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The Impact of Environmental Stress Factors on Egyptian Finances in the Last Quarter of the Eighteenth Century

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Abstract

Climate plays a crucial role in sustaining Egypt's agricultural economy, which was essential for fulfilling financial obligations to Istanbul, including planting, taxation, and monetary transactions. However, during the late eighteenth century, various institutions, particularly the Egyptian financial system, experienced severe disruptions. The state's inability to effectively govern the province, its failure to remit taxes, and the disruption of agricultural activities led to a breakdown in social cohesion. As a result, Egypt's political, economic, and military structures underwent significant disintegration. Existing historiography on this period has largely focused on archival records and local chronicles. However, climate particularly in connection with disease and environmental vulnerability remains a relatively underexamined factor despite its central role in shaping economic organization.

This study investigates the impact of environmental stressors such as climate variability, geographical challenges, epidemics, rebellions, and wars on Egypt's financial collapse during the late eighteenth century. By utilizing primary sources, including the Ottoman Archives of the Republic of Turkey (BOA), contemporary chronicles, and French reports on the Nile River, this research integrates dendrochronological data for comparative analysis. The correlation between climate variability, economic instability, and political conflicts underscores the critical role of climate history in understanding the complexities of late eighteenth century Egypt.

Key Words: Egypt, Irsaliyyah Revenue, Climate, Plague, Environment, Financial Collapse

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On Sekizinci Yüzyılın Son Çeyreğinde Çevresel Stres Faktörlerinin Mısır Maliyesi Üzerindeki Etkisi

Özet

İklim, Mısır'da tarımsal ekonomiyi sağlayan en temel hayati unsurların başında gelmektedir. Üretimin devamlılığı, ekim faaliyetlerinin yapılması bunun sonucunda toplanılan vergilerin Mısır'ın ve İstanbul'un ihtiyaçlarına yönelik karşılanması böylece Mısır'ın İstanbul'a karşı mali yükümlülüklerini yerine getirmesi en temel bağlamda iklim, vergi ve Nil Nehri arasındaki pozitif ilişkiye bağlıdır. Fakat on sekizinci yüzyılın son çeyreğinde Mısır'daki Mali organizasyonda kırılma yaşanmış, İstanbul ve Mısır arasındaki mali denge bozulmuştur. Sonuç olarak, Mısır'daki siyasi, ekonomik ve askeri yapılar önemli ölçüde çözülmüştür. Bu döneme ilişkin mevcut tarih yazımı ise büyük oranda arşiv belgeleri ve yerel kronikler üzerinden şekillenmektedir. Ancak, iktisadi organizasyonu etkileyen başlıca unsurlardan biri olan iklim özellikle de hastalıklar ve çevresel kırılganlıklarla ilişkili olarak görece sınırlı biçimde ele alınmaktadır.

Bu çalışma on sekizinci yüzyılın son çeyreğinde çevresel stres faktörleri olarak adlandırdığım iklim, coğrafi çeşitlilik, hastalıklar, salgınlar isyanlar ve savaş gibi unsurların aynı zaman diliminde meydana gelerek Mısır'daki siyasi ve mali kırılmaya bağlı olarak iktisadi çöküşün nasıl meydana geldiğini araştırmayı amaçlamaktadır. Bu bağlamda Devlet Arşivleri Başkanlığı Osmanlı Arşivi (BOA), yerel kronikler, Fransızların Nil Nehri üzerinde mezkur dönemde hazırladıkları raporlar ve dendrokronolojik iklim verileri (OWDA) kullanılacakır. Böylece iklim ve çevresel stres faktörlerinin on sekizinci yüzyıl Osmanlı Mısır Maliyesinde nasıl bir kritik rol oynadığı ortaya koyulacaktır.

Anahtar Kelimeler: Mısır, İrsaliyye Hazinesi, İklim, Veba, Çevre, Mali Çöküş

Introduction

The last quarter of the eighteenth century was a period of profound turmoil, shaped by complex political power struggles in Egypt. Following the separatist rebellion of Bulutkapan Ali Bey, the financial system approached a state of collapse. Egypt was unable to remit the sultan's treasury during the 1768–1774 uprising, only managing to send 20,861,211 paras as irsaliyyah revenue in 1775, covering a total of nine years[1]. Between 1776 and 1798, Egypt experienced an unprecedented convergence of crises, including fluctuations in the Nile's water levels, prolonged droughts, dengue and breakbone fever outbreaks, long-term plague epidemics, livestock diseases price increase[2], Mamluk revolts against the Ottoman Porte, and the French occupation (1798–1801). These factors profoundly affected Egypt and Istanbul on environmental, financial, and political levels. Egypt's agrarian economy relied on selling surplus agricultural produce and collecting taxes from peasants. For this system to function effectively, the Nile had to flood consistently each year, and climatic conditions had to support agricultural production. However, during the last quarter of the century, these conditions were rarely met. Consequently, severe

[1] During the first half of the eighteenth-century Egypt sent to Porte 10 million between 35 million paras per year. See. Stanford J. Shaw, *The Financial and Administrative Organization and Development of Ottoman Egypt 1517-1798,* Princeton University Press, Princeton 1962, pp.400-401; Osman Onur Genç, "An Example of Local Treasure in Ottoman Egypt "Kushufiyah" (1711- 1795)", Master diss., Hacettepe University 2021; Mücahide Nihal Engel, "Ottoman Egypt in the Mid Eighteenth Century-Local Interest Groups and Their Connection with and Rebellions Against the Sublime Porte and Resistance to State Authority", PhD diss., University of Birmingham 2017, pp. 266-267. According to 1765-66, *muqataa register* Egyptian government and all decision-making mechanisms of Pasha Diwans in Cairo are collected approximately 114.552.054 paras per financial year. About 5/4 of this money was spent for the needs of Egypt and the holy lands (Meqqa and Medina), while 5/1 was sent to Istanbul under the name of the irsaliyyah revenue which was 20.266.328 paras. BOA. D.BŞM.MSR.d. 16893; Genç, "Kushufiyah", pp. 78-79.

[2] In this period, food prices increased sharply due to the drought, plague and the low rainfall of the Nile River. This situation is handled throughout the study. See. Abd al- Rahman al- Jabarti, *"Abd al-Rahman al-Jabartî's History of Egypt, 'Ajâ'ib al-Âthâr fi'l-Tarâjim wa'l-Akhbâr"*, trans. Thomas Philipp, M. Perlmann, vol.II, Franz Steiner Verlag, Stutgart 1994, pp. 229,232, 292, 322, 374, 396, 397.

famines emerged, diseases proliferated, and the irsaliyyah revenue, which was expected to be remitted annually, was only sent to Istanbul six times in twenty-five years.

According to OWDA (Old World Drought Atlas) data, Egypt suffered five major droughts during this period, while optimal climatic conditions were recorded only three times.[3]. French scientific studies conducted during the occupation of Egypt revealed that the Nile overflowed sufficiently in just nine seasons but failed to do so in fourteen seasons over a twenty-five-year period[4]. These fluctuations had dire consequences: excessive flooding led to mosquito-borne diseases like dengue fever, while insufficient flooding resulted in droughts, inflation, livestock diseases, famines, and plague outbreaks[5]. Simultaneously, the Mamluk Beys' rebellion against the Ottoman Porte and the Russo-Ottoman War (1787–1792) exacerbated financial instability within the empire[6]. The crisis reached its peak with the French invasion of 1798, marking the end of classical Ottoman rule in Egypt.

The annual inundation of the Nile during June, July, and August significantly contributed to summer precipitation in Egypt. This phenomenon facilitated the cultivation of economically valuable crops such as rice, sugarcane, sesame, indigo, and cotton, as well as essential staple crops like *hinta* (wheat) and *durra* (corn), which were planted after the floodwaters receded. A productive harvest year depended on effective soil cultivation and sufficient water supply[7]. The primary objective of this study is to bridge climate history with socio-economic history by combining diverse archival sources with empirical data from the natural sciences. By doing so, it seeks to illuminate the impact of the Nile's hydrological patterns on Egypt's production-consumption balance and tax structure under Ottoman rule. Furthermore, this research highlights how Egypt's fragile economic structure was destabilized by external tax burdens and epidemic outbreaks such as degue and examines the Ottoman Empire's response to these crises.

This study aims to integrate palaeoclimatological data (OWDA reconstruction climate data) with archival sources, particularly the Ijmal records from the State Archives of Turkey and al-Jabarti's *History of Egypt*. Using the climatological data reconstructed by Edward R. Cook et al., this research seeks to establish annual climate patterns. Tree-ring analysis, a subfossil dataset providing drought data for June, July, and August, allows for a systematic comparison of climate conditions in late eighteenth-century Egypt with historical records. Additionally, this study aims to combine socio-economic history with objective findings from the natural sciences, using Ottoman Egypt as a case study to examine financial history and the tax system in the region. In an early modern empire where taxation was highly dependent on climatic conditions, this research seeks to demonstrate that historical analysis should not rely solely on archival documents but also incorporate empirical findings from the natural sciences. By intertwining these disciplines, it highlights how tax structures and financial stability were shaped by environmental factors and underscores the necessity of an interdisciplinary approach to understanding fiscal history.

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[3] For the climate data in the study, the Old-World Drought Atlas (OWDA) created by Edward R. Cook. See.Edward. R. Cook et. al. "Old World Megadroughts and Pluvials During the Common Era", *Science Advances*, vol. 1, 2015, p. 1-9.

[4] M. Le Pere, "Memoire Sur La Valléé Du Nil", *Description De L'Egypte Ou Recueil Des Observations Et Des Recherches*, ed. F. Panckoucke, Paris 1822, p. 628.

[5] al-Jabarti, *History of Egypt*, 81-193-158-228; Daniel Panzac, *La Peste Dans L'Emrire Ottoman (1700-1850)*, trans. Serap Yılmaz, Tarih Vakfı Yurt Yayınları, İstanbul 2011, pp.16.

[6] During the war, the Russian Tsar sent a letter through his consul in Alexandria to encourage the Mamluks to revolt. The Russian Tsar's attempt was understood by the Ottoman authorities and Djezairli Ghazi Hasan Pasha's men were captured during his escape from Egypt. See. BOA.TS.MA.e. 384-39; TS.MA.e. 640-48. "On the 14th the pasha held a diwan at al-Ayni Palace, where he assembled all the amirs, ocaks, and shaykhs, because of the arrival of an ambassador carrying letters from the king of Moscow. Concerning its arrival, there exists a report, which must be reproduced as it was related to us. Here is what it says: When the king of Moscow learnt of the move of the Ottomans against Egypt in the beginning, he sent a letter to the amirs of Egypt through his consul in Alexandria. In this letter, he put them on their guard against the Ottoman move and prodded them to fortify the port city and prevent Hasan Pasha from passing...The ambassador reached Damietta during the last days of Ramadan, discerned the reversal of the situation, raided the port city, and captured a great number of corvettes". See. al-Jabarti, *History of Egypt*, p.269.

[7] Kenneth Cuno, *The Pasha's Peasants Land, Society, and Economy in Lower Egypt, 1740-1858*, Cambridge University Press, Cambridge 1992.

1. Environmental Stress Factors

Environmental stress factors, coupled with recurrent outbreaks of disease, famine, and political unrest, led to widespread devastation, severely disrupting administrative, economic, and agricultural processes. In Egypt, climate and the Nile River played a central role, serving as the lifeline of agricultural production and forming the foundation of the economy. The livelihood of the *fellah* (peasant farmers), who were the backbone of Egypt's agrarian production, was intricately linked to the annual fluctuations of the Nile and broader climatic conditions.

Beyond its direct influence on agricultural yield, climate indirectly impacted human and animal health, affecting labor availability and economic productivity. The correlation between Nile flood levels, seasonal precipitation variability, and disease outbreaks is illustrated in Table 1, providing a comprehensive overview of the interdependencies between environmental stressors and socio-economic conditions in late eighteenth-century Egypt.

2. Climate and Nile River

Egypt's very existence is intrinsically linked to agricultural production and the labor force, both of which are shaped by the interplay between climate and the Nile River. Consequently, villagers contribute to sustaining agricultural output by fulfilling their tax obligations, while the state endeavors to preserve its administrative structure through tax collection. This reciprocal relationship signifies an implicit agreement between the ruling authorities and the governed population. Climate serves as the principal variable in ensuring the persistence of this agreement, akin to a proverbial sword of Damocles, introducing uncertainty into classical-period agricultural economies due to its unpredictable and uncontrollable divine influence.

The agricultural zone of Egypt extends along the Nile River basin between 24°-32° North latitude and 27°-31° East longitude. It is bordered by the Mediterranean Sea to the north, the Persian Gulf to the east, the Libyan Desert to the west, and the Nubian Desert to the south[8]. The coldest months of the year are January and February, with an average temperature of 11°C, while the hottest months are July and August, with an average temperature of 29°C[9]. Despite being an arid region with minimal rainfall, annual precipitation in Cairo and Lower Egypt averages only nine days. The total annual precipitation in Cairo is approximately nine hours on average, while in Upper Egypt, rainfall is nearly nonexistent[10]. Thus, the Nile River serves as an indispensable source of essential precipitation.

Table 1: Reconstructed June-July-August Palmer Drought Severity Index (PDSI) values of the OWDA[11], French reports on the Nile[12], Chronicle of al-Jabarti[13] and Ottoman Archive documents (BOA) between 1700 and 1798.

[8] *Statistique D'El Egypte*, Alexandrie 1870, pp. 5.

[9] F. Amici, *Essai De Statistique Generale De L'Egypte Annees 1873, 1874, 1875, 1876, 1877*, Imprimerie Française Maurés, Le Caire, p. 11.

[10] These meteorological data belong to the years 1868-1871 and are used to form an opinion. See. Amici, *Essai De Statistique*, pp. xv:15- xvı: 16.

[11] Edward. R. Cook et. al, "Old World".

[12] M. Le Pere, „Valléé Du Nil", p. 627.

[13] See. al-Jabarti, *History of Egypt*.

Date	PDSI-JJO	PDSI 10 Year Spline	Annual Overflow of the Nile (Cubit)	Annual Diseases (Chronicle of al-Jaberti's)	Environmental Impact on Diseaster (Chronicle of al-Jaberti's)	The Amount of the Irsaliyyah Revenue sent to Istanbul
1775	1.006	0.653	23			3.127.236
1776	1.216	0.414	21			3.127.236
1777	0.884	0.001	22			0
1778	-2.671	-0.466	23			1.763.433
1779	-0.131	-0.808	24	Dengue or Breakbone Fever	Children Death	9.920.258
1780	-1.725	-1.036	23			0
1781	-0.165	-1.166	22			0
1782	-1.766	-1.242	18			0
1783	-1.639	-1.237	18		Price Increase and Village Abandoned	0
1784	-0.854	-1.16	18		Price Increase and Famine	0
1785	-0.228	-1.07	20	Plague and Fever		0
1786	-2.493	-0.982	22			0
1787	0.840	-0.856	22	Cattle Plague	Price Increase, Rat Infestation	0
1788	-1.644	-0.741	22	Plague	Price Increase	0
1789	-1.051	-0.575	21			0
1790	-0.083	-0.356	21		Too Much Rain	0
1791	0.983	-0.15	19	Plague		142.475.000
1792	-0.694	0.024	20		Starvation, Price Increase, Famine, Worm Infestation	0
1793	-0.060	0.253	19			0
1794	-0.055	0.569	19			0
1795	1.280	0.938	20			0
1796	1.866	1.263	20			0
1797	1.964	1.479	20			0
1798	0.968	1.608	22			32.915.606

References: This table has been compiled by adopting the methodology employed by Özlem Sert as a model. See. Özlem Sert, "Environmental History of Rice Plantations in the Early Modern Ottoman Empire Between the 15th and 19th Centuries and Its Potential for Climate Research", Journal of Environmental Geography, vol. 14 (1-2), 2021, pp. 1-14.

This study utilizes reports on the Nile by French scientists during the French occupation of Egypt (1798-1802), annual records from the al-Jabarti chronicle, and their comparison with the reconstructed Old World Drought Atlas (OWDA) June-July-August Palmer Drought Severity Index (PDSI) values for Ottoman Egypt north of Cairo (Nile River Delta) between 1775-1798. Tree-ring data indicate that values above zero correspond to sufficient temperature and humidity levels, while values below zero signal drought conditions and elevated temperatures. The data reveal that within this timeframe, values were above zero for only nine years, with ideal temperature conditions occurring exclusively in 1776, 1795, and 1796. However, it must be noted that the Nile River did not flood adequately during these years. In 1775, 1776, and 1777,[14]. The Egyptian governor collected an annual tax revenue of 25,182,427 paras from the irsaliyyah tax. However, only in 1775 and 1776 could an average of 3,127,236 paras be remitted to Istanbul,[15] as the remaining funds were allocated for local expenditures in Egypt and the holy cities of Mecca and Medina. A direct correlation is observed between OWDA June-July-August precipitation data, Nile River floods, disease outbreaks, and tax revenues in 1778. That year, Egypt sent only 1,763,433 paras as irsaliyyah revenue due to severe drought. Notably, despite the drought,[16] the Nile River rose to an extraordinary height of 23 cubits, with floods increasing to 24 cubits the following year. According to al-Jabarti, this rise was unprecedented, with all paths parallel to the Nile being impassable from mid-August to September[17]. On July 29, 1779, al-Jabarti recorded the emergence of dengue fever in Cairo and its surrounding areas.[18]. The outbreak particularly affected children and exhibited symptoms such as high

[14] BOA. D.BŞM.MSR.d. 16903-image 9-10.

[15] Ordinarily, the taxes gathered in Egypt are expressed and transmitted in Egyptian paras. However, in this document, the tax is specified in Istanbul money, denoted as gurush, rather than Egyptian paras. To maintain textual consistency, it is crucial to convert Istanbul gurush into Egyptian paras. It is established that 1 Istanbul gurush is equivalent to 5.9 Egyptian paras. See. BOA.D.BŞM.ZMT.d. 13837; Baki Çakır, 'Kese', *TDVIA* , İstanbul, Ek-2, p.42. https://cdn2.islamansiklopedisi.org.tr/dosya/EK-2/CEK214991.pdf ; BOA.D.BŞM.ZMT.d. 13837

[16] BOA. D.BŞM.MSR.d. 16903-image11

[17] al-Jabarti, *History of Egypt*, pp. 36-81; M. Le Pere, "Valléé Du Nil", p. 628.

[18] 'In the middle of Rajab there appeared in Cairo and its outskirts a disease which was called dengue or breakbone fever. It spread among all segments of the population including children. Its symptoms include fever, the acute phase lasting three days, sometimes a longer or shorter period, according to the constitution of the patient. The disease causes pain in the joints, knees, and extremities,

fever, fatigue, acute infection, and joint pain.[19] Modern medical research identifies dengue [20] as an arboviral disease transmitted by the bite of female mosquitoes, primarily Aedes aegypti and Aedes albopictus, in tropical and subtropical regions such as Egypt, Brazil, and India[21]. Dengue fever has an incubation period of 3 to 15 days and is characterized by sudden chills, headaches, lumbar pain, and severe prostration. Body temperature can rise rapidly to 40°C, accompanied by bradycardia (slow heart rate) and hypotension (low blood pressure)[22]. Al-Jabarti's historical description aligns with contemporary medical findings, which establish a direct correlation between high precipitation levels and increased dengue transmission[23].

The OWDA PDSI JJA precipitation data and French reports on the Nile indicate that in 1778 and 1779, the Nile River overflowed while temperatures remained high. These conditions fostered an ideal environment for the outbreak of dengue fever. Al-Jabarti states that Cairo and its hinterlands were severely impacted, with the Delta and Upper Egypt likely experiencing even higher infection rates. This evidence suggests that when the Nile River exceeds its usual flow, it can cause more harm than benefit. The extreme drought of 1778 further exacerbated the situation, as the convergence of drought conditions and Nile flooding led to the formation of marshy grounds, creating optimal breeding conditions for mosquito vectors.

3. Drought, Rebellion, and Plague

Despite numerous adversities, the governor of Egypt managed to collect 25,182,427 paras in taxes for irsaliyyah revenue in 1779. Of this sum, 15,449,241 paras were allocated to meet the needs of Egypt and the holy cities of Mecca and Medina, recorded as expenditures. The remaining amount, along with the outstanding balance from 1777, resulted in a total of 9,920,258 paras being remitted to Istanbul.[24].

The period between 1782 and 1792 was among the most turbulent in the 18th century, characterized by economic, political, military, and environmental crises. The Nile River experienced one of its most severe droughts of the century. Concurrently, while the Ottoman Empire was engaged in conflict with Russia, Mamluk Beys revolted against Istanbul and refused to pay taxes. Furthermore, Egypt suffered from multiple outbreaks of plague and livestock epidemics, leading to widespread famine and disease. Food prices surged, and Cairo, among other cities, was overrun by rats. This situation, in turn, triggered internal instability, decreased agricultural yields, and weakened the state's capacity to extract revenue through taxation. In this fragile context, plague outbreaks amplified existing vulnerabilities and accelerated political disintegration. This interpretation resonates with Edna Bonhomme's argument that plague outbreaks in late eighteenth-century Egypt were deeply intertwined with environmental fragility and socio-political

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hampers the movement of the fingers, and (causes) some swelling. The aftereffects last for over a month. The disease takes a person unaware, raises body temperature, effects the brain and the knees. It stops when treated with sweating and hot bath. (The outbreak) was an unusual episode. See. al-Jabarti, *History of Egypt*, pp. 81.

[19] Ibid., pp. 81.

[20] The dengue pandemic was first officially described in 1949 in the Guangdong region of China. Subsequently, it was revealed that the contagious vector was Aedes aegypti mosquitoes. In 1980, this pandemic was found on the Chinese island of Hainan. The morbidity rate is 2,146 per 10,000 people and caused 64 deaths. See. Thomas L. Hall and Victor W. Sidel, "Diseases of the Modern Period in Chine", *The Cambridge World History of Human Disease*, ed. Kenneth F. Kiple, Cambridge University Press, Cambridge 2008, pp. 367.

[21] Mona Gaber et al., "Dengue Fever as a Reemerging Disease in Upper Egypt: Diagnosis, Vector Surveillance and Genetic Diversity Using RT-Lamp Assay", *Journal of Plus One,* vol. 1-12, 2022, pp. 2.

[22] James Mcsherry, "Dengue", *The Cambridge World History of Human Disease*, ed. Kenneth F. Kiple, Cambridge University Press, Cambridge 2008, pp. 660.

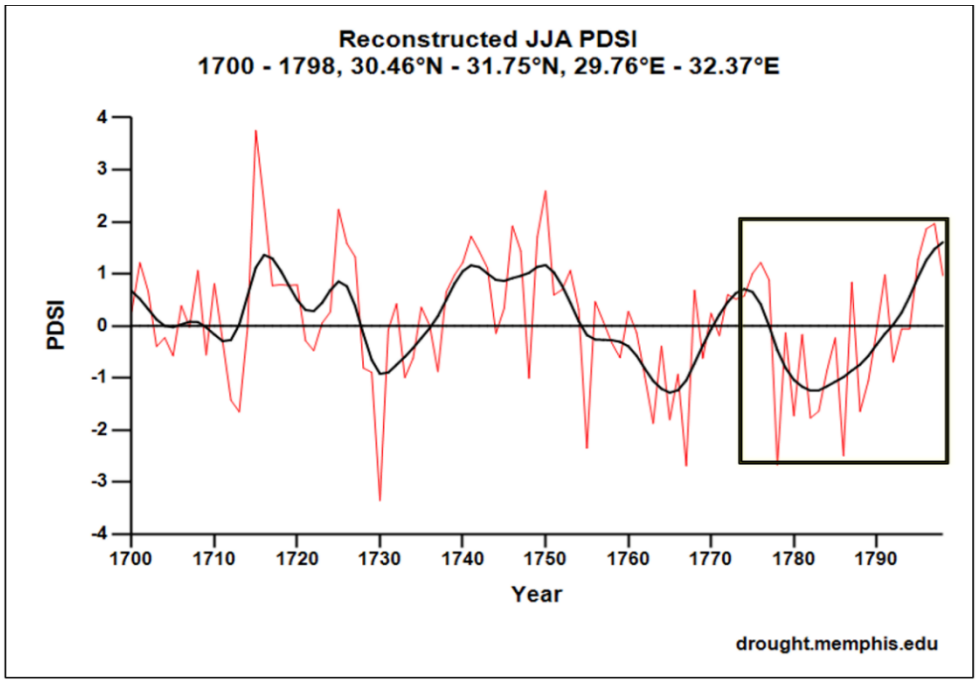
[23] al-Jabarti, *History of Egypt*, pp. 81; Mcsherry, "Dengue", pp. 661.

[24] D.BŞM.MSR.d. 16906A; Engel, "Ottoman Egypt", p. 269; Genç, "Kushufiyah", p. 59.

disintegration[25]. This decade of hardship preceded the French invasion (1798-1801) and significantly weakened Egypt's socio-economic structure.

The situation deteriorated further in October and November of 1783, exacerbating public fear and distress. The Nile had failed to flood adequately in 1782, and the following year proved even more dire. The river, often referred to as "God's gift to Egypt," rose to only 18 cubits[26] an insufficient level for agricultural production. Inadequate irrigation drastically reduced grain yields, leading to severe food shortages. The price of wheat fluctuated before stabilizing at 10 French riyals per irdeb.

Table 2: Reconstructed June-July-August Palmer Drought Severity Index (PDSI) values of the OWDA for Northern Egypt (Delta) in 1700-1798.



References: Reconstructed June-July-August Palmer Drought Severity Index (PDSI) values of the OWDA for Ottoman Egypt of North of Cairo (Delta) between 1700-1798. See. Edward. R. Cook et. al, "Old World".

Figure 1 presents a line graph derived from the PDSI JJA data in Table 1, where red squares indicate precipitation variability in the Delta region. The black trend line represents average precipitation levels. Values above zero signify favorable precipitation for agriculture, whereas values below zero denote drought conditions. The data indicate that the second half of the 18th century was marked by more severe droughts compared to the first half[27] with the final quarter of the century exhibiting the highest levels of

[25] Edna Bonhomme, "*Plagued Bodies and Spaces: Medicine, Trade, and Death in Ottoman Egypt and Tunisia, 1705–1830 CE*", PhD diss., Princeton University 2017, pp. 171–174, 186–188.

[26] According to al-Jabarti, a Nile River overflow reaching 21 cubits provided sufficient water for crop cultivation. Conversely, a level below this threshold signaled the onset of drought conditions. See. al-Jabarti, *History of Egypt*, pp. 16-36-94-97-123-138. Nevertheless, as indicated in Table 1, surpassing 23 cubits for two consecutive years was associated with the emergence of diseases linked to the Nile River.

[27] This situation highlights a key reason why Egypt's revenues were consistently collected and sent to Istanbul in the first half of the century, but this pattern didn't continue in the second half. The institutional collapse in Egypt can't be solely explained by adverse climatic conditions. However, there is a direct link between the inability to create the necessary financial conditions to address institutional disintegration and the climate.

aridity. Furthermore, over a 25-year period, the Nile River failed to rise above 20 cubits on 11 occasions, a level deemed inadequate for sustainable agricultural production in Egypt.

A letter sent by Ibrahim Bey, the qaimaqam of Egypt, to the Ottoman Porte in 1783 reported that a severe famine had persisted in Egypt for two to three years. Consequently, Egypt was unable to supply grain to Istanbul and the holy cities of Mecca and Medina[28]. The Nile had not exceeded 18 cubits for three consecutive years, resulting in extreme drought and increased tax burdens on peasants (fellahin) and urban dwellers. Mamluk Beys, collecting taxes under the names *mal-ı jihat* and *def-i mezalim*, further exacerbated the hardship by demanding advance tax payments from coffee and spice merchants[29]. This heavy taxation led to mass migration from rural areas to cities, where an overburdened population faced food shortages and resorted to scavenging for sustenance, even consuming animal carcasses. Grain prices soared, with the cost of wheat reaching 100 French riyals per irdeb, while granaries in Cairo remained empty[30]. According to archival documents from the State Archive of Turkey, a resident of Cairo wrote to the Ottoman Sultan on November 13, 1784, warning of the dire conditions. The Nile's low water levels, coupled with oppressive taxation by Mamluk amirs, had instilled widespread fear of famine among the populace. The letter also highlighted increased instances of banditry, with marauders looting homes and seizing property[31] . Another letter, signed by Mehmed Pasha, the governor of Egypt, on the same date corroborated these claims, emphasizing the devastation caused by famine and widespread lawlessness[32].

The year 1785 witnessed further calamities. According to al-Jabarti, an outbreak of plague[33] emerged in April but began to subside by May 24, dissipating within a month. Daniel Panzac notes that plague outbreaks in Egypt typically commence in January and subside by August[34], with flea infestations

[28] BOA.HAT. 29-1358.

[29] For detailed information. See. Abdul Rahim Abdul Rahman, 'Financial Burden on the Peasent Under the Aegis of the Iltizam System in Egypt', *Journal of the African Studies*, vol. 12, 1976, pp. 122-135.

[30] Hasan Pasha who protector of Egypt was equal to 1 French riyal to 100 paras on September 27 in 1787. Accordingly, al-Jabarti on these dates, 1 French riyal is equal to 100 Egyptian paras. So, 100 French riyals are equivalent to 10.000 Egyptian paras. As a result, 1 irdeb of Wheat (150 kilograms) has increased to 10.000 Egyptian paras. See. al-Jabarti, *History of Egypt*, p. 241.

[31] BOA. HAT. 1430-58530.

[32] BOA.HAT.29-1363.

[33] Firstly, Plague has affected many societies from past to present. The best-known plague pandemics are Justinianic Plague (AD. 541 to Circa 750) and black death (1346 to 1353). See. Nükhet Varlık, *Plague and Empire in the Early Modern Mediterranean World The Ottoman Experience, 1547-1600*, Cambridge University Press, Cambridge 2015, pp. 1; Edna Bonhomme, *"Plagued Bodies and Spaces: Medicine, Trade, and Death in Ottoman Egypt and Tunisia, 1705–1830 CE"*, Ph.D. diss., Princeton University 2017, p. 171–174, 186–188.; John Haldon et al., "Between Resilience and Adaptation: A Historical Framework for Understanding Stability and Transformation of Societies to Shocks and Stress", *Covid-19: Systemic Risk and Resilience*, ed. Igor Linkov et al. Springer Press, Switzerland 2021, pp. 244. "The pathogen causing the plague is *Yersinia Pestis*. This bacterium causes the disease in 3 different ways: bubonic, pneumonic, and septicemic". See. Jürg Luterbacher et al. "Past Pandemics and Climate Variability Across the Mediterranean", *Euro-Mediterranean Journal for Environmental Integration* vol. 5/46 (8-10), 2020, p. 46. The carrier of the disease can be many mammals, but the main factor in keeping the bacterium alive are rodents and fleas that feed on them. See. Varlık, *Plague*, pp.19-20. The plagues afflicting Egypt were systematically classified into distinct categories, namely bubonic and pneumonic manifestations. The bubonic plague exhibits comparatively lower lethality when juxtaposed with the pneumonic plague. See. Alan Mikhail, *Under Osman's Tree the Ottoman Empire, Egypt & Environmental History*, The University of Chicago Press, Chicago and London 2017, pp. 176-177; According to Nükhet Varlık and Ann Carmichael, the lethality of bubonic plague varies between 40-70 percent. See.Varlık, *Plague*, pp. 7; Ann G. Carmichael, "Bubonic Plague", *The Cambridge World History of Human Disease*, ed. Kenneth F. Kiple, Cambridge University Press, Cambridge 2008, pp. 628. The bubonic plague induces lymph node swelling and inflammation, hence its nomenclature, accompanied by the manifestation of high fever in affected individuals. Conversely, the pneumonic plague is disseminated through respiratory means, primarily through coughing and sneezing, resulting in lung infection. See. Varlık, *Plague*, p.7.

[34] According to Alan Mikhail, a recurring pattern of plague epidemics afflicted Egypt at nine-year intervals, spanning from the Late Medieval period to the conclusion of the nineteenth century (1347-1894). See. Alan Mikhail, "Plague and Environment in Late Ottoman Egypt", *Water on Sand*, ed. Alan Mikhail, Oxford University Press, New York 2013, p. 112.

serving as primary vectors for transmission[35]. The spread of the disease is influenced by heat and humidity, with optimal transmission occurring between temperatures of 20.5 to 25 degrees Celsius and humidity levels of 65 to 75 percent[36]. Meteorological records indicate that in Egypt, average temperatures in March, April, and May were 16.96°C, 20.01°C, and 26.50°C, respectively.[37]. The PDSI-June-July-August drought index for 1785 suggests that while drought conditions were not as severe as in preceding years, the Nile River still failed to reach the optimal flood height of 21 cubits, which negatively impacted agricultural productivity. Al-Jabarti attributes persistently high food prices to this continued water shortage. However, lower levels of flooding and relatively stable air temperatures may have mitigated the spread of plague by preventing increases in humidity, which would have otherwise facilitated flea proliferation[38]. Had temperatures been higher, humidity levels would have risen, fostering an ideal breeding environment for fleas and exacerbating the outbreak.

The sustained failure of the Nile to flood had profound consequences on Egyptian society. The rebellion of the Mamluk Beys further compounded these challenges, making life increasingly difficult for the people. The combination of drought and rebellion led to widespread famine, yet the Mamluks exploited the crisis to consolidate their power, imposing additional taxes on an already suffering population. In 1785, they declared their refusal to remit taxes to Istanbul[39]. In response, the Ottoman Porte commissioned Jazzar Ahmad Pasha, the governor of Sayda, to assess the situation. Given his prior service under Bulutkapan Ali Bey and familiarity with Egyptian affairs, Jazzar Pasha's report underscored the collapse of Ottoman authority in Egypt and recommended the suppression of the Mamluks as a prerequisite for restoring order[40]. Consequently, Istanbul dispatched Djezairli Ghazi Hasan Pasha, the Grand Admiral (Kapudan Pasha) of the Ottoman Empire, at the head of a fleet comprising 180 ships and a contingent of soldiers to reestablish control. Initially, Hasan Pasha succeeded in quelling the Mamluk insurrection, forcing the rebels, led by Murad and Ibrahim Bey, to retreat to Upper Egypt. Order was subsequently restored under Hasan Pasha's administration[41]. By 1786, under Hasan Pasha's governance, Egypt's total revenues amounted to 124,082,143 paras. Of this sum, 64,485,076 paras were allocated for the salaries of soldiers and Cairo's elite, while 26,969,394 paras were dispatched to support Mecca and Medina. Additionally, 2,543,941 paras were spent on provisions such as persimmons, sugar, rice, and grain for the imperial shipyard. A further 4,916,039 paras were designated for the reconstruction of Cairo, and 25,182,427 paras were recorded as prior years' expenditures. Due to expenditures exceeding revenues, the Egyptian administration was compelled to borrow 14,734 paras to achieve financial equilibrium. As a result, Istanbul was deprived of Egypt's revenues for that fiscal year, underscoring the profound economic disruptions caused by years of drought, rebellion, and plague[42].

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[35] Doctor Lefevre, who conducted extensive research in Alexandria during the plague epidemic of 1834-1835, posited that the dissemination of the plague relied upon specific conducive conditions. These conditions included the dispersion of plant and animal substances in the air, ambient temperature and humidity levels, the inherent characteristics of decomposing materials, the quantity of decomposing matter (comprising cataplasis and burial customs), atmospheric electricity, and the hygiene practices of Egyptians, especially those dwelling in environments characterized by poor cleanliness. However, Clot Bey contends that these factors, while significant, are not independently sufficient as primary determinants of plague emergence. According to Clot Bey, such conditions prevail annually in Egypt; yet the occurrence of the plague is not a regular annual event. See. Clot Bey, *De La Peste Observee En Egypte*, Paris 1840, pp. 209-221.

[36] Panzac, *Peste*, pp.115; Varlık, *Plague*, pp.40-50.

[37] These data show the average temperature data between 1868 and 1871. See. Amici, *Essai De Statistique*, pp. 11.

[38] Varlık, *Plague*, pp.18.

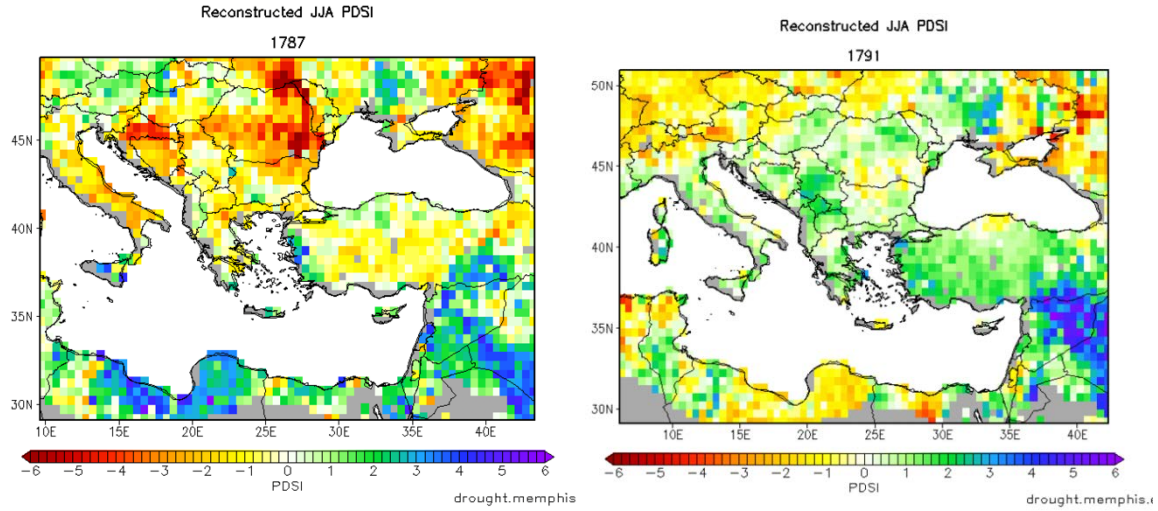
[39] Helen Anne B. Rivlin, *The Agricultural Policy of Muhammad Ali in Egypt*, Harvard University Press, Cambridge 1961, p. 4.

[40] Stanford J. Shaw, *Ottoman Egypt in the Eighteenth Century, The Nizamname-i Mısır of Cezzar Ahmed Pasha*, Harvard University Press, Cambridge 1962, pp. 6-7; Genç, "Kushufiyah", p.147.

[41] BOA.TS.MA.e. 872-19

[42] This document verifies that the final irsaliyyah revenue dispatched from Egypt occurred in 1779, pertaining to the tax revenue of 1778. Notably, the document highlights that no tax remittance has been forwarded to Istanbul for a period of eight years.

Table 3: Reconstructed June-July-August Palmer Drought Severity Index (PDSI) values of the OWDA in the Mediterranean world especially Ottoman Egypt in 1787 and 1791.



References: This mapped version of the June-July-August drought index (PDSI) reconstruction data by Edward R. Cook in Table 1. See. Cook et. al., 'Old World'.

The map above presents the June-July-August drought index (PDSI) reconstruction data compiled by Cook et al. These maps aim to enhance the understanding of the plagues that occurred in 1787, 1788, and 1791.

In 1787, under normal circumstances, Egypt experienced favorable conditions for a productive harvest. According to PDSI data, the climate not only provided optimal conditions for agricultural production but also ensured sufficient resources. Furthermore, the Nile River overflowed by 22 cubits, reaching a level considered above the ideal. However, despite these seemingly favorable conditions, famine had led to an abnormal increase in meat and food prices as early as January 1786[43]. The situation was so severe that Hasan Pasha, stationed in Egypt to maintain control, had to implement price regulations for meat and food products.

This persistent food scarcity suggests that the repercussions of the famine extended into the following year. The resulting shortage of animal feed directly impacted livestock nutrition, weakening their immune systems. Under these conditions, a severe cattle plague [44] (Rinderpest) [45] emerged in Egypt in late

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Additionally, it is indicated in the document that essential provisions for the imperial kitchen, including sugar, rice, lentils, wheat, and barley, have not been dispatched to Istanbul. See. BOA.TS.MA.d. 2890.

[43] Mutton was reduced from 10 paras to 8 paras, water buffalo from 7 paras to 6 paras, cooking butter to 18 paras, and Fresh butter to 14 paras as well as oqqa of bread is fixed at 1 para. See. al-Jabarti, *History of Egypt*, p. 225.

[44]The etiological agents responsible for the Plague disease (Yersinia Pestis) and cattle plague (Rinderpest) differ fundamentally, with the former being caused by a vector bacteria and the latter by morbilliviruses, constituting a pivotal distinction between the two plagues. Noteworthy is the lethality rate associated with cattle plague (Rinderpest epizootic), which, according to certain studies, stands at 90 percent. However, recent investigations have indicated an alarming increase in this fatality rate, reaching 100 percent. See. Paul Pierre Pastoret, "Rinderpest: A General Introduction", *Rinderpest and Peste Des Petits Ruminants Virus Plagues of Large and Small Ruminants*, ed. Tom Barrett and Paul Pierre Pastoret, William Taylor Press, United Kingdom 2006, p. 3; Neeraja Sankaran and Robin A. Weiss, "Viruses: Impact on Science and Society", *Encylopedia of Virology*, ed. Dennis Bamford and Mark Zuckerman, Elsevier Press, Cambridge 2021, p. 679; Peter Wohlsein and Jeremiah Saliki, "Rinderpest and Peste Des Petits Ruminants- The Diseases: Clinical Signs and Pathology", *Rinderpest and Peste Des Petits Ruminants Virus Plagues of Large and Small Ruminants*, ed. Tom Barrett and Paul Pierre Pastoret, William Taylor Press, United Kingdom 2006, pp. 68; Thomas J.

February, lasting until the end of June[46]. The epidemic resulted in the deaths of a significant number of animals, severely disrupting agricultural activities[47]. Al-Jabarti documented the widespread loss of livestock in Cairo and the Delta, leading to a sharp increase in the prices of healthy animals and dairy products. This price surge can be attributed to the fundamental role of oxen and other livestock in agricultural production, highlighting the interdependence of human and animal labor within the agroecosystem. The loss of draft animals necessitated the increased use of human labor, a shift that, according to Alan Mikhail[48], laid the foundation for the corvée system, which mandated unpaid labor for reconstruction projects during the reign of Muhammad Ali Pasha[49]. Egypt had long faced a scarcity of draft animals for daily agricultural work. Farmers often shared ownership of animals such as oxen, cows, and water buffaloes through a system known as "hissa." This practice underscored the economic difficulties faced by agricultural workers and the crucial role of livestock in sustaining agricultural productivity[50].

The impact of the plague that emerged in May 1788 on Egypt is evident, though al-Jabarti's limited coverage suggests its temporary nature. Despite the arid conditions indicated by PDSI data, the Nile's overflow of 22 cubits in August generated optimism among the population. This favorable environment facilitated agricultural production, and the continued abundance of resources into 1789 contributed to a substantial decline in food prices. For instance, the price of one irdeb of wheat fell from 9.5 French riyals to 3.5 French riyals[51]. Due to the food surplus, rice that was unprofitable in local markets was exported to merchants trading in Izmir, Thessaloniki, and Kusadasi. In response, an imperial decree from Istanbul mandated that rice prices should not exceed 100 paras per kile[52].

The revival of agricultural production in Egypt enabled the collection of taxes for Istanbul, which was crucial during the Russo-Ottoman War of 1787. Facing financial strain and the loss of the Ozi region, a key grain supplier,[53] the Ottoman government sought payment of the irsaliyyah revenue for 1788, 1789,

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Brouwers and Bernard Am Van Der Zeijst, "Vaccine Production, Safety, and Efficacy", *Encylopedia of Virology,* ed. Dennis Bamford and Mark Zuckerman, Elsevier Press, Cambridge 2021, p. 281.

[45] Despite the absence of a precise understanding of the transmission mechanism, it is recognized that Rinderpest morbillivirus shares a close genetic relation to the measles virus. Consequently, there is a prevailing hypothesis that its emergence and spread in animals coincided with the process of animal domestication. See. Bernard Vallat, "Foreword", *Rinderpest and Peste Des Petits Ruminants Virus Plagues of Large and Small Ruminants*, ed. Tom Barrett, Paul-Pierre Pastoret and William Taylor, Elsevier Press, United Kingdom 2006, pp. xix; Tilahun Yılma, "A Modern Vaccine for An Ancient Plague: Rinderpest", *Naturebiotechnology,* vol.8, 1990, pp.1007-1008. Nevertheless, the occurrence of Rinderpest in wild animals such as wolves suggests that the virus has the potential for transmission from wildlife to domestic animals. See. Ashley C. Banyard et al., "The Morbilliviruses", *Rinderpest and Peste Des Petits Ruminants Virus Plagues of Large and Small Ruminants*, ed. Tom Barrett, Paul-Pierre Pastoret and William Taylor, Elsevier Press, United Kingdom 2006, pp. 17-18. The classic symptoms of the disease are fever, erosive lesions in the mouth, discharge from the nose and eyes, severe diarrhea, and loss of dehydration. See. "Rinderpest", WOAH, accessed January 20, 2024, https://www.woah.org/en/disease/rinderpest/ .Rinderpest, the biggest fearful dream of societies throughout history, was eradicated in 2011 thanks to the vaccines developed by FAO (Food and Agriculture Organization of the United Nations) and WOAH (World Animal Health Information System). See. Carina Conceicao and Dalan Bailey, "Animal Morbilliviruses (Paramyxoviridae)" *Encylopedia of Virology*, ed. Dennis Bamford, Mark Zuckerman, Elsevier Press, Cambridge 2021, pp. 77-78.

[46] 'During this time a virulent epidemic spread rapidly among the cattle with such violence that animals were falling in the streets. Ibn Basyuni, warrior champion of Sandiyun, in particular, lost 160 oxen, and other losses were on a similar scale. During this month (March) the cattle plague spread throughout the northern part of the country and reach Cairo. Cattle collapsed in the streets and in the pastures, and the land was full of the stench of decaying carcasses. Some of the animals were slaughtered just in time; the others perished'. See al-Jabarti, *History of Egypt*, pp. 232- 228-229; Alan Mikhail, *Nature and Empire in Ottoman Egypt an Environmental History, Cambridge University Press, Cambridge 2011,* p. *219.*

[47] al-Jabarti, *History of Egypt*, pp.232.

[48] Mikhail, *Osman's Tree,* pp.133-134.

[49] Mikhail, *Osman's Tree*, pp. 144-145.

[50] Mikhail, *Osman's Tree*, pp. 117-118.

[51] al-Jabarti, *History of Egypt*, p. 292.

[52] BOA. C.IKTS.44.2186-2.

[53] "During Muharrem (Sept. 21-Oct. 20, 1790) news arrived that the Muscovites had attacked several Muslim fortresses and provinces among them the region of al-Awza (Turk. Ozu, a fortress in the region of Silistria. It was conquered by the Russian under

and 1790 [54]. However, in late January and early February 1791, a plague outbreak in Egypt further exacerbated the crisis[55]. The emergence of rats increased the severity of the plague even more[56].

The presence of rats intensified the severity of the epidemic, resulting in the deaths of the governor of Egypt and several Mamluk amirs in Cairo[57]. The plague spread across Egypt and persisted through May[58]. In response, Istanbul issued an imperial order instructing Mamluk Beys and Cairo's notables, who had taken refuge in rural areas, to return to the capital and restore stability[59]. Although the intensity of the plague diminished by August, approximately one-fifth of Cairo's population perished, with an estimated daily mortality rate of 1,500 people[60]. The epidemic disrupted Egypt's state organization, exemplified by the appointment of three officials to a single position on the same day, only for them to succumb to the plague shortly thereafter[61]. The irsaliyyah revenue, which had been prepared in 1790, was only dispatched in June 1791 due to the ongoing epidemic as only 142.475.000 paras[62]. Istanbul faced an additional challenge in the form of a Mamluk uprising, which threatened to seize control of Cairo. Given the continued Russo-Ottoman War, the Russian Tsar had an incentive to incite the Mamluks against Ottoman rule. In response, Istanbul issued repeated imperial orders to prevent rebellious factions from entering Cairo[63].

Although the Mamluk Beys sought forgiveness by sending gifts to Istanbul, their request remained unaccepted until August 1791[64]. However, due to the ongoing war and the instability caused by the plague, Istanbul ultimately decided to reintegrate the Mamluks into the administrative framework. An imperial decree issued in September 1791 explicitly stated that, due to the chaotic conditions in Egypt, the treasury could not be sent to Istanbul[65].

The concurrent epidemics led to severe famine as the Nile River barely overflowed. The resulting population loss exacerbated food scarcity, causing a dramatic surge in prices. For instance, the price of wheat rose from 2 to 6 French riyals before stabilizing at 4 French riyals. [66]. The governor of Egypt and the Mamluk Beys conveyed to Istanbul that they were unable to remit taxes or cover pilgrimage expenses

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Suvarov in 1788) which yield crops to Istanbul just as Upper Egypt does to Cairo. Also that a great rise in prices was taking place in Istanbul". See. al-Jabarti, *History of Egypt*, p. 299.

[54] BOA.CDRB.7.333.1; Ibid., pp. 295.

[55] According to Daniel Panzac, plague occurred in 10 different geographies of the Ottoman Empire in the same period. See. Panzac, *Peste*, pp.102.

[56] Mikhail, *Osman's Tree*, p. 179.

[57] BOA.HAT. 1399-56283; BOA.C.ML. 52-2431; BOA.HAT.1412-57500.

[58] According to al-Jabarti, some people did not die even if they were sick. This indicates that the plague may be of bubonic origin. 'It was quite unusual for someone who complained of illness not to die. The apperence of the stricken one was also unusual, he would not be feverish, but the man would be sitting, then begin to shake from cold and would cover himself but would not recover except be delirious or die on the same day or the next.' See. al-Jabarti, *History of Egypt*, p. 315; BOA.C.DH.35-1722-1.

[59] BOA.HAT. 1412-57500.

[60] According to Bruce McGowan, in the last quarter of the eighteenth century, due to wars, financial instability, and insecurity, there was a great decrease in the Ottoman population in the Arab geography, especially in Egypt. See. Bruce McGowan, "Âyanlar Çağı, 1699-1812", *Osmanlı İmparatorluğunun Ekonomik ve Sosyal Tarihi*, ed. Halil İnalcık and Donald Quataert, Vol. II, Eren Yayıncılık, İstanbul 2006, p. 769.

[61] Mikhail, "Plague", p. 113.

[62] The reason why this amount is an average amount is that the tax record for this year could not be found in the Ijmal records. This record was taken from the imperial order, and a clear amount was not specified. The average amount is 5699 Egyptian purses. See. BOA.C.DRB.7.333.2.

[63] BOA.HAT.212-11499; C.DH.35-1722-1.

[64] BOA.HAT, 1411-57363.

[65] BOA.C.DH.145-7243-1.

[66] al-Jabarti, *History of Egypt*, p.322.

due to the devastation[67]. Istanbul appears to have accepted this plea, as an imperial decree instructed the Egyptian governor to collaborate with Mamluk amirs and Cairo's notables to facilitate Egypt's recovery[68].

The conditions of 1792 mirrored those of the previous year, with another drought and a Nile flood of only 20 cubits, insufficient for agricultural production. The soil, already degraded from the previous year, further suffered from aridity. Al-Jabarti noted that the drought led to an increase in the rat population, further exacerbating agricultural losses[69]. The scarcity of animal fodder drove up the price of yellow straw from 5 to 100 paras per donkey load, equivalent to 1 French riyal. Consequently, villages were abandoned as peasants migrated to urban centers in search of sustenance, leading to famine-related deaths. Food prices surged, with wheat reaching 10 French riyals per irdeb, barley 15 riyals, and broad beans 13 riyals. To mitigate the crisis, Istanbul dispatched wheat to Egypt, stabilizing grain prices at 14 French riyals[70].

In contrast, 1793 proved to be a prosperous year. Despite an insufficient Nile overflow, the lack of cultivation in preceding years had enhanced soil fertility. Al-Jabarti recorded an exceptional agricultural yield, with one feddan of land producing five times its usual output[71].Despite these improvements, the Porte was unable to access the irsaliyyah treasury. Consequently, the Egyptian governor was instructed to remit the revenues for 1794 and 1795 in 1796,[72]. But the treasure could not be sent. Porte[73] only got the revenues of Egypt on March 6 in 1798[74]. Yet the funds were not sent. The Ottoman administration only received Egypt's revenues on March 6, 1798. According to Ijmal records, the Egyptian governor collected 56,751,630 paras in taxes for the irsaliyyah revenue, of which 23,836,024 paras were allocated to Egypt and the holy cities of Mecca and Medina, leaving 32,915,606 paras for Istanbul[75].

The final receipt of Egyptian revenues by Istanbul occurred in 1798, marking the end of the traditional Ottoman administrative and financial system in the region. The French occupation of Egypt signaled a definitive rupture. Throughout the late eighteenth century, environmental stressors, including drought, inadequate Nile flooding, and repeated plagues, played a pivotal role in the gradual erosion of Ottoman control over Egypt.

Conclusion

This study elucidates how the financial stability of Egypt withstood environmental challenges during the final quarter of the eighteenth century. The analysis involved a simultaneous examination of financial records from the period, climate data, and local chronicles to discern Egypt's responses to stressors such as drought, disease, and rebellion. The findings indicate that a significant climate crisis unfolded in Egypt during this time, resulting in disease outbreaks and livestock losses. While contending with rebellions by Mamluk beys amid conflicts with Russia, the Ottoman state, over 25 years, sporadically obtained the Egyptian *irsaliyyah* revenue only six times, reflecting intermittent economic fluctuations.

The primary factors influencing agricultural production namely, climate conditions and the Nile River failed to provide the requisite conditions for grain production. Concurrently, the Ottoman state faced

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[67] 'Nil-i Mubarek hakkın ifa etmiştir mukata-i emvalinden habbe-i zahire tahsil ve ahzının imkanı yokdur vüzerayı mueyyin iradat ve irsaliye hazinesi ve sair mürettebat devlet-i aliyyeye bir akce viremeyecegimiz zahire ihracından başka mir'ul hacc-ı mısrın ba defteri mufredat şu kadar bin kise mesarifatu varur ana dahi bir habbe virilmez...' See. BOA.HAT.117.

[68] BOA.C.DH.42.2083.1.

[69] al-Jabarti, *History of Egypt*, 374.

[70] Ibid.,397.

[71] Ibid.,415.

[72] BOA.C.ML. 224-9344.

[73] Ottoman Sultan Selim the third state in his handwriting on the Ijmal record which arrived with the treasury on March 6 in 1798, 'Mucebince iş bu hulasa defteri bas muhasebeye kayd ve evrak-ı saire ile hıfz olunub divan-ı humayun tarafından tahrir olunacak emr-i serif... olunmak icin bir suret-i kayd.' See. BOA. C.ML.629-25867

[74] This date coincided almost immediately before the French invasion of Egypt.

[75] BOA.C.ML. 629-25867.

challenges in implementing structural reforms in Egypt, owing to prevailing political, economic, and military crises. Despite attempts by Egyptian finance to recover, these efforts were impeded by recurring environmental stressors. Drought, identified as a significant stress factor, emerged as the most influential element affecting production and consumption in Egypt. The occurrence of famine, exacerbated by drought, compromised the immune systems of both humans and animals, rendering them susceptible to pathogens such as the plague. This cascade of events led to internal turmoil and rebellions, hampering agricultural production and tax collection efforts.

This study represents an innovative methodological approach by integrating paleoclimatological data with archival sources and contemporary chronicles in the analysis of Ottoman Egypt. While previous research has drawn comparisons between climatic conditions and historical events, this study advances the field by systematically incorporating climate data as a crucial determinant of financial stability within an agrarian-based economy. Unlike earlier works that primarily focused on political and economic factors in historical analyses, this research highlights the direct influence of environmental conditions on fiscal structures, tax revenues, and administrative stability.

The novelty of this approach lies in its ability to demonstrate that financial resources cannot be optimally harnessed without due consideration of climate dynamics, given that the Ottoman Empire's revenue system was predominantly dependent on agricultural taxation. The findings underscore the necessity of treating financial and climatic variables as interdependent rather than separate domains. By conceptualizing the Ottoman fiscal structure as a multivariate function where climate, economy, and governance interact on the same analytical plane this study offers a new framework for understanding economic resilience in pre-modern states. This interdisciplinary perspective contributes to the broader historiographical discourse by emphasizing the role of environmental factors in shaping economic and political trajectories, thus fostering a more comprehensive understanding of historical financial crises.

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