

SEEDS OF POWER

explorations in
Ottoman environmental history

edited by

Onur İnal and Yavuz Köse



Sample excerpt from

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Introduction

THE OTTOMAN ENVIRONMENTS REVISITED

Onur İnal and Yavuz Köse

The Ottoman Empire was one of the greatest world empires in the early modern period. Established by the Ottoman Turks, a small band of warriors, as a tiny principality in North-western Anatolia at the turn of the fourteenth century, it brought large areas under its control within less than three centuries. The rapidly expanding Ottoman Empire, on one hand, asserted control over diverse ethnicities, religions and cultures; on the other, it tried to understand and engage with nature in different forms and sought various ways of coping with disturbances and natural and man-induced disasters such as earthquakes, floods, fires, droughts, famines, food shortages, locust attacks, epidemics and epizootics. Effective strategies and techniques were developed for the *Ottomanization* not only of peoples and cultures, but also of topographically, geographically and ecologically diverse territories. The Ottomans, as they crossed rivers, mountains, deserts and seas, mutually interacted with the peoples, animals, plants and pathogens of the lands they encountered. They endeavoured to understand and harness, or to use David Blackbourn's definition, 'conquer', nature through technology and culture for their own ends.¹ In this respect, the Ottomans are remarkable not just for their political and military success but also for their desire and ability to understand, adapt, modify and manage different environments.

At its height in the second half of the seventeenth century, the Ottoman Empire stretched from the gates of Vienna in the west to the Caucasus Mountains in the east and from the tip of Arabian Peninsula in the south to the Ukrainian steppes in the north, covering an area of 3.81 million square kilometres.² This vast world empire encompassed an enormous diversity of natural environments, from the snow-covered mountains of Eastern Anatolia

1. Blackbourn 2006.

2. McCarthy 2014, p. 199.

and sweltering deserts of Libya to the primeval forests of Montenegro and fertile river deltas of Mesopotamia. The vegetation in Ottoman lands varied greatly from region to region, depending on the topography, climate and soil type. The Rhodopes and the Pirin Mountains in the Balkans and the Pontic Mountains in Northern Anatolia contained the best preserved forests in the region, providing timber for the imperial shipyards but also a variety of forest products such as firewood, charcoal, wax, honey, resin, game meat, animal skins and edible and medicinal plants.³ Bushy *maquis* was found everywhere close to the Mediterranean coast and consisted of evergreen, drought-resistant woody plants and shrubs. Prairies and steppes, on the other hand, dominated the majority of Anatolia, the Middle East and North Africa.

The Ottoman Empire was an agrarian empire, in which the majority of population lived in the countryside and had constant contact with the soil.⁴ In its exceptionally diverse and environmentally heterogeneous habitat, one could find a variety of agricultural crops. Cereals such as wheat, barley, rye and oat were cultivated in every corner of the empire because bread was a major staple of the Ottoman diet. In addition, aquatic crops such as rice and sugar cane; pulses such as pea, chickpea, lentil, bean and horse bean; vegetables; fruits; seeds; herbs and spices were widely available across the empire. Crop species in Ottoman lands became more diversified with the arrival of new plants from the Columbian Exchange, such as corn, tobacco, tomatoes, potatoes, peppers, beans, sunflowers and pumpkins.⁵

The Ottoman Empire had a wide variety of feral and domesticated animals. Millions of sheep, goat and cattle roamed over the vast prairies in the Balkans, Anatolia, Egypt and Syria and were the main source of livelihoods for both urban and rural people. They provided raw material for weavers and tanners, fertilised the soil through dung, and filled stomachs with meat, milk and other dairy products. Moreover, in the absence of paved roads and wheeled traffic, beasts of burden such as buffaloes, oxen, horses, donkeys, mules and camels were important means to convey merchandise, conduct pilgrimages, conquer or explore new lands. Donkeys and mules were mostly used for the transportation of goods, while horses rarely served as pack animals. Camels,

3. On forests, see Dursun 2007; on timber, see Mikhail 2013a.

4. İnalçık and Quataert 1994.

5. Stoitianovich and Haupt 1962; Andrews 1993; Artan 2000, p. 112; Trépanier 2014; Bilgin 2016.

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however, were preferred haul animal, simply because they could go long distances with little water and food and greater loads than other haul animals.⁶

The Ottoman Empire was surrounded by the world's richest bodies of water – the Black Sea, the Marmara Sea and the Mediterranean, but also major rivers such as the Tigris and Euphrates in the Fertile Crescent, the Nile in Egypt and the Danube in the Balkans – which included a variety of fish and seafood including mussels, oysters and shrimps.⁷ The Ottoman rivers and lakes were sources of energy, too: they provided transportation, powered mills and watered farmlands. In short, the Ottoman Empire was more than a human-made assemblage; it was a living organism comprising humans, animals, plants, landforms, gems and germs. Both humans and non-humans (or 'more-than-humans') formed and transformed this living organism for more than six centuries. Thus, analysing its history requires an examination not only of Ottoman human society but also of the complex interactions between humans and their natural environment.

The prevalent historiography attributes Ottoman success primarily to the empire's military strength and centralised bureaucracy, with power emanating from the sultan and his household. Looking from an environmental historical viewpoint, however, it can be suggested that the Ottoman Empire's ability to control, manipulate and mobilise its financial, natural and human resources was a key to its sustenance and longevity. In other words, Ottoman power was predicated on interconnections among economy, society and nature as much as on military and political force. From the slowly turning wheels of watermills in Syria to the planters of citrus trees in Palestine and from the *fellahs* picking cotton along the Nile Valley to nomads milking goats and sheep in the Taurus Mountains in Anatolia, each and every human and non-human actor represented the seeds of Ottoman power, the power that allowed the Ottoman Empire to maintain control over large territories for a long period of time.

Ottoman Environmental History: A New Sub-Discipline with Deep Roots

Ottoman environmental history is a relatively new sub-discipline with deep roots. Even though the Ottoman Empire has only recently appeared on the radar of historians taking an environmental historical vantage point, its great

6. For camels as haul animals in the Ottoman Empire, see Faroqhi 1982; Tuchscherer 2010, Mikhail 2014, p. 64.

7. For the first – and hitherto most comprehensive – study of fish and fisheries in Istanbul and the Ottoman Empire, see Devciyan 2006.

geographic, climatic and ecological diversity has long inspired researchers from different disciplines and sub-disciplines.⁸ Over the past decades, researchers have engaged with various aspects of Ottoman environments and dealt with themes and issues pertaining to the Ottoman peasantry, agricultural production and the productivity of the land, tenurial relationships, urban-rural interactions, epidemics, natural disasters and the effects of government policies with environmental consequences.⁹ Valuable information about environmental conditions and the enormously complex relationships among the empire's residents, animals, plants, pathogens, geographies, cultures and ideas can be found in the existing literature on Ottoman environments. However, the overwhelming majority of these studies have employed the lenses of, for example, military, political, economic, social, fiscal or agricultural history, but not environmental history.

Environmental history as a perspective, or a way of thinking about human-environment relations in the past, is a relatively new phenomenon in Ottoman studies. The environmental 'turn' touched Ottoman historians a very short time ago. Young researchers in Europe and North America have carried out excellent pioneering research about the Ottoman Empire. Alan Mikhail, perhaps the most prolific Ottoman environmental historian, has mainly written about early modern Egypt.¹⁰ Sam White has researched the impact of the so-called 'Little Ice Age' on Ottoman lands, as well as pandemics and panzootics in early modern Ottoman Empire.¹¹ Except for some peripheral studies, natural disasters in the Ottoman Empire and responses to them at state, communal, and individual levels long remained under-researched. This lacuna has recently been filled by Yaron Ayalon.¹²

The last few years have seen an unprecedented level of interest in interdisciplinary and cross-disciplinary studies. As a result, environmental historical

8. For an extended discussion of the field, see İnal 2010.

9. For some economic, social, fiscal and agricultural historical studies that refer to Ottoman environments, see Hütteroth 2006; McGowan 1981; McNeill 1992; Güran 1988; Toksöz 2010; Quataert 1980; idem 1981; Faroqhi 2010; İslamoğlu-İnan 1994.

10. Mikhail 2011; idem 2014; idem 2017. See also his edited volume on the environmental histories of the Middle East and North Africa, idem 2013b.

11. White 2010; idem 2011; idem 2017. Historians of disease, medicine and public health have more or less used the methodological framework of environmental history. Birsan Bulmuş has explored the long geopolitical history of plague and the interplay between disease, national sovereignty and quarantine (see Bulmuş 2012). Nükhet Varlık has dealt with correlations between epidemics, population changes and the natural environment in the Ottoman Empire (see Varlık 2013; idem 2015).

12. Ayalon 2014; idem 2011.

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studies that speak to histories of science, technology, transportation, migration, consumption, tourism, public health and agriculture have appeared. For example, Michael Christopher Low has analysed the interconnections between Ottoman modernisation, technology and public health in the Hijaz in the late nineteenth and early twentieth centuries.¹³ Camille Cole and Faisal Husain have researched imperial projects on the Tigris and Euphrates rivers in Ottoman Iraq from an enviro-technical point of view.¹⁴ Chris Gratien has investigated the relationship between migration, settlement, disease and environment in Southern Anatolian littoral.¹⁵ Alexandar Shopov has explored urban agriculture in the early modern Ottoman Empire, with a special focus on Istanbul.¹⁶

This edited volume is the first collective effort to take an original look at the Ottoman Empire through the lens of environmental history. It builds on, and aims to go beyond, previous efforts and casts light on applying environmental perspectives to historical processes and events in the long history of the Ottoman Empire that are somehow associated with ‘nature’ or ‘the environment’. It is obvious that getting an environmental history of such a remarkably diverse ecological realm between the covers of a single book is not an easy task. This book, therefore, does not aim or purport to integrate everything about Ottoman environmental history. It simply aspires to illustrate major questions and interpretative insights that have become central to the field. Thus, it is no more than a modest attempt to raise questions and seek new answers to old questions about the ways Ottomans interacted with their natural environment through time.

The Ottoman ‘Eco-System’: A Jigsaw Puzzle

The Ottoman Empire needed a well-structured administration to utilise and manage its human and non-human resources in a sustainable manner. As the Ottoman Empire took control over diverse places, peoples and ecologies, the imperial administration was increasingly involved in and developed strategies for the provisioning of cities, armies and navies, drawing supplies from ever more distant sources and at times at greater costs. White has termed the Ottoman logistical project of food and good procurement a sort of ‘imperial ecology’, ‘which operated on a far larger scale than anything else in Europe at the time,

13. Low 2015.

14. Cole 2016; Husain 2014; idem 2016.

15. Gratien 2017.

16. Shopov (forthcoming).

and encompassed a wide range of goods from wheat to salt and saltpeter'.¹⁷ Mikhail, highlighting 'sets of relationships among resources, peoples, ideas, animals, and places in which all the elements of the system are connected to and depended upon one another', has recently described the Ottoman Empire as an 'eco-system'.¹⁸ The idea of the Ottoman Empire as an ecosystem' he wrote, 'foregrounds how the smallest and largest of imperial actors were connected through means of trade, administration, and mutual reliance'.¹⁹ Indeed, viewing the Ottoman Empire as an ecosystem, a series of ecological relationships, helps us to see how the Ottoman state and society interacted with other living organisms and non-living components of the environment. Stressing the interconnections between state, residents, animals, plants and natural resources, this book's chapters adopt a similar perspective and treat the Ottoman Empire as an 'ecological system'. The chapters that follow further explore ideas, actors, but also internal and external factors that formed, transformed and had an impact on the Ottoman terrestrial and marine ecological system, which was one of the richest in Eurasia and comprised a large number of crop species, non-crop plants, weeds, mammals, reptiles, invertebrates, insects, fungi, bacteria and parasites, but also non-living substances such as air, water, energy and soil minerals.

The book is organised into four parts, grouping chapters around four major topics: 1) Climate and Landscapes; 2) Resources and Energies; 3) Technologies and Infrastructures; and 4) Ideas and Actors. Chapters in each of these parts use different perspectives to make *explorations* in the environmental history of the Ottoman Empire. The chapters in the first part, 'Climate and Landscapes', deal with the interplay between climate change and transformations in Ottoman landscapes during the early modern period. In the opening chapter, Elias Kolovos and Phokion Kotzageorgis examine the impact of the 'Little Ice Age' climate fluctuations on Ottoman Greek lands. The Little Ice Age, which had an overwhelming impact on living creatures of every kind, manifested itself in the Ottoman Empire as freezing winters and wet summers and caused heavy snow and rainfall and inundations. The failure of crops during the Little Ice Age contributed to the political, economic and social crises in Anatolia in the sixteenth and seventeenth centuries. Ottoman historians have recently explored

17. White 2017, p. 93.

18. Mikhail 2017, p. 199. The term ecosystem was first used in 1935 by Arthur G. Tansley, an ecologist, to define 'the whole system (in the sense of physics) including not only the organism-complex, but also the whole complex of physical factors forming what we call the environment of the biome – the habitat factors in the widest sense'. (Tansley 1935)

19. Mikhail 2013b, p. 9.

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from a historical-climatological point of view the interrelations among harsh climatic conditions, unpredictable weather, unravelling imperial provisioning and settlement system, and the *Celali* revolts which broke out in the 1590s. Existing studies suggest that the Little Ice Age and its environmental stress played a major role in the breakdown of Ottoman provisioning systems and the outbreak of the *Celali* revolts and subsequent political crises. Kolovos and Kotzageorgis challenge such sweeping generalisations with regard to the impact of Little Ice Age on the Ottoman Empire and draw attention to the importance of regional case studies that use local archives and microclimatic data. In their in-depth case study on Salonica and Crete, they demonstrate that the Little Ice Age was not as devastating as in the Anatolian plateau, simply because the geography, geomorphology, microclimate, demography and vegetation in these places were very different.

Early modern climatic fluctuations and their impact on Ottoman lands also form the subject of Mehmet Kuru's paper on Anatolia during the reign of Süleyman I (r. 1520–1566). Examining the long-term aridity index and climatic conditions, Kuru explains how the shifts in climatic conditions, fiscal population and agricultural production were interconnected at the height of the Ottoman Empire in the sixteenth century. 'Magnificent', the sobriquet given to Süleyman I by his contemporaries in Europe, metaphorically stands for the favourable climatic conditions in the period he investigates. Kuru claims, unlike in the late sixteenth and early seventeenth centuries, when extreme weather conditions characterised by freezing winters and wet summers were prevalent, the empire experienced a relatively long and exceptionally stable climatic interval era favouring population increase and agricultural expansion in Anatolia. In this extended period of 'magnificent' climate, the Ottoman state could rapidly compensate for the hardships of internal disturbances thanks to an increased abundance of agricultural products. Conversely, the *Celali* revolts at the turn of the seventeenth century were from place to place inescapable and dramatically uncontrollable. Climatic variability, and especially the irregularity of precipitation, made the situation worse.

In the last quarter of the eighteenth century, the Italian archaeologist and numismatist Domenico Sestini visited Istanbul and left an invaluable record of the vineyards on the shores of the Bosphorus. Sestini's work is treasure trove for an environmental historian wishing to venture into socio-ecological aspects of viticulture in Ottoman Istanbul because he did not solely document the vineyards in and around the city, but also provided glimpses of the geomorphology, climate and ecology of the Bosphorus with regard to grape growing

and winemaking. In her article, Suraiya Faroqhi, through a close reading of Sestini's account, unearths interesting information with regard to viniculture and viticulture that Ottoman sources do not tell, such as differing opinions on and practices of grape cultivation, individuals involved in planting and harvesting, wine making and wine consumption, as well as wages and profits. Faroqhi concludes that the vineyards on the Bosphorus 'have disappeared without a trace': presumably there existed a number of prosperous non-Muslim consumers in Istanbul who stopped drinking the mediocre wine produced in the environs of the city and opted for 'better wines from western Anatolia or even southern Thrace'.

As grapes retreated from the shores of the Bosphorus, they expanded on the rich alluvial plains of Western Anatolia a couple of decades later and changed the course of the region's history. 'Resources and energies', the second part of the book, opens with a chapter that explores how we might consider figs and grapes as historical actors in nineteenth century Western Anatolia. Actually, the grape had been cultivated in the region for millennia, but it was in the second half of the nineteenth century that it became a major commercial crop. In this period, the grape in the form of the dried raisin, together with its companion, the fig, was the principal export item of the region, attracting foreign capital investment and technology, promoting trade, creating employment in the urban and rural, and bringing the countryside and city together. Every autumn, raisin and fig-laden camels arrived in the warehouses of Izmir. There, they were cleaned, sorted and packed, before being shipped to Western European and North American markets. Onur İnal argues that figs and raisins had a profound impact on economic and social life in Western Anatolia and transformed the region's human and natural landscape irreversibly. 'The story of fig and grape', he suggests, 'reveals a great deal about social and economic life in a major Ottoman port-city in the nineteenth century, but also illustrates the ways in which city and country interacted'.

In Ottoman realms, animals were almost everywhere, and they are central to understanding the Ottoman society. Up to the end of the Ottoman Empire, together with human beings, they constituted the principal sources of energy. In the second half of the nineteenth century, while camels plied between Izmir and its hinterlands, carrying sacks of dried figs and raisins, buffaloes transported timber from the deep forests in the Kocaeli district (*sancak*) in North-western Anatolia to the nearest docks for shipment to Istanbul. In his article, Semih Çelik focuses on the effect of the increasing demand of timber upon *kereste-keşan* (woodcutter) villagers and their animals, to show 'how the relationship

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between animals, human beings and nature was altered in relation to the development of politics of natural resource and labour'. Çelik notes that social and economic life of the villages in the Kocaeli district revolved around felling and transporting the wood to the shores of the Sea of Marmara. 'The need to breed cattle (buffaloes particularly) for dragging and transporting wood and timber', he suggests, 'tied the lives of animals, rivers, trees and human beings tightly'. In the chapter, he concludes that, because 'the fate of the animal and human beings were interwoven', any change to the human-animal relationship could be detrimental to the lives of both humans and animals.

In her chapter, Styliani N. Lepida enters a territory that has long awaited exploration by the environmental historians of the Ottoman Empire. She addresses the management of water in Cyprus, the third largest Mediterranean island after Sicily and Sardinia, during the seventeenth century. The island experienced a stable, favourable climate with enough precipitation during the Venetian period in the sixteenth century. However, shortly after it came under Ottoman rule in 1571, things changed for the worse and the island suffered from the effects of drought. Cyprus was surrounded by bodies of seawater, yet had limited sources of fresh water. The Ottoman administration sought ways to manage available water by building, preserving and improving water infrastructure such as watermills, wells and reservoirs. Through the study of travellers' accounts, Ottoman court documents and legal transactions, Lepida illustrates how the issue of water management was intertwined with other political, social and economic issues and involved 'almost all layers of the Cypriot social pyramid, bringing together various members of Ottoman society'. In this respect, her study covers much more than what its title implies.

Water, when examined through the lens of environmental history, has the capacity to bring the histories of, among other factors, labour, consumption, health and technology together. This is evident in two chapters in the third part of the book, 'Technologies and Infrastructures'. K. Mehmet Kentel's study focuses on the debates about and development of the Terkos waterworks, designed to supply the 'cosmopolitan' Pera (*BeYOğlu*) district of Istanbul with water. Kentel details the concerted effort of the Pera community, experts and urban administrators to bring potable water from Lake Terkos in the northern periphery of the city in the late nineteenth century. At the beginning of his study he points out the potential of water 'to provide a critical lens to explore the ways in which modern urban spaces have been shaped with the interaction of a wide variety of human and nonhuman actors, located not only at the heart of the urban centres but rather dispersed along a set of "uneven geographies"'.

Indeed, as he traces the ninety-kilometre-long pipes between Lake Terkos and the city centre, he reveals that they not only transported the Terkos water, but also ideas about the natural environment, thereby bringing the city to the periphery and vice versa. The construction of the Terkos waterworks helped the city to establish a new relation to nature. '[W]ith the start of the construction of the Terkos waterworks', Kentel notes, 'the material relations, expert knowledge, will to modernisation and ideology of progress, which was shaping Pera's urban space, had poured into the rural periphery'. In this respect, it brought about 'a set of messy and unequal relations between the various human and nonhuman actors involved, from Terkos to Pera'.

Egypt was the biggest and one of the most important Ottoman provinces. It was a source of revenue for the sultan and a major supplier of grain, cotton, sugar and other foodstuffs to the Ottoman Empire. Moreover, its geostrategic location between the Indian Ocean and the Mediterranean was of utmost importance to the Ottomans. Ottoman environmental historians have so far dealt with the Nile Valley and Delta as they were the most vital areas for Egypt.²⁰ In his paper, Mohamed Gamal-Eldin focuses on the intertwined issues of urban planning, population growth, engineering, sanitation and diseases in Ismailia and Port Said, the cities that came into existence with the opening of the Suez Canal in 1869. Gamal-Eldin describes the two cities as 'spaces on the margin' because their histories were overshadowed by large and prominent cities located on the Nile River and Delta such as Cairo and Alexandria. The decision to build two new towns on the Suez Canal and change the natural environment, however, was not without its discomforts and unwanted results. The increase in water in the already swampy environments of Ismailia and Port Said created stagnant pools, providing the perfect home for the larvae of malaria-carrying *Anopheles* mosquitoes to reproduce. In his chapter, Gamal-Eldin argues that decisions of urban development, canalisation projects and colonialism triggered the malarial outbreak in Ismailia and Port Said. Through the use of travelogues, reports, medical journals and visual archival data, he sketches the policies, practices and technologies developed to cope with the malaria situation in both cities in the late nineteenth and early twentieth centuries.

The fourth and last part of the book contains studies of persons, institutions, ideas, thoughts and regulations that shaped environmental thought and environmental decision-making in the Ottoman Empire and early Republican Turkey. In his chapter, Chris Gratien traces the political ecology of rice, exploring 'how rice prompted reflection on the differentiation and organisa-

20. See Mikhail 2011; Mitchell 2002.

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tion of imperial, provincial and agricultural space as well as on the Ottoman government's responsibilities towards its citizens' in the late Ottoman Empire. Gratién shows how rice, an important staple of the Ottoman diet, occupied the political agenda probably more than any other agricultural product in 1910. In late winter that year, *Meclis-i Mebusan*, the lower house of the Ottoman parliament held heated debates over whether rice cultivation contributed to the spread of malaria or not. Whereas the critics of rice viewed rice paddies as a threat to public health, defenders of rice saw economic benefit in cultivating rice. The rice debates culminated in the creation of the Rice Cultivation Law (*Pirinç Ziraatı Kanunnamesi*). The law spelled out how rice should be cultivated so as not to aggravate malaria. Furthermore, it set the legal foundations of combatting malaria in early Republican Turkey.

Yavuz Köse in his article explores the traces Alexander von Humboldt (1769–1859) – the 'proto environmentalist' – left in the late Ottoman Empire and early Republican period. Even though Humboldt in his lifetime was already a legend and a much acclaimed scientist-traveller, and in 1869 almost the whole world was celebrating his centennial, there are surprisingly few Ottoman sources that mention him. It was only in 1932 that a certain Mustafa Niyazi [Erenbilge] published a short biography of Humboldt. Mustafa Niyazi (1887/88–1947), a soldier and geography teacher, was also the author of probably the first geography publication on Anatolia (published around 1922). Köse, after presenting the Ottoman and early Republican sources which allude to Humboldt, examines and discusses the Humboldt biography in close connection with Mustafa Niyazi's work on Anatolia. He suggests that, 'it is not Humboldt the cosmopolitan environmentalist but Humboldt the scientific traveller and discoverer who serves as a good role model and argues for the importance of geography in school education'. The incentive was to encourage Turkish youth to get know and love their new homeland.

The final chapter, by Selçuk Dursun, sheds light on the hitherto under-researched topic of forest commons, a special type of forests in the Ottoman Empire that encompassed both the *cibal-i mubaha* (unenclosed forests on the mountains) and the *baltaliks* (village coppices), and the chapter explains how forest commons intersect with environmental, legal and social issues. Because forest commons were not within the boundaries of the property regime until the last period of the Ottoman Empire, rural residents benefited from them in various ways. However, 'the privatisation of the use of forests', as Dursun argues, 'eventually entailed an absolute loss of poor peasants' right to use forests and woodlands'. In other words, state-led privatisation and commercialisation

deprived villagers of a substantial means of livelihood and cut their ties with nature.

The environmental history of the Ottoman Empire resembles a jigsaw puzzle of thousands of pieces, comprising seas, lakes, rivers, mountains, forests, steppes, deserts, towns, villages, people and animals. Some pieces are there, but many are still missing; some are fairly clear, but some have to be reconstructed. It is, therefore, the task of Ottoman environmental historians to attempt to piece together the various parts of the picture. The contributors to this book have done their bit. Every chapter tells a story and adds another piece to the puzzle of the environmental history of the Ottoman Empire. The puzzle will acquire greater coherence and meaning when more pieces are fitted together.

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