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Environments of War

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Contents

FEATURED REVIEW

BOOK REVIEWS

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Peacetime Changes to the Landscape in Eighteenth-Century Transylvania: Attempts to Regulate the Mureş River and to Eliminate Its Meanders in the Josephine Period

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The article focuses on the attempts of Habsburg authorities in eighteenth-century Transylvania to regulate the Mureş River and eliminate its meanders in order to improve salt and timber transport to Hungary and the Banat region. These attempts ultimately led to changes in the landscape of the province by reshaping riverbanks and removing their vegetation. These changes were prompted by the need to change the type of transport vessel as a result of the timber crisis. To this end, specialists from Upper Austria were brought to build the new softwood vessels that were cheaper and corresponded with the characteristics of the Mureş River. The engineer Mathias Fischer was appointed project leader. He also initiated and planned cleaning operations on the river. The article also presents the work methods and machines employed during these operations and discusses the failed operation to eliminate the meander at Ciugud. In addition, the efforts of the Transylvanian *Gubernium* and Salt Office led to the accelerated development of towns such as Alba Iulia and Topliţa.

Keywords: environmental history, river regulation, landscape changes, early modern era, timber trade, salt trade

In the eighteenth-century, many West European states initiated canal building and river regulation projects. They were promoted and carried out in order to increase agricultural output as well as to protect agricultural land and human settlements from floods. In addition, they played a significant role in preventing and reducing the spread of epidemic diseases among humans and animals alike.[1]

Navigable rivers played an important role in transportation. The expansion of internal waterways was an essential requirement for the economic development of pre-industrial societies. Before the planned expansion of the road network and the emergence of railways, rivers and canals had been the

1 Szücs, "Auenbewirtschaftungsformen an der Theiß," 243; Scholl, *Ingenieure in der Frühindustrialisierung*, 118.

main transportation routes for natural products and resources. Transportation costs over water were cheaper than over land, especially given that the poor state of roads was a serious hindrance to traffic.

River regulation and river bank stabilization greatly contributed to the expansion of internal waterways. Thus, many river sections were straightened by eliminating meanders and deepened by removing sediment through dredging, and river banks were stabilized, which not only made the passage of ships smoother, faster, and safer, but also reduced the risk of floods.

The main focus of this study is how the landscape of the Mureş River changed in the context of the eighteenth-century timber crisis and the efforts made by the Habsburg state—central and local authorities alike—to achieve this change, and how it impacted economic growth and human settlements.

In the second half of the eighteenth century, Transylvania went through a timber crisis. Due to the reduction of wood resources and an increase in their price, the Transylvanian *Gubernium* decreed that, instead of hardwood, softwood should be used in shipbuilding. The new task of shipbuilding was given to Upper Austrian masters.[2] One of the most critical measures that the *Gubernium* took was to regulate the Mureş River based on the model of the Traun River in Upper Austria. Austrian specialists viewed this river as a model for Transylvania because its course and discharge were similar to those of the Mureş River.[3] Their aim was to accommodate the new salt ships made of softwood timber. As a result, significant material efforts were made to eliminate all potential obstacles and meanders on the river, which could damage the salt ships and implicitly their precious cargo, as well as hinder the transportation of other resources from Transylvania to Hungary, such as timber and military matériel.

The first part of the article deals with the technologies used in the cleaning of the Mureş River in 1779, discussing the issues that emerged during this operation and its environmental impact. In parallel with this dredging operation, they also attempted to improve the waterway by stabilizing the riverbanks and removing obstacles, such as rocks, trees, mills, and bridge ruins. The navigable section of the Mureş River extended from Mirislău (Miriszló in Hungarian) to Zam (Sameschdorf in German, Zám in Hungarian) where it left Transylvania, flowing into the region of Banat. This operation involved the local town halls from the provinces adjoining the Mureş River, such as Transylvania, the Banat,

2 Österreichisches Staatsarchiv, Neue Hofkammer, Siebenbürgische Kammerale, Salzwesen, 198, Year 1779: 531.

3 Ibid., 172.

and Hungary, as well as engineers, a local workforce, and representatives from Vienna.

The final part discusses the operation to eliminate meanders, which mainly targeted the area around Ciugud (Schenkendorf in German, Csügöd in Hungarian), close to the Alba Iulia fortress, in 1786. The so-called "Limba" (Tongue) meander was the first to be eliminated. However, because there was no hydrotechnician to run the operation, it was carried out inexpertly and in an improvised manner, which ultimately made it unsuccessful. In the end they were forced to move the village instead. These operations, apart from their primary target of eliminating meanders, also focused on the removal of vegetation from the river banks, more precisely brush and smaller wooded areas that could potentially hinder work and transportation.

State of the Art

This topic on the changes to the landscape that occurred following attempts to regulate the Mureş River has not yet been tackled either by Romanian historiography or Hungarian historiography. Works dealing with transportation on the Mureş River tend to focus on the history of salt mining. Given the interdisciplinary character of this topic, which brings together knowledge and perspectives from the fields of history and geography, one should take a brief look at the scholarly works that have touched upon it.

The subject was briefly approached in a recently published monograph on forests in eighteenth-century Transylvania, more precisely in the chapter dealing with knowledge transfer from Austria to Transylvania and the search for solutions to the timber crisis that affected inland navigation in this province.[4] Given that a detailed approach to the issue of forestry would go beyond the limits this paper, only one of its aspects will be analyzed in this article.

in the eighteenth century, Transylvania and Europe witnessed an acute timber crisis, principally caused by overharvesting. At the time, wood was the main energy source in industry. The increase in the price of timber strongly impacted each economic sector. As for the military, the oak timber crisis affected the construction of fortifications, transport vessels, and bridges. As a result, Transylvanian town halls regulated the access of individuals as well as goats and cattle to forests and the harvesting of certain tree species, restricted construction,

4 Rus, *Wald- und Ressourcenpolitik*, 218–23.

replaced timber with brick, stone, and roof tiles as primary building materials, and introduced fast-growing tree species.

Konrad Müller[5] was the first to approach the subject from the perspective of the history of transportation in his work on the Habsburg economic policy before and during the reign of empress Maria Theresa. Müller discusses, among others, the efforts of the Salt Office, Treasury and *Gubernium* to modernize transportation by land and by water alike. His work, largely based on documents from the State Archives in Vienna, provides an overview of the aforementioned modernization efforts. Mercantilist policies in Transylvania were principally focused on the exploitation of natural resources. Maria Theresa's reforms offered the province the much-needed opportunity to develop its economy. However, their implementation was hindered both by underpopulation and resistance from the aristocracy and landed nobility.

In the category of works on the history of transportation one should also mention the authors who approach the history of salt mining and timber rafting. Thus, authors such as Beniamin Bossa,[6] Ioan Dordea,[7] Volker Wollmann,[8] Harald Heppner,[9] Viorica Suciu and Gheorghe Anghel,[10] Dorin-Ioan Rus,[11] and Dorel Marc[12] discuss ethnographic and historical aspects of transport by water without approaching the issue of the regulation of the Mureş River.

One should also mention the most recent approaches concerning the regulation of the Tisa (Tisza) River and the Danube. For the first case, Linda Szücs's study[13] focusing on the impact that the regulation of the Tisa River had on the agriculture in the surrounding areas is notable. Edit Király's work,[14] despite mainly focusing on the regulation of the Danube and its perception in the nineteenth century, provides many pieces of relevant information on the eighteenth century as well.

5 Müller, *Siebenbürgische Wirtschaftspolitik*.

6 Bossa, "Transportul sării pe Mureş," 141–49.

7 Dordea, "Un proiect din anul 1790 privind reorganizarea economiei sării," 441–57; Dordea, "Aspecte ale transportului sării pe Mureş," 165–93.

8 Wollmann and Dordea, "Transportul şi comercializarea sării," 135–71.

9 Heppner, "Die Wasserstraßen und ihre Bedeutung," 91–106.

10 Suciu and Anghel, "Mărturii ale practicării plutăritului," 376–87.

11 Rus, "Din istoricul societăţii de plutărit din Reghinul-Săsesc (1852–1908)," 91–95.

12 Marc, "Sisteme de transport şi de comercializare tradiţională a sării," 152–57.

13 Szücs, "Auenbewirtschaftungsformen," 237–50.

14 Király, *"Die Donau ist die Form."*

Transylvania's Rivers and Their Role in Salt Transportation

Transylvania's navigable waterways (Mieresch/Maros/Mureş, Samosch/Samos/Someş, Alt/Olt, partially Arieş/Aranyos and Körös/Criş) had been used for salt transportation since the Roman period. The earliest plans to render navigation easier, which were included into larger projects for the reorganization of salt mines, can be dated back to the time when the province was an autonomous Principality (1541–1688).[15]

River projects in Transylvania trace their origin to the issue of efficient salt transport. In 1699, shortly after Transylvania came under Habsburg rule, the Aulic Chamber reorganized the salt monopoly as well as the main warehouse located at Partoş (Alba Iulia) where a dockyard for the building of ships, ferries, rafts, and other types of vessels needed for the transportation of salt and other goods on the Mureş River operated in the eighteenth century. The main task of the Salt Office, whose headquarters were located in Alba Iulia, was to organize the transportation of salt and other goods on the Mureş River, which required the hiring of an ever-growing number of rafters and crews for ships.[16] Ordinarily, the Office carried out the transport of salt, but it also often carried out the transport of various other goods, such as grain, foods, wine, iron, lead, copper, lumber, boards, and building stones, to the western areas of Transylvania, the Banat, and Hungary. In 1788, following the outbreak of the Austro-Russo-Turkish War (1787–91), the Office became involved in the transport of war matériel too. On 28 January 1788, the Transylvania Gubernium requested the Salt Office to put at the Army's disposal 25–30 pontoons needed by troops to build bridges for crossing rivers and streams.[17]

In 1786, the Austrian hydrologist François Joseph Maire describes in his work the empire's great waterways and the economic advantages that their navigability could bring. Regarding raw materials and goods that could be more cheaply transported by water from Transylvania, Maire mentions salt, antimony, grain, tobacco, hemp, wine, horses, sheep, leather, wax, and honey. Salt played a crucial role within trade. Hungary, Slavonia, and Croatia were supplied with Transylvanian salt, the quantity delivered annually reaching 600,000 quintals.

15 Strider, "Ein Bericht," 260–61; Rus, "Böhmische und slowakische Berichte," 93.

16 Suciu and Anghel, "Mărturii," 373.

17 Suciu and Anghel, "Mărturii," 374.

As for goods that could be transported to Transylvania by water, he mentions manufactured products, sugar, coffee, and luxury items.[18]

In 1772, the Office at Partoş owned 262 vessels, but the transport to Szeged (Seghedin) of the necessary 600,000 quintals of salt (30,000 tons) required at least 400 vessels. In 1778, 92 vessels were brought back from Arad to Partoş for reuse, while in 1780 the number of vessels included in the Office's inventory reached 300.[19]

Measures for the Navigability of Transylvanian Rivers in the Eighteenth Century

After Habsburg authorities took control of Transylvania, they started to draft plans to render the rivers navigable again, given that they had been used for salt transport in Roman times (106–275 AD). In 1700, Count Johann Friedrich von Seeau submitted such a plan for the Someş and Olt rivers,[20] but it failed for same reason as later plans, because of a lack of qualified personnel and technology. For example, a 1771 project aimed to bring ship crews from the German states and regulate the Mureş and Arieş rivers with the help of modern machinery brought from the German states. Although the plan was approved, it was ultimately abandoned[21] likely because of the devastation caused by floods that year,[22] which prompted the Financial Directorate to reallocate the funds to flood relief efforts.

Throughout Maria Theresa's reign, new river regulation projects were submitted in order to improve navigation on the Monarchy's main rivers.[23] One of them was Maire's ambitious project to create a waterway connecting Sibiu and Trieste. The first step was to link up the Olt and Mureş rivers at Sibiu, thus creating easier access to the Danube. Then, this waterway was to be unified with another one that linked Szeged to Pest, thus allowing Austria access to West European markets by water. In Maire's vision, a logical consequence was to link up the Mureş and Someş rivers as well, which would hasten Transylvania's

18 Maire, *Bemerkungen,* 147.
19 Suciu and Anghel, "Mărturii," 373.
20 Wollmann, "Der siebenbürgische Bergbau," 42.
21 Müller, *Wirtschaftspolitik*, 57.
22 Rus, "Die Überschwemmungen," 43–62.
23 von Hietzinger, *Statistik der Militärgränze,* 82–102.

economic progress.[24] Colonel Jean-Baptiste Brequin de Demenge's 1766 plan,[25] which aimed at linking the provinces of Croatia, Transylvania, Hungary, and the Banat to the Drava River in order to facilitate trade by water, was ultimately abandoned.[26]

According to a mercantilist-inspired transport system in Europe, navigation on internal waterways was seen as the best quality means of transportation. Certainly, transport by land was not neglected either. The developmental potential of navigation on internal waterways was especially significant in this time period. Wherever opportunities for economic development arose, the use of waterways was always taken into account. However, this development was somewhat slowed down due to the limited territory of many states, and their separation by trade barriers and customs.[27]

Under the influence of mercantilist theories, absolutist rulers improved transport conditions by promoting navigation on internal waterways in order to increase the economic power of their states, and started the systematic reorganization by connecting the various fluvial transport systems. Thus, in Western Europe numerous plans to regulate rivers and to build canals between the main navigable rivers were drawn up. In 1770, the Austrian government issued a navigation ordinance for the Danube (Donau-Schifffahrtsordnung) and initiated the systematic regulation of navigable rivers.[28] Although certain mercantilist states also expanded their road infrastructure, in most states transport was moved on internal waterways. For instance, during the Russo-Austro-Turkish conflict, war matériel was mostly transported by water. The era of mercantilism witnessed a wave of canal building in Central Europe too. Absolute monarchs perceived transport policies, which included the planning and construction of canal networks, as a means to further unify their state. Canals were also supposed to stimulate trade and bring together economic zones. Canal building also contributed to the transformation of the landscape with the aim of achieving economic unity.[29]

In 1773 Count Auersperg, who was at the time Governor of Transylvania, claimed that the regulation of the three rivers would be very costly, which is

24 Maire, *Bemerkungen*, 80–81.
25 Schönburg-Hartenstein and Zedinger, "Jean-Baptiste Brequin," 69–71.
26 Maire, *Bemerkungen*, 21.
27 Voigt, *Verkehr*, 240.
28 Ibid., 238.
29 Ibid., 312.

why the Diet ultimately rejected the project.[30] Navigation on the Mureş River was hindered by numerous obstacles that caused material and human losses. For example, in 1771 several vessels sank, and total material losses were estimated at 1,165 florins. In 1774, a tower located in the village of Folt collapsed into the river and prevented navigation. Vessel owners and inhabitants of surrounding villages were ordered to clear the riverbed of stones and fallen trees, and remove sunken vessels and rafts.[31]

The value of canals was recognized from the early eighteenth century when numerous plans were drawn up. Their implementation, however, generally failed due to financial constraints. In Transylvania, several military and civil engineers, such as Fischer, Croner, Mraz, and other scientists participated in the mapping of the province initiated during the reign of Joseph II. Their river measuring and mapping endeavors laid the foundations for the 1779 Mureş River regulation project.

Canal building targeted the removal of all obstacles and the creation of a safe environment for the transport of timber and salt with the new types of vessels on the Mureş River. The documents sent by Viennese Court to the Treasury and the War Council in June 1781 reveal a plan for the comprehensive regulation of the Mureş River.[32] According to a 1775 report and its annexed map, which has since been lost, there were 96 meanders along this river, 87 of them quite large, which had to be partially straightened. In addition, all the points of entry and exit from the old riverbed had to be sealed off. Given that the total length of the meanders measured 3,532 lines,[33] the Financial Directorate in Vienna proposed shortening it to 1,620 lines (calculated in Viennese feet[34]), which would cut the distance by 1,912 lines. Thus, many dangerous obstacles would be eliminated and the duration of the trip would be reduced by half. By increasing transport speed, they would be able to reduce the size of the vessels and consequently keep the amount of "material losses to a minimum, which would increase the yearly revenues of the Imperial Treasury" ("auch das Schwenden selbst des Materials auf geringerer Prozent heruntersetzt, damit dem königlichen Ärarium jährlich großen Nutzen zuwenden würde").[35]

30 Müller, *Wirtschaftspolitik*, 57.

31 Bossa, "Transportul," 143–44.

32 Österreichisches Staatsarchiv, Neue Hofkammer, Siebenbürgische Kammerale, Salzwesen, No. 200, Year 1781: 281.

33 The Line is a unit of length equal to 1/10 or 1/12 of an Inch.

34 In the eighteenth century, a "Viennese foot" was equal to 32,032 cm (Trapp, 1998: 229).

35 ÖStA, NH, SK, Salzwesen, 200, 1781: 289–90.

In 1786, the engineers Fischer, Mraz, and Croner were entrusted with planning the regulation of the Mureş, Someş, and Olt rivers, respectively. The greatest technical challenge that the engineers faced during the regulation of these rivers was the elimination of the numerous rocks and meanders that required many machines and specialists.[36] They had to report on the obstacles that hindered navigation on the aforementioned rivers, on how they could be eliminated, and on the number of specialists that would be required to carry out the task.[37]

The 1779 Regulation Plan

The 1779 plan drawn up by the Salt Office envisaged the regulation of the Mureş River and the introduction of new types of softwood vessels. It was arguably one of the most ambitious landscape transformation projects in eighteenth-century Transylvania. It required the dredging and cleaning of the Mureş River, and its regulation through the elimination of its meanders, with the aim of making navigation easier. Carrying out this project would require the transfer of experts and technology and the professional training of local specialists, which counted as something new for Transylvania. The greatest hurdle, however, was technical. The main reason for commencing this project was the rising price of oak timber needed in shipbuilding due to the aforementioned over-harvesting crisis starting in the mid-eighteenth century.[38] The previous source for hardwood timber had been the Hungarian state forests in the area of Arad, more precisely in Vărădia de Mureş (Waradia or Totvărădia / Tótvárad), (*Fig.* 1) from where it was brought to Partoş.[39] The price of softwood for vessels was considerably less, and varied according to dimensions and furnishing. A softwood vessel without a roof cost 83 florins and 13½ kreutzer, while the price of one with a roof could reach 101 florins and 16¾ kreutzer. The cost price of an oak ship reached 125–140 florins.[40]

36 Müller, *Wirtschaftspolitik*, 57.

37 Magyar Nemzeti Levéltár Országos Levéltára, Erdélyi Országos Kormányhatósági Levéltárak, Gubernium transylvanicum levéltára, Gubernium transylvanicum in politicis, Ügyiratok F 46, 1786, No. 3997: 1–8.

38 Österreichisches Staatsarchiv, Neue Hofkammer, Siebenbürgische Kammerale, Salzwesen, 198, Jahr 1779: 169–217.

39 ÖStA, NH, SK, Salzwesen, 198, 1779: 172.

40 Ibid., 211.

In December 1778, the navigation engineer Fischer, head of the Mureş River project, sent the Treasury a proposal for the building of softwood vessels. According to Fisher, the length, width, and depth of these ships would make them more efficient. They could also sail on rivers with lower water levels. The test ship measured 10 klafter in length,[41] 15–16 Austrian ft. in width, 2 ½ Austrian ft. in height. Soon after it was built, the Treasury approved a pilot trip on the Mureş River between Maros-Portu and Szeged.[42] The minutes of the discussions following the test reveal that the engineers Fischer and Hubert were satisfied with the outcome. They argued that the vessel's slight bent forward was no reason for concern, but still recommended that the vessels be covered with canvas instead of wood.[43]

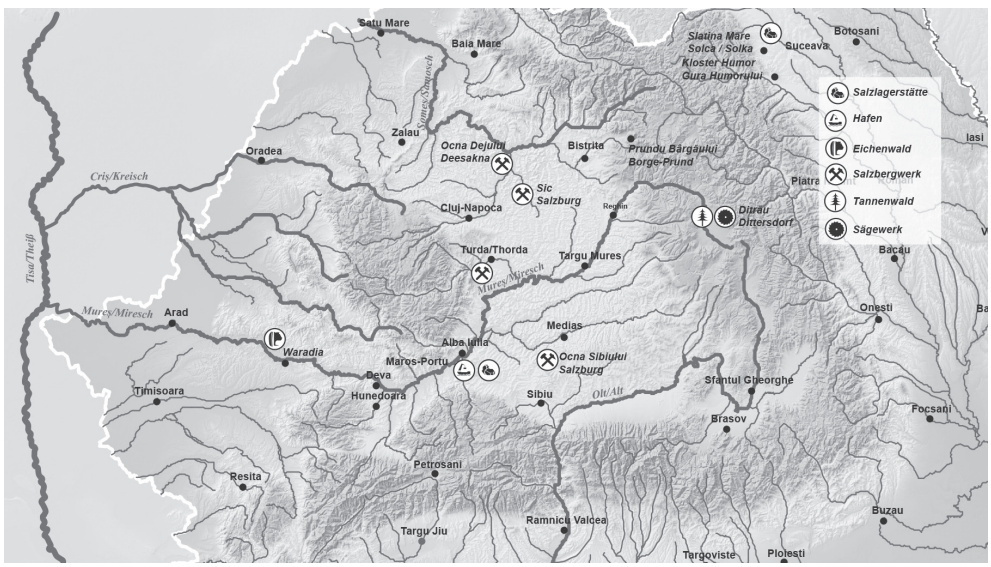

Figure 1. Salt mines and waterways in Transylvania (made by Bianca Tămăşan)

Because the new vessels built from softwood were less resistant to accidents than those built from hardwood oak, the Treasury ordered at its meeting held in Lugoj on 13 February 1778 a new cleaning operation of the Mureş River, the demolition of floating mills, and the removal of logs, broken bridge pillars, and other elements that could potentially jeopardize navigation. At the same meeting, the Treasury also decided on what type of machinery was necessary and set the

41 As a unit of length, 1 klafter is equal to about 1.80 m.

42 Ibid., 24–27.

43 Ibid., 59.

summer of 1778 as starting date of the operation so that the new ships would be serviceable by the spring of 1780.[44] The engineers Samuel Nazdroviczky and Fischer, upon testing each machine, comparing prices, and evaluating maintenance costs, gave a professional opinion in favor of the windlass (*Erdwinde* in German) for the Transylvanian sectors of the river. According to the two engineers, this machine was used the following way: (1) if placed on a ship, it could easily be attached to any part of a log; (2) in order to better attach the logs to the machine, Wallachian workers would be hired due to their ability to stay longer underwater; (3) once the log was taken to the riverbank and attached to it, it could be conveniently redirected and easier unattached; (4) the machine's force could be increased with the help of a tackle; (5) if the riverbank was uneven, the logs could be removed with various lifting machines, which, required more work; and (6) experience showed that with the help of the windlass even larger tree trunks with branches could be removed. Both Commissions representing the regions of the Banat and Hungary, respectively, agreed with the two engineers' technical proposal. The wooden debris removal operation started on 11 August and ended on 1 October 1778 with the removal of 117 logs and tree branches of various sizes.[45]

On 27 February 1779,[46] the Financial Committee in Vienna (Wiener Finanzkommission) approved the plan drawn up in Sibiu (Nagyszeben/Hermannstadt) and tasked the engineer Hubert with building the new ships projected to be 100 feet long, 15–16 feet wide, and with a total depth of 2½ feet (= 28.35/4.5–5/0.75 m.). As for the width of the Mureş River, it reached 150 paces at Alba Iulia (Gyulafehérvár), 200 paces at Deva (Déva), Şoimuş (Marossolymos), and Ilia (Marosillye), while in the flatland, as it slowed down, it reached up to 300 paces. As for its average depth in the navigable sector that started at Alba Iulia, it reached at least 1 fathom or even more.[47]

On 27 March 1779, the Viennese Financial Directorate set the production cost for each new ship at 83 florins and 13½ kreutzer. The timber would be brought from the Giurgeu Mountains in the Eastern Carpathians.[48] The engineer Karl Loidl was tasked with building a sawmill in the mountains to mill

44 Ibid., 28–56.

45 Ibid., 58–69.

46 ÖStA, NH, SK, Salzwesen, 198, 1779: 47.

47 Militärische Beschreibung von Hungarn / Anhang zu der Kriegs-Charte des Gross Fürstenthums Siebenbürgen.

48 ÖStA, NH, SK, Salzwesen, 198, 1779: 169; 211.

planks and beams for shipbuilding.[49] As for the building technique, the Viennese Aulic Chamber proposed the use of the same methods as navigators in Upper Austria because the Traun River had a similar course and flow speed to the Mureşin Transylvania. In addition, they recommended the adoption of Austrian shipbuilding methods and ordered the relocation of several masters from Upper Austria to Alba Iulia in order to create a shipyard.[50] Finally, the Commission sanctioned the building of a road that ran parallel to the Mureş River in order to facilitate the traction of ships with the help of oxen and horses. The road was to be built with the help of peasants from villages along the river.[51] With the new ships, the Transylvanian Treasury was aiming for higher revenues, given that they were more spacious, required only a small crew, and their maintenance costs were low in comparison to the older hardwood ships.

The navigation engineer Fischer was tasked with organizing the transport of logs in the river, beginning in December 1778, for the building of the new vessels. Upon conducting field research, Fischer reported first in February and then in May to the Financial Directorate that it was necessary to build a canal at the confluence between the Topliţa stream and the Mureş River. In his opinion, it would be an easy task because it merely required the removal of a few rocks that hindered transport. In addition, he also considered that in order to facilitate transport up to the sawmill at Ditrău (Ditró/Dittersdorf) (Fig. 1), it would be necessary to build a road that would cost an estimated 100 florins.[52] On 23 May 1781, the Transylvanian Treasury submitted to Vienna a protocol on the cost of building the waterway on the Topliţa stream, which amounted to 633 florins. According to the same document, the logs moved on this waterway would be used to mill planks.[53]

This politically directed transformation of salt transport by changing the type of ships required not only the regulation of rivers, but also the dredging of riverbeds. Thus, in December 1779,[54] the General Staff in Sibiu considered the possibility that the 2nd Wallachian Border Guard Regiment could take over this task on the Someş and Tisa rivers where the new ships would operate. The experience of the cleaning operation on the Mureş River from the summer and

49 Ibid., 171.
50 Ibid., 174.
51 Ibid., 194–211.
52 Ibid., 321–22.
53 ÖStA, NH, SK, Salzwesen, 200, 1781: 63–68.
54 ÖStA, NH, SK, Salzwesen, 198, 1779: 758–63.

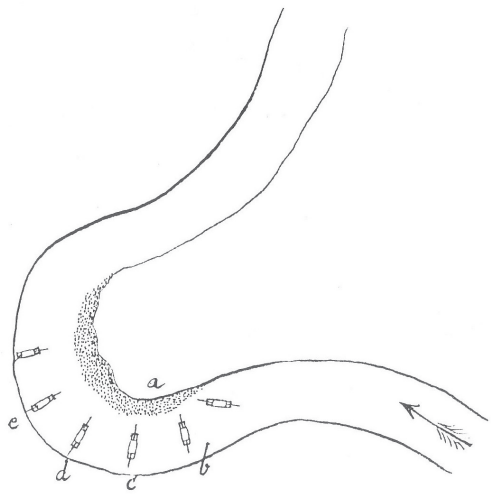

Figure 2. The meanders on the Mureş River
(ÖStA, NH, SK, Salzwesen, 199, no. 8, 2 December 1780.)

autumn of 1778,[55] when an insufficient workforce was recruited from among local peasants, provided the Financial Directorate with the opportunity to make the above decision. In February 1780, they informed Colonel Enzenberg, commander of this regiment in Năsăud, that border guards could now use larger ships for salt transport on the Someş River.[56]

On 5 August 1780, the Financial Commission in Vienna sent their approval to the Gubernium in Sibiu of the sum of 8,760 florins for the shipyard at Maros-Portu, of which 4,261 florins were allocated for the building of 31 ships (each cost 137 florins and 47½ kreutzer). The remaining sum was allotted to auxiliary buildings.[57] In addition, on 2 December 1780, the Commission allotted an extra 1,873 florins and 20 kreutzer for the construction of 10 wintering places for ships.[58] According to Fischer's plan, these places were to be built beyond the river, in an area protected from floods (Fig. 2).[59]

The plan followed the design of wintering places for salt transport vessels at Salzkammergut (on the Traun River, especially at Wels) conceived by the imperial

55 Ibid., 28–56.
56 ÖStA, NH, SK, Salzwesen, 199, 1780: 42–51.
57 Ibid., 442–553.
58 Ibid., 1094–98.
59 Ibid., 1097.

and royal cameral engineer Hubert in 1776.[60] Hubert had already provided technical instructions regarding these places as well as other similar designs for the region of Banat.[61]

The aim of this measure was to reduce travel time to Szeged by a third, which meant that each round-trip salt transport, which had required five weeks until then, would now require about three weeks without pause. This also meant that several shipments of salt could be moved by the newly-built ships over a short period of time. As a result, lower quantities of timber would be used, which would bring more revenues to the Imperial Treasury; however, the quantity of timber to be used depended on the ship's size and furnishing. In order to build the a along the river, arable lands had to be reduced, brush and forest surplus on riverbanks had to be cut. In addition, the construction work required timber, stone, as well as skilled and manual laborers, carts, and various tools. In order to carry out the first set of requirements, the engineer Fischer made the following proposal:[62] (1) landowners had to build levees and embankments wherever banks were sunken or uneven in order to protect villages and lands from floods; (2) cavities located next to riverbanks had to be filled up or crossed by a bridge; (3) brush and trees along riverbanks had to be cut; (4) garden fences along riverbanks had to be torn down so that ships could be hauled upstream; (5) mill owners had to erect tall and strong protection bars around mills, which were obstacles to navigation of rivers. In 1771, the Mureş River alone numbered 186 mills that had to be bypassed. The projected demolition of these mills caused an uproar among owners.[63]

Unfortunately, Fischer's plan to render the Mureş River navigable with softwood vessels, which can be considered very ambitious for the prevailing technical conditions in Transylvania, was ultimately abandoned for lack of qualified personnel.

According to the 1779 plan to regulate the Mureş River, wherever the river had two branches, one of them had to be closed off. For this they adopted a holistic approach, meaning that every angle and aspect was taken into account, from the width, length, and depth of the waterway to safety measures for ships as well as the adjoining roads, agricultural lands, and human settlements.

60 Ibid., 1095.

61 Ibid., 1095–96.

62 ÖStA, NH, SK, Salzwesen, 200, 1781: 281–318.

63 Müller, *Wirtschaftspolitik*, 57.

While choosing the trajectory and outlining the scope of the regulation work, Fischer started from certain principles that reflected the necessity to maintain a stable riverbed: (1) respect for the natural evolution tendency of the riverbed and creation of favorable water-flow conditions; (2) preservation of floodwater flow direction and water transport capacity by avoiding flow blockages; and (3) regulation works carried out in stages by following the evolution in time and space of morphological phenomena and by avoiding unwanted effects.

As we indicated above, the works to protect the banks of the Mureş River had to be conducted according to the particularities of its flow, the necessity of these works being closely connected to the regulation solutions. Because riverbank protection works were costly as they absorbed a significant amount of building materials, the Viennese Financial Directorate wanted them reduced to the required minimum. In any case, cutting through the meander neck required at least two consolidation points (upstream and downstream). However, there was the risk that calibration works could destroy natural consolidations (Fig. 3). It was

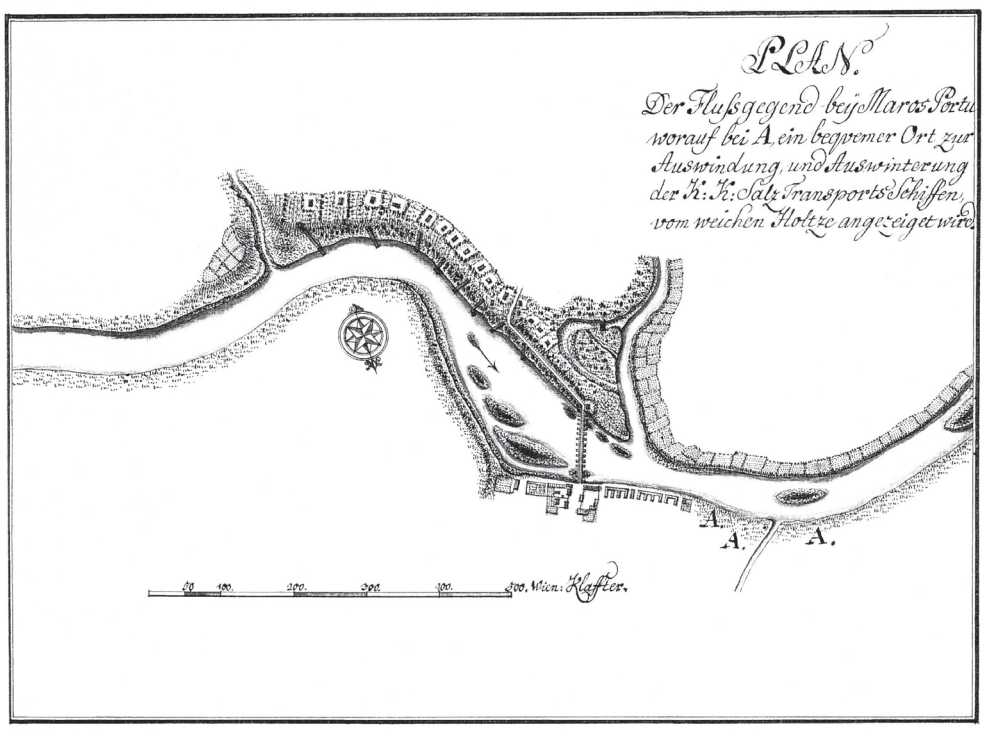

Figure 3. Wintering places for ships
(ÖStA, NH, SK, Salzwesen, 199, no. 8, 2 December 1780)

also stipulated that levees should be built in certain sections near the riverbanks for their protection.

This planned transformation of the landscape could also appear as an attempt by the Financial Directorate to improve transportation by water and riverside living conditions alike.[64] In this time period, the custom of regulating internal waterways within ample projects in order to facilitate transport, to ensure protection against floods, and to prevent the outbreak of epidemic diseases was always linked to centralizing interests of state power.[65] This implies the existence of a political-economic will, as well as a group of advisers and specialists that perceived the transformation of the landscape as an impetus for agriculture and for economic progress in general.

The new transformation of the landscape was based on the use of techniques and work methods theretofore unknown in Transylvania. They represented the best premise for carrying out projects on river regulations, canal building, and draining operations. The great technical projects were not carried out simply by bringing or importing know-how, but also by connecting them with institutions, scientific ideas, and technical procedures.[66] A novel element of this project was that it placed the landscape within the general context of its use, thus serving economic interests, such as the promotion of transport. Secondly, it relied on extensive mapping and surveys, which helped engineers eliminate risk factors. The technical plan was accompanied by mission statements, financial proposals, as well as revenue and expenditure estimates.

Impact on Human Settlements

By building new transport routes in the era of mercantilism, the transport reorganization plan created the premise for the economic development of regions rich in raw materials or located in the proximity of waterways, also giving an impetus for the structural transformation of human settlements and landscapes alike. The fact that transportation by water played a substantial role is also demonstrated by the presence of human settlements along the rivers. Among them, those situated at each end of a route or at the intersection of major waterways and roads acquired greater significance. Because waterways were used only for a short period in a year, travelers and traders had to stop over

64 Király, "*Die Donau,*" 30.
65 Király, "*Die Donau,*" 41.
66 Ibid., 43.

in these settlements for a longer time and then continue their journey by land. This had a positive impact on the local economic and cultural life.

This is also how the settlement of Partoş developed. The local Naval Office contracted annually administrative personnel and ship crews, who lived in the neighborhood close to the port. Moreover, this area of town hosted many shipbuilders. There three plans for the fortress and town of Alba Iulia from this time period that describe the main salt warehouse and the shipyard, both located on the right bank of the Mureş River between the bridge over the river and the mouth of the Mureş Canal, known as the "sanitary canal" in the nineteenth century. The plans were drawn up by the Fortress's Corps of Engineers.

Figure 4. Maros-Portu in the year 1740
(Suciu and Anghel, "Mărturii," 367–87.)

The first plan was drawn up in 1740 and entitled "Situation Plan for the Alba Iulia Fortress in Transylvania" ("Situations Plan der Festung Carlsburg in Siebenbürgen"). On the south side, one can distinguish the course of the Mureş River, the bridge with the customs office, and the road that links Alba Iulia to Sibiu via Sebeş. On the same bank is also located the mouth of the Mureş Canal and the salt warehouse (Salzniederlag). The latter, comprising a total of nine buildings, stretched along the right bank of the Mureş River for around 300 meters. The buildings of the salt warehouse were placed on the western side of a rectangle (Fig. 4).

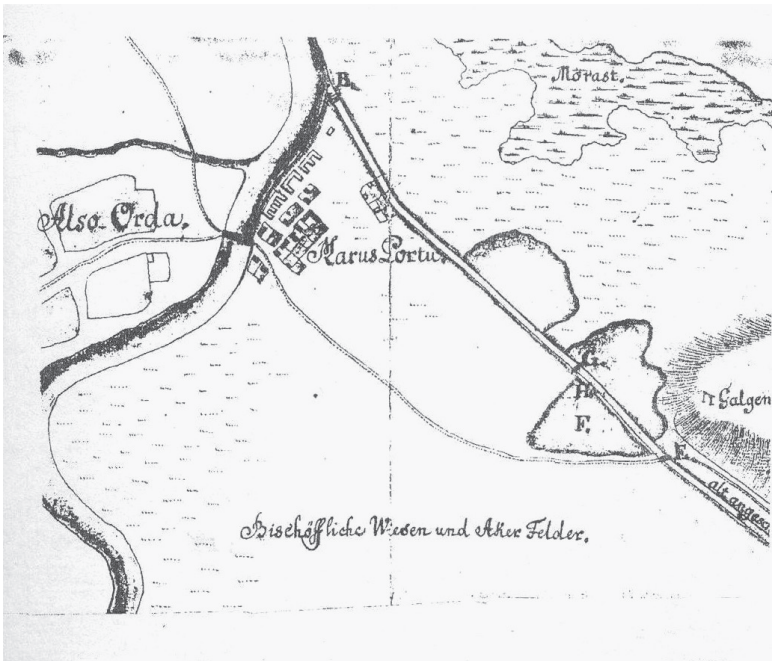

Figure 5 Maros-Portu in the year 1771
(Muzeul Naţional al Unirii Alba Iulia, fond "Colecţia de documente," no. 7409.)

The second plan was drawn up in 1771 and illustrates only the town's main elements: streets, canals, churches, as well as the salt warehouse at Partoş. They also marked the locality Maros-Portu on the right bank of the Mureş River. Apart from the 20 houses, one can also notice that the location of the buildings of the salt warehouse is identical to that from the previous plan (Fig. 5).[67]

The Mureş River project was also the source of demographic growth in Topliţa. In 1750 it counted 50 households,[68] and by 1785 their number reached 227, with a population of 1,470 inhabitants.[69] Work at the Austrian sawmill and in timber rafting increased the town's population as more individuals found employment there (Figs. 6 and 7).[70]

67 Suciu and Anghel, "Mărturii," 375–76.
68 Marc, *Evoluţia habitatului,* 55.
69 Prodan, *Din istoria Transilvaniei*, 288.
70 Marc, "Izvoare etnografice surprinse, " 479.

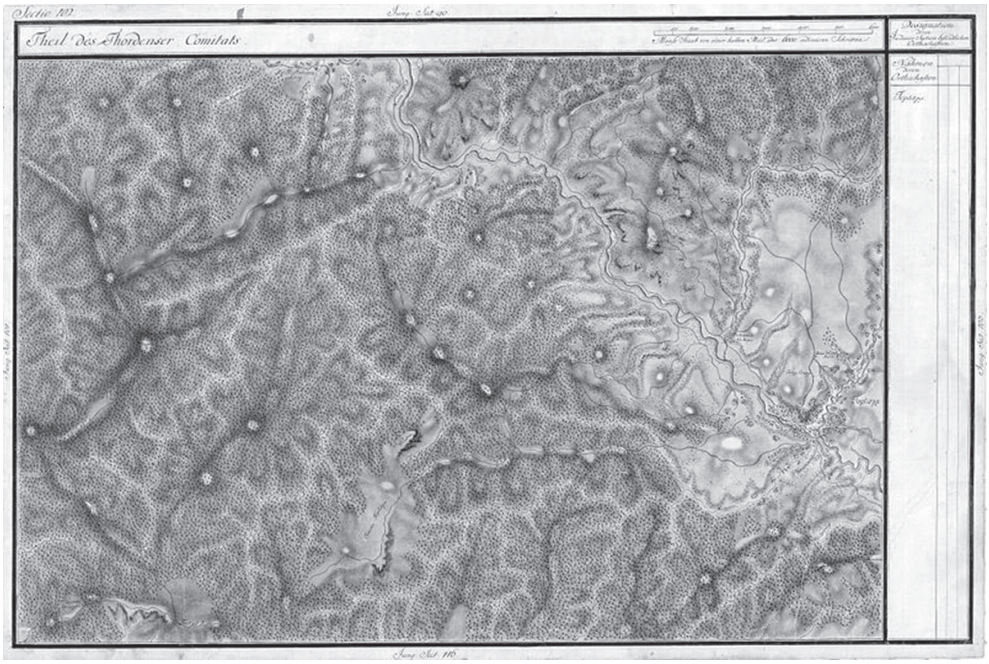

Figure 6. Topliţa during the Josephine land survey
(Dorel Marc, *Evoluţia habitatului tradiţional în zona Topliţei Mureşului Superior (sec. XVII–XX)*. Tg. Mureş: Ardealul, 2009.)

The River Regulation Attempt at Limba

The 1786 operation to eliminate meanders on the Mureş River started with the so-called "Limba" (The Tongue) meander, close to Alba Iulia. This operation included technical measures that Transylvanian Treasury were ultimately unable to implement properly due to lack of experience and inadequate equipment. The flawed intervention combined with eroding riverbanks resulted in the flooding of Ciugud. As a result, its population had to be evacuated and moved elsewhere.

The navigation engineer Fischer submitted to the *Magistrat* in Alba Iulia a formal request for the relocation of the inhabitants of Ciugud and for 300 laborers needed for the hydro-technical works.[71] On June 14, 1786, during the preparation stage for this operation, Fischer was asked the following questions: "where and how was the sector of the Mureş River, that was assigned to him,

71 MNL OL F 46, 1786, No. 4544: 1–2.

Figure 7. Topliţa during the Franciscan-Josephine land survey
(Personal collection)

navigable, if meanders prevented safe navigation, […] and whether circumstances required the employment of personnel."[72]

Fischer explained that the Mureş River was navigable from Mirislău, a locality upstream from Aiud (Enyed/Strassburg am Mieresch), where navigation was surely possible in springtime, even with a 5–600 quintal cargo on a type of vessel built straight and wide in order to be useful on lower-depth waterways. On deeper waterways, such as the Danube, larger and heavier cargo ships could navigate, which was important to the economy of the province as local produce could be moved easier, safer, and in larger quantities. On the lower course of the Mureş River up to Arad or to the Tisa River, navigation was possible until June.

In relation to the numerous meanders, small islands, and other obstacles hindering easier and safer navigation, Fisher maintained that the greatest issue was the dispersal of the current. This dispersal meant that the river, at higher current velocity, rather eroded the riverbank, which consisted mostly of soft earth, than deepened the rocky riverbed. He then proposed several measures to

72 MNL OL F 46, 1786, No. 5443: 3.

improve the course of the Mureş River, such as the improvement of the riverbed, the building of roads with effective drainage along the riverbanks, the protection of side valleys from floods, the regulation of mills and weirs, the construction of bridges over dangerous places, and the installation of water conveyance systems or similar objects that could be useful for the local population.

For the elimination of the meander he proposed: (1) building adequate machinery for the river; (2) the prior cleaning of the riverbanks and of the river sector; (3) cutting through the neck of the meander; (4) securing the lower part of the riverbanks; (5) sealing off the free branch; and (6) eliminating the possibility of floods.

They intended to cut through the neck of the meander at the point opposite Ciugud, namely, at the village of Drâmbar (Drombár), which meant building a canal between the two points. Then, Fischer argued, the population of Ciugud had to be relocated (Fig. 8).[73]

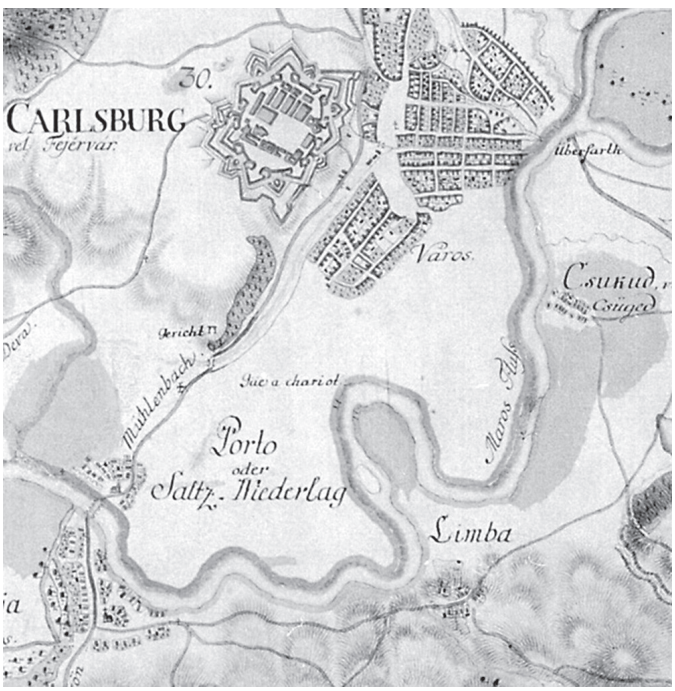

Figure 8. "Limba" and Ciugud in the year 1741. Military map of Alba Iulia, 1741. (*Plan der Hauptvestung Carlsburg in Furstenthum Siebenburgen, I. M. Eisele*, Catalogue of Count Ferenc Széchényi´s Maps and Atlases, no. 89.)

73 MNL OL F 46, 1786, No. 4544:1.

In a report dated 5 April 1786, Fischer asked the Transylvanian Treasury when it could finance the improvement of navigation and hydraulic issues. He explained that, similarly to Hungary, each county should employ an engineer specialized in hydraulic issues so that several works could be executed at the same time. In addition to this, he suggested that it would be very useful if they also conducted research and drew up future improvement plans with the help of a hydro-technician who was able to implement them and who was familiar the country's particularities as well as its problems.[74] Following this request, Transylvania's Gubernium approved on 2 July 1787 the payment of 1,397 florins and 20½ kreutzer to the Transportation Office at Partos for the execution of hydro-technical works at Ciugud.[75]

The resolution of these issues required the employment of experienced personnel, especially laborers who had previously worked on similar building projects, such as the improvement of road infrastructure, the renovation of public buildings, etc. These projects were ultimately abandoned, either for technical or financial reasons. The year 1786 was especially difficult for Transylvania due to a devastating earthquake,[76] numerous floods, and an epizootic outbreak,[77] which compelled the *Gubernium* in Sibiu to redirect financing towards the affected areas and to postpone the planned regulation of the Mureş River.

Three-quarters of a century later, on 6 May 1850, another project for the regulation of the Mureş River was submitted by the deputy Military Commissar of the Alba District, Dimitrie Moldovan, to the General Staff in Sibiu. The plan targeted rendering this river navigable for steamboats, but it was ultimately rejected.[78] The idea of regulating the Mureş River would be reexamined almost a century later, during the communist period.

The following question arises: How did the regulatory works influence the lowland downstream settlements? As we have seen, the policies to improve transportation on the Mureş River, which included its regulation, led to the further development of the town of Alba Iulia, the prime example of this study. Similar developments can be noticed in other towns, such as Deva and Arad, while the operation near the village of Ciugud, which ended in failure, caused the relocation of its entire population. It is certain, however, that river

74 MNL OL F 46, 1786, No. 5443: 4–7.
75 MNL OL F 46, 1787, No. 6149: 1–7.
76 von Hoff, *Chronik der Erdbeben,* 74.
77 Armbruster, *Dacoromana-Saxonica*, 401.
78 Suciu and Anghel, "Mărturii," 380.

regulation operations reduced the risk of flooding generally. Another example is the successful operation on the Târnava Mare River at Dumbrăveni (Ebesfalva in Hungarian/Elisabethstadt in German), which took place in 1771.[79]

Conclusions

The plans to regulate navigable rivers can be considered a novel element within the evolution of navigation on internal waterways in the early stages of Transylvania's industrialization in late eighteenth century. Industrial growth was a decisive factor in waterway regulation and the reorganization of timber and salt transport. This induced numerous changes in the natural environment and prompted the development of human settlements.

The Mureş River plan consisted of: (1) rethinking the timber and salt transport system on the internal waterways, which was determined by the acute shortage of oak timber needed in shipbuilding; (2) building softwood vessels according to the design of those used in Upper Austria; (3) regulating the channel of the Mureş River by straightening and reinforcing its banks as well as by eliminating menders; and (4) building canals for moving timber to the specially constructed sawmills.

The following changes were made to the landscape: (1) reinforcement of riverbanks; (2) building of a road which ran parallel with the Mureş River for the traction of vessels upstream; (3) building of the sawmill at Ditrău; (4) construction of the canal at Toplița; (5) rearrangement of the shipyard at Partoş; and (6) growth of towns and villages in the proximity of logging sites (for example Toplița) and of the sailors' neighborhood in Alba Iulia.

These projects aimed at reshaping the landscape and subordinating it to the economic imperatives of the Viennese Court. The centrally planned regulation of the Mureş River in Transylvania was meant to make the downstream transportation of goods (primarily salt) easier and more cost-efficient. In addition, this project was beneficial not only for the local labor market, given that the dredging, cleaning, and building works required a considerable number of skilled workers and manual laborers, but also for local industry and commerce as more goods could be moved.

Moreover, these operations had an environmental impact as they reduced ground water levels and the average discharge of the Mureş River. One should

79 Rus, "Die Überschwemmungen," 43–63.

also add, however, that constant and long-lasting tree harvesting in the area and climate change, as well as increasing demand for water in the fast-growing towns and in agriculture, may have very well contributed to this.

The poor state of roads meant that the expansion of internal waterways (regulation of rivers and construction of canals) became a necessity. In comparison to roads, which became unusable in bad weather, waterways were much more reliable and cost-efficient. The latter were better suited for moving heavier cargo, especially salt. Around ports located alongside waterways, several towns grew and thrived as a result of commercial and shipping activities.

Novel for Transylvania was the dissemination of technical innovations as well as the rethinking of the shipbuilding system that was achieved by bringing specialists from Austria. There were, however, several obstacles that had to be overcome, such as cost, safety issues, and lower water depths. Revolutionary for the province was also the progress of institutional structures and infrastructure. Further improvements to infrastructure involved the facilitation of water transport through the building of a new type of vessel, adopting a new navigation system, and expanding the Maros-Portu port.

The geographic distribution of salt and timber resources required the design and promotion of new cargo vessels. Topographic difficulties and landscape particularities propelled the improvement of these means of transportation and of the infrastructure. The development of the "salt industry" led, on the other hand, to the creation of new economic centers in areas where timber was used in construction.

Towards the mid-eighteenth century, transport over waterways had become a major revenue source for the state. During this century, states were willing to invest heavily in the expansion of internal waterways and to encourage the creation of transregional waterway networks in order to move larger quantities of goods and to increase their revenues. As for Transylvania, the measures that central authorities took were revolutionary for the time since they transformed the landscape by expanding and improving transport routes and by rethinking transport over water and ways to conserve timber. According to a 1791 report, approximately 500,000 quintals of salt produced from the mines at Turda, Cojocna, and Ocna Sibiului were transported on the Mureş River annually.[80]

80 ANR-Cluj, collection: Tezaurariatul Minier, No. 49/1791, 23.

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