘scorched earth policy’, that is, the devastation of the hinterland of the Ottoman forts, had been suggested time and again by the Hapsburg military commanders (the most notable being the 1577 Viennese military conference), but the plan was eventually rejected for military, economic and political considerations. However, at least on two occasions (in 1598 and 1664), Hungarian commanders brought havoc to Ottoman Hungary. In July 1598, Miklós Pálffy (1552–1600), district captain-general of Érsekújvár (1589–1600), burned down a large territory as far as 130 kilometres to the south of Buda. In January 1664, Count Miklós Zrínyi (Nikola Zrinski, 1620–64), defender of the Muraköz Region (the area between the Rivers Drava and Mura in southern Hungary, now Međimurje in northern Croatia) scorched the whole area along the Drava, and burned down Süleyman I’s famous timber bridge at Eszék (Osijek), the main crossing point over the Drava and its surrounding swamps.50 Burning of villages, grain fields and woodlands was also frequent during smaller raids by both parties.

Deforestation had an effect on the region’s hydraulic system too. Streams poured into rivers from deforested hills, bringing a lot of silt with them, banking up valleys, and blocking riverbeds. All these were facilitated by war conditions, which hindered water regulation works that had helped maintain riverbeds in earlier centuries. War conditions demanded military work on waterways, such as creating protective marshes. On plain lands, protection was secured by building castles in river estuaries and river bends or by routing water via canals from nearby rivers, streams or marshes into ditches dug around the castles. Such waters protected the riverside and ‘swamp forts’ of Győr, Tokaj, Szolnok, Gyula, Temesvár, Szigetvár, Kaposvár, Ecsed and Tata.

As contemporaries, both Europeans and Ottomans, noted, many of these forts appeared to the observer as islands within lakes and marshes (see Figure 3.2). In his Tercüme-i Coğrafya-i Kebir (Translation of the Great Atlas) Behram Dimiški (d. 1690/1) commented on these features of several forts in Hungary. Thanks to its deep moat, Temesvár looked like an island, whereas its surroundings were inaccessible swamp. Behind its inner castle there was a lake created from the waters of the Temes River. He had similar comments on Beçkerek, which stood in the Temes River on an island, surrounded by bogs.51 Kanije was enclosed by the Zakany River. It was inaccessible on every side for at least a mil (or about three kilometres),52 because of its swamps.

52 Fekete claims that 1 mil = ½ farsah, that is the distance that a horseman could travel in half an hour. 1 farsah was about 6,230 metres in Hungary, and about 5,760 metres in the Arab lands (Fekete, ‘A hódoltságkori törökség’).
Sigetvar was also built in the centre of a large lake, encircled by waters and marshes. Its separate two fortresses (in fact, there were three) were connected by a bridge. Contemporary Ottoman and European topographical illustrations of Sigetvar and other ‘swamp forts’ were also in accord with these descriptions, and the maps prepared by Luigi Ferdinando Marsigli at the end of the seventeenth and the beginning of the eighteenth centuries provide vivid illustrations of the marshlands of Hungary and the Hapsburg–Ottoman frontier.

In marshy and swampy areas, soil humidity and evaporation were extremely high. Foreign mercenaries fighting in Hungary in the sixteenth and seventeenth centuries complained about the harmful evaporation and dampness of the soil, which was so high that the shirts of soldiers who slept in tents were soaked in water by morning, despite the fact that the tents had multiple layers for better protection against the weather.

This was coupled with the extreme weather: summers were hot and winters were very cold. May was already very warm, with unbearable heat in July and August. Not only were the seasons extreme, but temperature discrepancies during the day meant that summer days were too warm and nights were too cold and damp. On the other hand, evenings became very cool by the end of September, the first snow fell in October, and everything was covered by thick snow from November through February. Especially cold and harsh winters were recorded in the middle and at the end of the sixteenth century and in the middle and at the end of the seventeenth century. All these were the effects of the so-called ‘Little Ice Age’. The observations of contemporaries have been confirmed by climate historians, although changes in seasonal climate were considerable. While summers in 1534–6 and 1556–9 were exceptionally warm and dry, those in 1541–4 were cooler. Winters in 1565–96 and 1687–98 were especially severe. In the last third of the sixteenth century in every season (except autumns) temperature fell more than 1°C, and rainfall usually concentrated in midsummer.

Persistently snowy winters and extraordinarily rainy summers were often followed by strikingly bad crops and famine. This occurred in the frosty 1690s, when the crops all over Europe were at their worst. The quantity of rainfall increased, and reached its peak at the turn of the eighteenth century. Periods with strikingly high rainfall coincided with the Long Hungarian War (1593–1606), the Ottoman campaigns of 1663–4, and the Holy League’s War of 1683–99, which greatly reinforced the negative effects of wars on the economy and society.

12) According to Walter Hinz (Islamische Masse und Gewichte umgerechnet ins metrische System (Leiden: Brill, 1955), 63) 1 mil = ¼ farsah, that is about two kilometres.
54 In English see John Stoye, Marsigli’s Europe, 1680–1730: The Life and Times of Luigi Ferdinando Marsigli, Soldier and Virtuoso (New Haven: Yale University Press, 1994).
Wars claimed their victims by causing famines and epidemics and by destroying the normal functioning of the economy and society. Underfed, weak soldiers were easily susceptible to epidemics, which the armies spread among frontier populations. In the period between the sixteenth and the eighteenth century, the *morbus hungaricus* was the illness that made Hungary notorious. Medical history has identified the *morbus hungaricus* with epidemic or ‘louse-borne’ typhus, a disease of war and famine, which, in 1542, killed some 30,000 German and Italian soldiers during Joachim of Brandenburg’s Hungarian campaign. Although by then it had already been known in Italy, Spain and France, infected German mercenaries returning from Hungary spread it to other countries in Europe, causing typhus outbreaks in Bohemia, Austria and Germany. It seems that typhus was known as a localised endemic disease in Hungary and the Balkans, and it is probable that the Hungarians and the Ottomans had developed some kind of immunity against it. Besides their more careful hygienic measures, this relative immunity must have been responsible for the fact that the disease did not do as much harm among the Hungarians and Turks as it did among the German mercenaries fighting in Hungary. The German mercenaries were infected via lice and, since they did not have immunity, what had earlier been a localised endemic disease soon assumed epidemic proportions and claimed its victims by the thousands.\(^{56}\)

The Hapsburg–Ottoman Long War of 1593–1606 saw a succession of different epidemics and calamities. Plague broke out in Pozsony County in 1599, famine and plague decimated the population in several areas of Hungary and Transylvania in 1600, plague and cattle-plague broke out in Upper Hungary in 1601, and in 1602–3 famine and plague devastated Transylvania thanks to exceptionally bad crops and the war. The plague claimed numerous victims in the seventeenth century, especially among the urban population. In 1621, within four months, out of Debrecen’s 12,000 citizens 2,000 people fell victim to the plague, while in June 1645, 2,200 people died of the plague in Lőcse. The plague of 1655 killed almost half of the inhabitants of Sopron, and the number of people living in the city did not reach the pre-plague population of 4,000 until the end of the century.\(^{57}\)

### Conclusion

This chapter has shown some possible themes where environmental and military historians can mutually benefit from each other’s research. It argued that, although in somewhat different ways, the Ottomans and their Hapsburg rivals both had keen interest in geography and mapped their empires and resources, and possessed adequate

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\(^{57}\) Ágoston and Oborni, *A tizenhetedik század*, 99–104.
information as to the terrain and river systems of their lands and frontiers. The Ottomans occupied and reinforced dozens of forts along the River Danube and its tributaries, demolishing those deemed useless or impossible to defend. The chapter has also demonstrated that the formation of the Ottoman–Hapsburg military frontier was significantly influenced by Hungary’s terrain and river systems. On the other hand, war and defence-related activities—such as construction of forts, shipbuilding, cannon casting, saltpetre and gunpowder production—significantly affected the environment of the frontier by clearing its woodlands and causing considerable deforestation along and beyond the frontier. This deforestation, in turn, influenced the region’s hydraulic system and accelerated the spread of swamps, as did the establishment of dozens of ‘swamp-forts’. The spread of marshlands, in turn, negatively affected the micro-climate and created situations in which epidemics, such as *morbus hungaricus*, spread more rapidly.

Nevertheless, wetlands and swamps also offered refuge for tens of thousands of people. Whole villages ‘disappeared’ and were relocated during campaigns, and during Ottoman, Hungarian and Hapsburg raids, as well as before the taxation season (24 April and 26 October, in case of Ottoman Hungary). While both the Ottomans and the Hapsburgs tried to familiarise themselves with the country’s topography, the locals obviously enjoyed advantages in this regard. To follow villagers into the marshes meant great risks for soldiers and officials. The authorities had to rely on local guides, whose loyalties were often questionable. We know of several stories, some undoubtedly embellished during the centuries, telling of how these guides led Ottoman and Hapsburg soldiers and officials into swamps only to abandon them there. Whatever the historical accuracy of such stories regarding the details, they show that marshes, and geography in general, played a more important role in warfare and the daily life in the frontier than is usually acknowledged.

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