

Connecting Ecologies: Egypt and the Balkans during the Climate Crisis in the Mid-1780's¹

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Abstract: *This article examines a brief episode from the Little Ice Age and its impact over the Ottoman empire during mid-1780's. It aims to explore the transregional connections in the Eastern Mediterranean, driven by the adverse socio-economic consequences of climate stress after the eruption of Iceland's Laki volcano in 1783 – 1784. The study tends to set up a series of causations illustrating how a certain global climatic event has considerable local socio-economic influences that test the Ottoman provisioning system and create a possibility for central administration to connect remote ecological zones in order to meet the necessities of food supply across the Mediterranean. Current scientific research utilizing archives of nature, such as dendrochronology, ice core analysis, sediment studies, and pollen analysis, provides insights into the past climate. This data corresponds with a range of written records meticulously maintained in archives of societies, with the most significant for this study being the documents preserved in the Ottoman archives. The written sources examined in this paper emphasize on the logistical coordination between two remote ecological zones: the Balkans and Egypt, situating this coordination within the larger context of political, economic, and social instability of the Ottoman Empire in a period of climatic stress. The Ottoman provisioning system of grain supplies connected food shortages in Egypt and the Hejaz to different agricultural areas in the Balkans and the Black Sea basin in order to mitigate the crisis in the Nile valley. Although this aid had a temporary effect, it nevertheless demonstrated the extent of the state's administration ability to balance the natural resources across the vast territory of the empire.*

Key words: *Ottoman empire, Balkans, Egypt, Hijaz, Laki, Iceland, climate crisis, grain provisioning, natural resources management*

JEL: *O13, P48, Q15, Q54*

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Introduction

A significant period of the Ottoman Empire's existence coincided with the climatic interval commonly referred to as the Little Ice Age (LIA) which roughly spans from the mid-14th to the mid-19th c. This cooling period is characterized by a significant drop in average annual temperature by 1 degree Celsius, leading to the expansion of glaciers, longer and harsher winters, prolonged droughts and shorter growing seasons. These climatic changes have considerable social, economic, and environmental impacts, such as crop failures, famines, and shifts in population dynamics. The LIA is also seen as a time of sharp climatic anomalies rather than a continuous period of extreme cold. The causes are believed to be a combination of factors, including volcanic activity, solar variability, and changes in ocean circulations (Fagan, 2000; Parker, 2013, pp. 1–109; Degroot, 2018).

According to Sam White, the Little Ice Age has a profound impact on the Ottoman Empire by disrupting agriculture, disordering provisioning system, straining the economy, fueling social unrest and rebellions, and weakening the state's military and political structures during the late 16th and 17th c. These factors collectively contribute to the empire's long-term challenges and decline during the Early Modern period (White, 2006, 2011). Relying on White's conclusions Alan Mikhail, Elias Kolovos and Phokion Kotzageorgis explain that the different phases of the Little Ice Age have varying effects on the diverse ecological and climatic conditions across the vast territory of the empire (Mikhail, 2015; Kolovos, Kotzageorgis, 2019). Therefore, it is necessary to analyze specific local case studies that correspond to the current state of the empire in each phase of this final period of global cooling.

This article aims to explore the transregional connections in the Eastern Mediterranean, driven by the adverse socio-economic consequences of climate stress during the mid-1780s. Therefore, this paper tends to set up a series of causations illustrating how a certain global climatic event has considerable local socio-economic influences that test the Ottoman provisioning system and create a possibility for central administration to connect remote ecological zones in order to meet the necessities of food supply across the Mediterranean. The time period of the analysis is marked by the eruption of Iceland's Laki volcano in 1783 – 1784, which was particularly significant for its profound impact on the global climate. Existing scientific scholarship based on *archives of nature* such as dendrochronology, ice cores, sediments and pollen analyses reveals the past climate in the mid-1780's (Thordarson, Self, 2003; Oman, Robock, Stenchikov, Thordarson, Koch, Schindell, Gao, 2006; Zambri, Robock, Mills, Schmidt, 2019; Zambri, B., A. Robock, M. J. Mills, A. Schmidt, 2019). These data correspond with a variety of written documents carefully preserved in the *archives of societies* (Brönnimann, Pfister, White, 2018; Kleemann, 2023). In his recent study Alan Mikhail combines both *archives* to explain the negative climatic

effect of Laki eruption over the Egyptian grain cultivation and how the disruption of food production contributes to the overall social and political turmoil in this Ottoman province (Mikhail, 2015). In addition to the existing scholarship, this article draws upon a diverse range of archival documents meticulously compiled by the Ottoman central and provincial administrations.² The attentively kept Ottoman documentation exemplify the efforts that the central administration is taking to mitigate the calamity in Egypt. The provisioning system is one of the mechanisms employed by Ottoman officials to link Egypt with other ecological regions around the Mediterranean to address food shortages in the Nile Valley. Consequently, the distant ecology of the Balkans, which operates under a distinct agricultural system with different cultivation methods, enables the Ottoman authorities to manage certain instances of food scarcity in Egypt.

From Iceland to Egypt

On June 8, 1783 Laki volcano in Iceland began to erupt. The series of eruptions lasted for about eight months and finally ended in February 7, 1784. It was one of the most significant volcanic events in human history, with profound climatic, environmental, and societal impacts. Known as a fissure eruption, Laki produced massive amounts of lava, ash, and gases, making it a subject of interest across multiple disciplines, including geology, climatology, and history. The eruption ejected an estimated 15 km³ of basaltic lava and approximately 120 megatons of sulfur dioxide (SO₂) into the atmosphere, marking it as one of the largest basaltic eruptions in recorded history. The intense lava flow drastically altered the Icelandic landscape, burying entire farmlands and affecting the local hydrology. The eruption triggered a period of famine due to crop failures and livestock deaths (Thordarson, Self, 2003).

Laki eruption had far-reaching climatic and environmental impacts, felt not just locally in Iceland but across the Northern Hemisphere. The most dramatic effect of the eruption was the injection of sulfur aerosols into the upper Troposphere and lower Stratosphere, which resulted in a range of atmospheric and climatic consequences. The SO₂ emissions created a dense volcanic haze that spread across Europe, known as the "Laki haze." This haze significantly reduced solar radiation, causing a drop in temperatures. Studies suggest that the haze spread as far as North America and

² The archival sources used in this study are located in the Ottoman Archives, managed by the General Directorate of Archives under the Presidency of the Republic of Türkiye. These archives are commonly known as Başbakanlık Osmanlı Arşivi, and will hereafter be abbreviated as BOA. Most of the documents are classified in different sections of *Cevded* collection, such as *Adliye* (BOA, C.ADL.), *Askeriye* (BOA, C.AS.), *Bahriye* (BOA, C.BH.), *Dahiliye* (BOA, C.DH.), *Maliye* (BOA, C.ML.), *Eyalet-i Mümtaze* (BOA, C.MTZ.) etc. Other cited documents will be correctly presented with the corresponding abbreviations.

parts of Asia (Schmidt, Thordarson, Oman, Robock, Self, 2012). The aerosols from the eruption led to a global temperature drop of about 1.0°C–1.5°C in the Northern Hemisphere during the years following the eruption (1784–1786) (Thordarson, Self, 2003, pp. 16–19). The global disruption of the hydrological cycle was also profound. The sulfur released by Laki contributed to acid rain, which damaged vegetation across Europe and affected soil chemistry and agricultural production (Thordarson, Self, 2003, pp. 8–10, 14–15, 20; (Schmidt, Thordarson, Oman, Robock, Self, 2012, pp. 2–4).

Alan Mikhail connects the scientific data with historical sources in order to provide an insightful exploration of the global impacts of the 1783–1784 Laki eruption, particularly in the context of Ottoman Egypt. His work emphasizes on how climate alterations and environmental events influenced the political, economic, and social dynamics in Ottoman Egypt (Mikhail, 2015). The volcanic aerosols and the resulting cooling effect weakened the African monsoon, reducing rainfall in the highlands of Ethiopia and other regions that feed the Blue Nile, the primary source of the Nile's annual floodwaters. As a result, Egypt experienced lower-than-normal floods during and after the Laki eruption in 1783 and 1784 (Oman, Robock, Stenchikov, Schmidt, Ruedy, 2005; Oman, Robock, Stenchikov, Thordarson, Koch, Schindell, Gao, 2006; Oman, Robock, Stenchikov, Thordarson, 2006b). The reduced flooding diminished the amount of water and nutrient-rich silt that reached Egypt's agricultural lands, directly affecting crop yields (Mikhail, 2015, pp. 271–274). The decline in agricultural productivity led to food shortages and increased grain prices. The episodes of famine and economic hardship were common in Ottoman Egypt during periods of environmental stress, and the aftermath of the Laki eruption would have exacerbated these conditions. Famine in Egypt often led to widespread suffering, plague outbreaks, population displacement, and the weakening of provincial authority. The crisis in Egypt was welcomed by the Mamluk leaders, who had been attempting to seize power for several decades. They held local power in the countryside, but faced increasing resistance and resentment from the population, particularly as they attempted to maintain tax revenues despite the economic downturn (Mikhail, 2015, pp. 273–275).

The central administration in Istanbul was fully aware of the situation in Egypt. The loss of political authority and management of ecological resources in the Nile Delta poses a risk that the Ottomans might lose one of their wealthiest provinces. Moreover, this would endanger Ottoman oversight of the annual Muslim pilgrimage to Mecca and Medina. The Hajj pilgrimage held deep religious, political, and symbolic significance for the Ottoman Empire, serving as a vital aspect of the empire's identity and authority. The Ottomans, who saw themselves as the protectors of Islam and the Muslim world, took on the responsibility of facilitating and securing the pilgrimage to Mecca. This responsibility extended far beyond religious duties, influencing their

political legitimacy, administrative practices, and control over regions central to the Hajj route, such as the Hijaz and Egypt (For a detailed analysis of the Hajj under the Ottomans see: Faroqhi, 1994). The Egypt's economic involvement in provisioning the Hajj was a key aspect of Ottoman authority and the imperial economy in the region. Egypt, with its fertile Nile Delta, played a crucial role in providing grain and other supplies along the pilgrimage routes and for Hijaz (Faroqhi, 1994, pp. 146–173; Mikhail, 2011, pp. 113–123).

From Istanbul and the Balkans to Egypt

In 1785, the Ottoman Empire became directly involved in the escalating crisis in Egypt at the time when chronic food shortages and continued political unrest were endangering both the annual Hajj pilgrimage and the Empire's prestige within the broader Muslim world. To address the severe socio-economic impacts caused by the climate changes following the Laki volcanic eruption, the central authorities employed the imperial provisioning system of food supply as a means of alleviation. For more than six centuries as apolitical entity the Ottoman empire cast its shadow over different ecological and climatic zones from Central Europe to Mesopotamia and from Caucasus mountains to the Nile valley (Hütteroth, 2006; White, 2011, pp. 15–51; Mikhail, 2017). The evolving imperial administration have to adapt its policy to all local natural resources and environmental specificities in order to build up an effective provisioning system. It has to meet the constantly growing state's necessities of shipment a variety of raw materials, commodities and foods that feed the army, the capital Istanbul, big cities, Muslim charitable foundations etc. A ramified social network of peasants, pastoralists, officials, merchants and dealers provides grains, livestock, timber, metals and other goods for the state (Cvetkova, 1970; Faroqhi, 1984; Murphey, 1987; Greenwood, 1988; White, 2011, pp. 28–39).

The natural resource management through the provisioning system ensures the integrity of the Ottoman empire in an ecological sense. It was the way to incorporate all different ecological and climatic zones of the Eastern Mediterranean and the Near East to the purpose of the imperial center. Furthermore, this system connects different imperial ecologies by shifting natural resources through the whole territory of the Empire. It gives the possibility in the hands of the central and the provincial administration to balance the environmental resources' limits in certain areas by moving goods from zones of their excess to zones of their shortage (Murphey, 1987, pp. 232–234; Mikhail, 2011, p. 159, 2017, pp. 153–168).



Map 1. Eastern Mediterranean under the Ottoman empire, during the 18th c.

The prolonged crisis of Egyptian economy caused by climate change, social unrest and political turmoil requires the intervention from the capital in the mid-1780's. According to the Ottoman historian Taylesanizade Hafız Abdullah efendi due to the revolt, the famine and the high prices in Egypt the Ottoman central authorities in Istanbul organize an aid for the Muslim pilgrims in the time of the annual Hajj in 1785. On Friday 24 of Sha'ban (July 1, 1785) three ships loaded with wheat were sent to the Two holy sanctuaries (*Haramayn-i Muhteremeyn*), few months before the Dhu al-Hijjah (October 4 – November 2, 1785). For the shipment's supervision was appointed high ranking Ottoman official in the face of Ebubekir Bey, son of the former Grand Admiral (*Kapudan-i Derya*) İbrahim

Pasha, who had previously served as the head of the chief gatekeepers at the Sublime Porte (*Başbakıkkulu olan Ser-bevvabin-i dergah-i ali*) (Taylesanizade Hafız Abdullah Efendi, Emecen, 2003, pp. 20, 79). The significance of the Hajj for Muslims across the Islamic world required the involvement of officials from the Ottoman central military and civil administration to organize the sustenance of pilgrims. In July 1785, Ebubekir Bey himself settled in Alexandria, one of Egypt's major ports and a hub for Muslim pilgrims' traffic from all of North Africa and the Mediterranean. From there, he was able to directly oversee the entire process of food supplies that are intended to secure the Hajj. In late June to early July 1785, an order was issued to Ebubekir Bey, instructing him to secure additional shipments of grain from Alexandria. This grain was designated for pilgrims who had been stranded in the port as a result of the famine and unrest affecting the region. He was also responsible for distributing the foods to the city's markets at prices specifically determined by the central authority.³ The grain was loaded at three Balkan ports – Orfan (Orphano), Selânîk (Thessaloniki) and Kolos/Golos (Volos)⁴ – with the order to the local grain collectors (*mübayaacı*) sent in mid-November of the same year.⁵ The command of the ships is entrusted to captains Halil, Durak beshe, and Ahmed, who were directly subordinate to the acting Grand Admiral Gazi Hasan Pasha. The grain, amounting to approximately 1,040 tons of wheat and about 220 tons of barley, likely arrived in December 1785, as letters from el-Hajj Numan, the judge of Alexandria, to Istanbul are dated 1 Rabi' al-Awwal 1200 (January 1, 1786).⁶

Table 1.

Loads of grain received for pilgrims at Alexandria (November-December 1785)⁷

Port	Wheat kile⁸	Wheat ton	Barley kile	Barley ton
Kolos/Golos	21995	564.3037	1700	43.6152
Selânîk	11733	301.0218	5420	139.0555
Orfan	6890	176.7698	1607	41.22919
Total	40618	1042.095	8727	223.8999
Expected	50000	1282.8	10000	256.56

³ BOA, C.DH 129/6444. The order can be found also in BOA, A.DVNS.MSR.MHM.d. 10, order 29, form 28 June – 6 July, 1785.

⁴ See the Map.

⁵ BOA, A.DVNS.MSR.MHM.d. 10, order 29 derkenar, from 13 – 15 November, 1785.

⁶ BOA, C.DH 113/5631. See Table 1.

⁷ BOA, C.DH 113/5631, 2.

⁸ All units of measurement in the documents are given in Istanbul kile: 1 kile = 25,656 kilogram = 0.025656 ton (Murfhey, 1987, p. 227).

The grain shipments, coordinated under the supervision of Ebubekir Bey, emphasis the critical role played by the Ottoman state in managing both local economic disruptions and safeguarding the welfare of pilgrims. The Ottoman administration sought to mitigate the effects of famine and unrest by utilizing resources from Balkan ports and centralizing distribution control in Alexandria, aiming to maintain the continuity of one of Islam's most significant religious rites.

In 1786, the imperial center demonstrated its determination to deal with Egypt's political instability by deploying military forces to the region. In July the Ottoman fleet with the Grand Admiral Gazi Hasan Pasha himself arrived in Egypt with the task to put the province in order. Ottoman troops quickly restored the authority of the Sultan and chased away the rebellious local leaders. The forces of Gazi Hasan Pasha were compelled to depart from Egypt in October 1787 to focus on the empire's more urgent military campaign against Russia. Following the Ottoman withdrawal, Egypt's defiant rural chiefs reasserted themselves and quickly restored their former authority (Mikhail, 2015, p. 275). The more than year-long presence of Ottoman troops in Egypt clearly revealed the prolonged negative impact of drought, famine and food shortages that intensified the loss of political control over the region and the depletion of its natural resources. To sustain the army, the Ottoman administration was once again compelled to organize grain shipments to Egypt. Between June 1786 and March 1787, at least nine orders were issued to commanders of fortresses along the Straits to allow grain shipments intended for the Ottoman forces under Gazi Hassan Pasha, with the port of Alexandria as their final destination. The ships varied in tonnage and carried over 1,800 tons of wheat in total.⁹ One of the shipments also included specific quantities of biscuits (*peksimet*) and fat (*revgân*),¹⁰ while another carried more than 60 tons of barley as well.¹¹ It is likely that these were not the only food supplies sent to Gazi Hassan Pasha's army, as an order from January 1787 instructed that 25,000 Istanbul *kiles* or 640 tons of wheat had to be prepared for Egypt from the granary of the Naval Imperial arsenal (*Tersane-i amire*). This shipment was composed of the grain previously delivered to Istanbul from the ports of Selânik (9000 *kiles*), Orfan (1000 *kiles*) and Tekirdağ (15000 *kiles*).¹²

⁹ See Table 2.

¹⁰ BOA, C.AS 1040/45672, p. 1-2.

¹¹ Ibid.

¹² BOA, C.MTZ. 18/881, p. 1.

Table 2.**Ships transiting the Straits of Bosphorus and Dardanelles (June 1786 – March 1787), loaded with wheat for Ghazi Hasan Pasha's army in Egypt**

Date¹³	Ship Captain/ Origin	Kile	Ton
18 – 26 June, 1786 ¹⁴	Ahmed reys/ Muslim	11000	282.216
22 November – 1 December, 1786 ¹⁵	Cenave(?)/ Venice	10700	274.5192
10 – 20 January, 1787 ¹⁶	Andoni/ Venice	6800	174.4608
10 – 20 January, 1787 ¹⁷	Nikola/ France	4400	112.8864
10 – 20 January, 1787 ¹⁸	Françesko/ Dubrovnik	5600	143.6736
10 – 20 January, 1787 ¹⁹	Cezelo(?)/ Dubrovnik	11410	292.73496
30 January – 8 February, 1787 ²⁰	İstefani/ Dubrovnik	10000	256.56
9 – 17 February, 1787 ²¹	Bektaş/ Muslim	10000	256.56
28 February – 9 March, 1787 ²²	Petro/ Dubrovnik	3300	84.6648
	Total	73210	1878.27576

To sustain its military operations in Egypt, the Ottoman administration organized extensive grain shipments, highlighting the empire's reliance on well elaborated logistical networks to secure critical food supplies. The passage of the aforementioned nine ships to Egypt through the Bosphorus Straits and the Dardanelles opened up the possibility that grain shortages in the Nile Valley could be linked to the Black Sea region. Several significant ports, including Varna, Balchik, Kavarna, Trabzon, and others, were situated in this area.²³ From these ports, loads of grain were dispatched annually to Istanbul and other key locations within the empire (Özveren, 2003; Ağır, 2013, pp. 576, 579–582).

The dispatch of grain shipments from the Balkans' ports reflects the well-established imperial infrastructure for provisioning essential foods across vast distances, particularly to Egypt suffering from natural disasters like famine and political turmoil. The ecological conditions of the Balkans were fundamental to the Ottoman Empire's grain supply system, as the region was essential for providing grain to Istanbul, military forces at the frontlines, and other parts of the empire (McGowan, 1969, 1981, pp. 12–15; Murphey, 1987, pp.

¹³ This is the dates, when the orders were sent to the commanders of the Straits' fortresses.

¹⁴ BOA, C.BH 69/3256, p. 1.

¹⁵ BOA, C.AS 794/33660, p. 1.

¹⁶ BOA, C.AS 1040/45672, p. 1-2.

¹⁷ Ibid.

¹⁸ Ibid.

¹⁹ Ibid.

²⁰ BOA, C.BH 252/11686, p. 1-2.

²¹ BOA, C.AS 330/113681, p. 1-2.

²² BOA, C.AS 973/42358, p. 1-2.

²³ See the Map.

32–34; Finkel, 1988, pp. 119–208). The Balkans, characterized by a mix of mountain ranges, river valleys, and coastal plains, provided a varied agricultural environment. Fertile lowlands, such as the plains of Thrace, Dobruja and Macedonia, were highly suitable for large-scale grain cultivation. Agriculture in the Balkans was predominantly organized around grain cultivation, especially wheat and barley (McGowan, 1981, pp. 32–38; Murphey, 1987, pp. 32–34; Ağır, 2013, pp. 579–583).

The proximity of the Balkans to Istanbul made it a reliable and efficient source of grain, compared to more distant regions. The ports along the Danube River, the Black Sea and Aegean Sea coasts served as critical hubs for moving grain from inland areas to Istanbul and other regions in the Mediterranean (McGowan, 1981; Murphey, 1987, pp. 222–228; Ağır, 2013, pp. 274–279). The detailed accounts of the Ottoman administration make it possible to link grain supplies to Egypt with specific ecological zones in the Balkans through various export ports. For instance, at the port of Volos, grain is sourced from the Thessalian plain, while in the ports of Thessaloniki and Orphano, it is collected from the vast plains of Macedonia and the areas along the Vardar and Struma rivers. The port of Tekirdağ receives grain from the fertile regions of Northern and Eastern Thrace, and at the Black Sea ports of Varna, Balchik, and Kavarna, grain is gathered from the Dobruja region.²⁴ During the 17th and 18th centuries, landownership in these regions increasingly came under the control of large estate holdings (*çiftliks*), transforming grain cultivation into a market-oriented sector of the local economy (McGowan, 1981, pp. 58–79; Kayapınar, Kayapınar, 2019, pp. 277–278; Todorov, Dobrev, 2023, pp. 97–101). These areas together with their adjacent ports played a key role in the Mediterranean trade network, connecting Balkan grain production with the empire's economic hubs. Their strategic positions allowed for efficient grain distribution to meet the needs of Istanbul's population and support the Ottoman state's administrative and military functions. This integration emphasizes the Balkans' significance as a vital supply region for both local and imperial demands during the Ottoman era.

Conclusion

The narratives, explored in this paper, highlight the logistical coordination between two different ecological zones: the Balkans and Egypt, situating this coordination within the broader context of the Ottoman Empire's political, economic, and social instability. In this context, the negative environmental changes triggered by the eruption of Iceland's Laki volcano are pivotal in connecting the Ottoman Empire to the broader global climate crisis. The central administration's efforts to address the crisis in Egypt, which was characterized by food shortages, social instability, and political upheaval, facilitated the creation of transregional connections between distant regions in the Eastern Mediterranean. Grain supplies connected Egypt and the Hejaz

²⁴ See the Map.

to different agricultural areas in the Balkans and the Black Sea basin. The Ottoman provisioning system also established interdependent relationships among distinct social groups, including Balkan peasants, Muslim pilgrims from all over the Islamic world, and the Ottoman soldiers in Egypt. Various other groups, such as clerks, suppliers, and merchants, served as intermediary links within this network. At the core of these social nets lies nature and its resources, with the benefits derived from their exploitation evident on every level from production to distribution and consumption. Through the management of natural resources, the provisioning system plays a crucial role in maintaining the integrity of the Ottoman Empire from an ecological perspective.

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