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Author

Burke, Edmund

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Abstract

This essay argues that the Middle Eastern environment, with its legacy of squandered water resources, deforestation and pollution of all kinds, reveals a distilled essence of the coming environmental crisis of the planet. This is so because of the evident vulnerability of Middle Eastern semi-arid and arid landscapes. The essay examines the transformation of the regional environment over the period 1750-2000 CE. It considers modern human impacts in three broad ecological zones: the Middle East of the river valleys (where we survey the role of engineers in major water management projects), the Mediterranean zone of dry farming (where we examine the imposition of the California model of irrigation in Morocco), and the pastoral rangelands (where we evaluate the impact of scientific range management in the Maghreb). In the course of this survey, we come to understand that modernity was an outgrowth of a deeply rooted Eurasian development project. Ottoman reformers did not need the authorization of the West to adopt the fruits of this dimension of the developmentalist project, since they already internalized it from the start. Colonial policies toward the environment differed little from those adopted by indigenous modernizing elites. We conclude that from an environmental perspective, the history of the Middle East reveals an underlying continuity between the pre-colonial, colonial, and post-colonial periods, despite the undoubted massive environmental transformations introduced since 1800.

The Coming Environmental Crisis in the Middle East:

A Historical Perspective, 1750-2000 CE

By Edmund Burke, III

The coming environmental crisis of the Middle Eastern region, and indeed of the entire planet, has been well publicized. Unprecedented landscape degradation, depleted and ruined aquifers, deforestation and pollution have substantially affected the environment for the worse. It is not my purpose to provide an inventory of the coming environmental crisis. Rather, in this essay I will situate these changes in the context both of the deep history of human manipulations of the Middle Eastern environment as well as the present looming crisis. To what extent are the environmental problems that the region faces today the result of new forces, and to what extent can they be seen as the continuation of very long term historical trends? How can the kind of deep environmental historical perspective I am advocating here help us to rethink the place of modernity in human history as a whole? These are big questions, to be sure. But as we will see, the answers lead us in unsuspected directions. Let us begin by sketching the environmental legacy of the period 1500-1800.

A Global Environmental Perspective on the Middle East, 1500-1800

To begin with, if we put the environment at the center of the frame, we can distinguish three different Middle Easts: the Middle East of the river valleys (where most of the people still live, and where ancient empires flourished), the Mediterranean Middle East of dry-farming and commerce (with lower population densities), and the Middle East of the desert steppes and oases (with still fewer people, but politically and militarily powerful). While the three Middle Easts were each limited in important ways, together they made a potent combination. Under the conditions of the agrarian age, despite the fact that the Middle East was poorly endowed in wood (biomass) energy resources and demographically weak, its other natural endowments and strategic position astride world trade routes were sufficient to make it a power in the Afroeurasian zone for several millennia.

If one wishes to understand the history of the Middle Eastern environment since 1500, it is first necessary to see it in the larger context of the world as a whole, for global level determinants more than local ones drive this history. Around 1450, for a series of reasons not fully understood by historians, the world as a whole underwent a series of important changes. Although they primarily impacted East Asia, they can be observed in the Middle Eastern region as well. All across the hemisphere, human populations began to grow at a faster rate, trade and commerce increased, and networks of trade and communication expanded and deepened in unprecedented ways. While the changes were hemisphere-wide, they were particularly important in China, where the Ming dynasty (1367-1644) had just replaced the Mongol Yuan (1280-1367). The dynamic Chinese economy, propelled by its agricultural sector and growing population, became

increasingly marketized under the Ming, and China switched from paper money to a silver-based monetary system. In the absence of significant deposits of silver in its national territory, China entered the intra-Asian trade as one way to acquire silver in the vast quantities needed.¹ Chinese porcelains, silks and other manufactured products developed ready markets throughout maritime Asia, and as far away as the Ottoman empire (as evidenced by the vast collection of Ming porcelains in the Topkapi Palace) and Mediterranean Europe.

At this point, the fortuitous discovery of the Americas and the equally unexpected discovery of vast deposits of American silver by the Spanish conquistadores made it possible to link all of the continents economically for the first time. The result was the birth of the world economy. The discovery of the Americas transformed the strategic position of the Middle East in Afroeurasia in three major ways. First, starting from a central role in the exchange of goods, ideas, and people within the hemisphere, the Middle East became increasingly marginal to the new global communications network. Second, after the voyages of discovery, Europeans acquired direct access to West African gold as well as to American silver, marginalizing the trans-Saharan routes that had previously been an important source of monetary metals for Europe. Previously, Europeans had lacked both monetary metals and trade goods of interest to Asian consumers, which seriously limited their participation in the China-centered commercial boom of the early modern period. To purchase Asian silks, porcelains, spices and cottons, they had been obliged to pay in gold and silver, which they lacked. The availability of American silver expanded their ability to participate in these markets. Third, in a period of sharpened competition between Europeans, especially the Hapsburgs, and the Ottomans, the discovery of the Americas and the unintended demographic catastrophe of the Great Dying, which greatly depleted the populations there, provided Europeans with untrammelled access to American resources, including mining resources, timber, and vast agricultural lands. Together with the onset of the slave trade, these circumstances helped stimulate the sugar revolution of the seventeenth and eighteenth centuries that created the Atlantic world as a new center of world trade. In a nutshell, the Middle East was the regional major loser within Eurasia in the rise of the world economy to 1800.

However, this was not initially apparent. Militarily the Europeans did not decisively gain the upper hand over the Ottomans and other Asian land powers until the end of the eighteenth century. The European empire in maritime Asia until then, in contrast was mostly based in enclaves and islands. Ottoman armies were able to lay siege to Vienna twice in the period from 1500 and 1700, even as Ottoman navies gradually lost their edge. In the commercial revolution that began in the sixteenth century, Ottoman high-end goods, like carpets, porcelains, and Damascus steel were still competitive in the world market. By 1800, things had changed dramatically. Ottoman manufactured goods no longer commanded ready markets, though demand for commodities such as coffee and tobacco for a time picked up where the lucrative spice trade had left off. Middle Eastern manufactured products suffered greatly increased competition. The Middle East no longer controlled access to Asian commodities like spices, coffee, tea, and cotton. Instead

¹ Robert Marks, *Origins of the Modern World Economy* (New York: M.E. Sharpe, 2001).

the initiative passed increasingly to the Europeans, who controlled the oceanic routes to maritime Asia, as well as to the Americas.

None of these factors, though important, were as critical to the fate of the Middle East as the fossil fuel revolution. In a world historical perspective, the onset of the fossil fuel revolution brought to an end Braudel's biological old regime and the limits to growth that characterized it. Because Europe was well endowed with coal deposits fortuitously located near rivers and streams, it was able to transcend its dependence upon wood (biomass) energy. Relatively poorly endowed in forest resources, the Middle Eastern region also lacked coal, which keyed the first phase of the fossil fuel revolution. Previously, the region had depended upon its strategic position in the circuits of exchange to maintain its position vis-à-vis its neighbors, particular as its agricultural production stalled. If we wish to understand the modern Middle East, the fact that it missed the first phase of the fossil fuel revolution needs more emphasis than it usually receives. Only in the twentieth century, after the fossil fuel revolution moved on to its second phase and coal had been supplanted by petroleum and natural gas, did the Middle East once again become an energy player. But by this time Europeans controlled the region, so that Middle Easterners were unable to use "their" oil as they pleased. Instead, it belonged to multi-national corporations backed up by Western military might.

This brief sketch of the world historical context sets the stage for a brief appraisal of the rise of the Ottomans (1280-1922) and Safavids (1501-1722) from the point of view of the environment. The emergence of these two Middle Eastern "gunpowder empires" marked a renewed commitment to the agrarian bureaucratic state and thus renewed investment in agriculture. Under Shah Abbas (1588-1629) Persia sought to revive the agricultural potential of Iraq through the reconstruction of irrigation canals and associated infrastructure. Isfahan was endowed with gardens and vast royal irrigation tanks, and made a center of carpet production, while its hinterlands received significant investment in an effort to revive agricultural production.² Ottoman military/political policies are better known, even if their environmental consequences have been but little explored. Certainly Ottoman strategic ambitions were on a par with other major Asian land empires of the period. In the early sixteenth century, Ottoman engineers began work on two major canal projects that sought to link the Volga and Don rivers, and the Nile and Mediterranean.³ Neither in the end was completed, although work was advanced on both before they were abandoned. Ottoman needs for raw materials for the manufacture of swords, cannon, and hand-held gunpowder weapons must have stimulated the mining industry of Anatolia and the Balkans. We have no information on the environmental consequences of these projects, however. Nor do we know much about the impact of

² Peter Christensen, *The Decline of Iranshahr: Irrigation and Environments in the History of the Middle East, 500 B.C. to A.D. 1500* (Copenhagen: Museum Tusulanum Press, 1993), 73.

³ W. E. D. Allen, *Problems of Turkish Power in the Sixteenth Century* (London: Central Asian Research Centre, 1963).

Ottoman military demands, especially for the navy, on the forests of Black Sea and Caucasus.⁴

A general feature of the period 1500-1800 all across Eurasia was the rise of giant “primate” cities. The largest in Europe was Istanbul, which at its height in the seventeenth century had a population of 750,000. The system for provisioning Istanbul required the close organization of the grain trade of the Danube basin.⁵ While this undoubtedly had environmental consequences, these have been little studied. Much the same is true of the substantial urban construction boom that marked the Ottoman period. This affected not only Istanbul, but also most of the provincial capitals of the empire.

Central to the economic strategy of both the Ottomans and Safavids was the expansion of silk textile production. As a result, Bursa, Tabriz, Isfahan, and Shiraz became major silk producing centers with large artisanal populations and a network of provincial suppliers, with important investments in mulberry trees. Silk carpets and clothing were produced for both the luxury and domestic markets, and provided the fortune of many entrepreneurs as well as the royal households that patronized them.⁶ Extrapolating from what is known about the Lebanese silk boom in the nineteenth century, the Ottoman silk industry must have had important consequences, but again these have been little explored. The recent historical literature on the Ottoman empire makes it clear that there are no grounds for viewing it as a dark age.⁷ The Ottoman and (to a lesser extent) Safavid state elites were as committed to the developmental project as the elites of any other Eurasian empire in the period, even if the results were not always up to expectations.

A final item with environmental implications is the fact that the Ottoman and the Safavid empires were the homes of large numbers of pastoralists. In eastern Anatolia and the Iranian plateau, the resident, largely Turkish-speaking pastoral tribes maintained vast flocks of sheep, the wool from which was used to produce carpets and an array of woollen items for domestic use, including clothing, embroidered saddle bags, blankets, and tents. Much as in Spain, where the guild of wool producers was organized as the Mesta and sheep migration routes were sanctioned by the state, wool producers had an important role in the Ottoman economy.⁸ In addition, the Middle East (and especially the Ottoman

⁴ Bruce Macgowen, *Economic Life in Ottoman Europe, Taxation, Trade and the Struggle for Land 1600-1800* (Cambridge: Cambridge University Press, 1981).

⁵ Halil Inalcik, *The Ottoman Empire, The Classical Age, 1300-1600* (London: Weidenfeld & Nicolson, 1973).

⁶ Suraiya Faroqhi, Bruce McGowan, Donald Quataert and Sevket Pamuk, *An Economic and Social History of the Ottoman Empire*, 2 vols. (Cambridge: Cambridge University Press, 1994), Vol. 1; Leonard Helfgott, *Ties That Bind: A Social History of the Iranian Carpet* (Washington, DC: Smithsonian Institution Press, 1994).

⁷ Huri Islamoglu-Inan, *The Ottoman Empire and the World Economy* (Cambridge: Cambridge University Press, 1987).

⁸ On the *mesta* in Spain see David Ringrose, *Spain, Europe, and the "Spanish Miracle," 1700-1900* (Cambridge: Cambridge University Press, 1996). For the Ottoman case, see

empire) was a center for horse breeding for the European and Indian markets, a point first made by Braudel in his *Mediterranean World in the Age of Philip II*.⁹ Horse culture was of course integral to the lifestyle of Eurasian elites until modern times. The commercial breeding of horses for the elite and cavalry stables across western Eurasia was therefore a lucrative affair. Since the sale of horses was favored by both the Ottomans and the Safavids, vast areas were preserved for horse pasturage and sheltered from taxation. Indeed, a central way in which the environmental consequences of pastoralist power manifested themselves was in land use patterns. Pastoral political power considerably inhibited the expansion of agriculture, since agricultural lands were taxed at a high rate than pasturage. The political and economic clout of pastoralists durably affected the balance between agrarian, mercantile, and pastoralist power well into the twentieth century throughout the Middle Eastern region. It preserved large areas for the pastoralist lifestyle, and weakened the ability of the state to exploit its agrarian resources.

In the early nineteenth century the Ottoman empire slipped into another gear. After several false starts, the Ottomans engaged French and German military advisors and imported European military technologies.¹⁰ Under Sultan Mahmud II (1807-1839), a new army, the *nizam jedid*, was introduced. Additional reforms were introduced in the following years. The reform era that ensued is called the *tanzimat*. In the rest of the nineteenth century, Ottoman elites sought to introduce modern military reforms in response to Russian expansionism, on the model of those introduced earlier in Russia by Peter the Great. All of this occasioned a new mutation of the developmentalist project into modularized kit of political and economic policy choices. Over the course of the long nineteenth century it spread throughout the world. The reforms of the liberal project provided a vision of how the state and the economy might be transformed through its adoption, and how the state's enemies at home and abroad might be vanquished. Unforeseen by the Ottoman statesmen who were its chief architects, the *tanzimat* reforms and associated internal improvements laid the base for the modern Turkish republic of Attaturk after the Ottoman defeat in World War I. Under Muhammad Ali (1807-1849), Egypt vigorously pursued a parallel self-strengthening program (on which more below). Elsewhere in the region (notably in Arabia, Iran, Afghanistan, and Morocco) the implementation of the reforms of the liberal project had to await the post-1918 period. The adoption of the state-strengthening reforms of the *tanzimat* had important environmental consequences, even if little is known about them in detail.

Economically the liberal project stood for free trade, the rule of law and state assistance in support of trade and commerce. The Anglo-Turkish commercial accord of

Soraiya Faroqhi, *Towns and Townsmen of Ottoman Anatolia, Trade Crafts and Food Production in an Urban Setting* (Cambridge: Cambridge University Press, 1984).

⁹ Fernand Braudel, *The Mediterranean and the Mediterranean World in the Age of Philip II*, 2 vols. (Paris: Presses universitaires de France, 1949, 1973).

¹⁰ Bernard Lewis, *The Emergence of Modern Turkey* (Oxford: Oxford University Press, 1961); Niyazi Berkes, *The Rise of Secularism in Turkey* (Montreal: McGill University Press, 1964); Donald Quataert, *The Ottoman Empire to 1922*. (Cambridge: Cambridge University Press, 2001).

1838, which established a three percent *ad valorem* duty on imports and thereby facilitated the massive dumping of Manchester cottons by British manufacturers, provides a good example. When other European states hastened to conclude most-favored-nation treaties with the Ottomans, the rush of imported European manufactured goods became a flood and led to subsequent untold distress for many Ottoman handicraft producers. The establishment of private property in land was a second important liberal goal. The Ottoman Land Code of 1858 made it possible for the first time to reliably buy and sell land, thus facilitating the spread of commercial agriculture. However, the integration of the Ottoman empire into the world market cut both ways. As we will see below, it also facilitated the emergence of Egypt as a leading producer of long staple cotton fiber, a crucial raw material in the industrial manufacture of cotton goods. Other Middle Eastern products found ready markets in Europe as well. Commercial agriculture favored Lebanese silk spinners, Syrian tobacco and grain producers, and Palestinian citrus producers, among others.¹¹

Like the military/administrative reforms of the self-strengthening movement, the incorporation of the Middle East into the world market after 1750 cumulatively transformed its relationship with the environment. In general, liberal reforms accelerated land degradation and deforestation because of greater demand for timber for ships, houses, improvements and fortifications, and because of an upsurge in mining. The adoption of modern systems of communications – railroads, roads, modern port facilities and the telegraph in the nineteenth century, airports and information technologies in the twentieth century – had evident long-term environmental impacts as well. While the new technologies and forms of organization were subsequently perfected and systematized in Western Europe, little was culturally specific about the forms they took. Taken together, these changes, while they worked in sometimes contradictory ways and unevenly benefited different social groups, brought about far-reaching changes that undermined the old society without fully bringing the new one into being. Here the Ottoman experience essentially replicated that of the rest of the world outside Western Europe.

It soon became apparent that the introduction of European military methods and technologies could not be segregated from other areas of activity. Reforms in the administrative structure of the state, in the fiscal system, the educational system, the legal system, and ultimately in the relations between subjects and the state all derived from the military reforms as seemingly necessary adjuncts. State fiscality in the service of more and better military forces necessitated increasingly efficient administrative bureaucracies (learning to pluck the goose without killing it, so to speak). The *tanzimat* reforms greatly increased the reach of the state and hence of its control over its population. The environmental consequences were not long in manifesting themselves. Increased state power made possible the enforced sedentarization of pastoralists such as the Turkmen, Bedouin and Kurds. At a stroke, age-old land use patterns as well as relationships between pastoral nomadic peoples and sedentary populations were transformed. The displacement of pastoralists from marginal lands favored the expansion of commercial agriculture. This was to become a key theme in the modernization of Middle Eastern

¹¹ Roger Owen, *The Middle East in the World Economy* (London: Methuen, 1981).

societies. The newfound ability of the state to mould nature to its will also manifested itself in ambitious engineering projects, including the Suez Canal (1867) and the construction of major dams on the Tigris and Nile. The *tanzimat* era reforms had an important impact upon the environment of the Middle East and North Africa. They were not the only source of such changes.

Engineers and the Middle Eastern Environment

The long nineteenth century (1800-1914) was marked by the fossil fuel revolution, and with it the unleashing of the forces of the industrial revolution. It therefore had cumulatively important environmental consequences for humans. It was also the century of engineers. Such major engineering projects as the Suez Canal, the transcontinental railroads and telegraph lines were all emblems of modernity. They also demonstrated the ability of humans to tame nature through the application of steam power and electricity. Environmental historians have not paid much attention to the role of engineers in this period. Yet the role of the engineering profession was crucial to the transformations of the environment that ensued after 1750. Nowhere was this more the case than in the Middle East, where the French model of engineering in the service of the state was particularly influential. French graduates of the *École Polytechnique*, the *École des Ponts et Chaussées*, and the *École des Mines* played a central role in the modernization of French infrastructure in the nineteenth century.¹² The *École Polytechnique*, an elite school that selected the most brilliant students and produced a highly versatile corps of trained professionals, was of particular importance.¹³ In the nineteenth century it provided an appealing model for the recently independent American republics. For example, the U.S. Military Academy at West Point was originally modeled on the *École Polytechnique*.¹⁴ The prestige of French engineering prowess even extended to British colonial India, where irrigation officers were trained to the French model.¹⁵

The Ottoman empire, Egypt, and Persia all found the French model to be enormously attractive. As early as 1734 the Ottoman empire established an engineering school (*Hendesehane*), following the advice of a renegade French military instructor, the Count de Bonneval.¹⁶ Under Mahmud II (1806-1830), the renamed *Muhendeshane* (1827) was a vital cog in the *tanzimat*. Its graduates played a major role in the development of the engineering profession (both military and civil) as well as in the

¹² Antoine Picon, *L'Invention de l'ingénieur moderne: L'école des Ponts et Chaussées, 1747-1851* (Paris: Presses de l'École des Ponts et Chaussées, 1992).

¹³ On the *École Polytechnique*, see Jean-Pierre Callot, *Histoire de l'École polytechnique* (Paris: Charles Lavauzelle, 1982); and Terry Shinn, *Savoir scientifique et pouvoir sociale. L'École polytechnique, 1794-1914* (Paris: Presses de la fondation nationale des Sciences politiques, 1980).

¹⁴ Robert Fox, "Les regards étrangers sur l'École polytechnique, 1794-1850," *Revue de l'Occident Musulman et de la Méditerranée*, vols. 73-74, nos. 3-4 (1994), 213-230.

¹⁵ William Willcocks, *Sixty Years in the East* (Edinburgh & London: William Blackwood & Sons Ltd., 1935).

¹⁶ Berkes, *Rise of Secularism in Turkey*, 48.

higher councils of state.¹⁷ In the nineteenth century many Turkish students were sent to Europe to study science and engineering—especially to France. Most of the prestige projects in the Middle East in the nineteenth century were the result of French engineering prowess. French colonies in North Africa (Tunisia, Algeria, Morocco) were the direct if unwilling recipients of French engineering expertise. On the eve of World War I there were several hundred European-trained engineers in the Ottoman domains, including Egypt. Engineers were leading purveyors of the ideas of progress and mastery over nature that were central to the developmental project.

In the first half of the nineteenth century, the *École Polytechnique* was heavily influenced by Saint-Simonian thought. Henri de Saint-Simon (1760-1825) was a French utopian socialist thinker whose ideology of social progress, Saint-Simonism, became a key ideology of progress throughout the Mediterranean and beyond. It was particularly appealing to engineers. Moreover, many leading graduates of the *École Polytechnique* were followers of Saint-Simon and his leading disciple, Barthelemy Prosper Enfantin (1796-1864). Under the influence of Enfantin, a faculty member at the *École*, Saint-Simonism evolved into a cult of progress adapted to the needs of an industrial age. Saint-Simonians were among the founders of leading French banks of the period, including the *Credit Mobilier*, the *Credit Foncier*, and the *Credit Lyonnais*. Saint-Simonian ideas about the French path to development also emphasized the construction of a modern railroad grid that would link the Atlantic and Mediterranean worlds. A leading Saint-Simonian theorist, Michel Chevalier (1806-1879), developed a vision of the Mediterranean as an economic and political hub of trade and culture, linked together by a vast network of railroads and canals under the leadership of French technocrats and capitalists.¹⁸ In 1832 Chevalier published a highly influential article, “Le Système de la Méditerranée,” in his newspaper, *Le Globe*. The goal of French industrial policy, he proposed, should be the unification of the Mediterranean into the new global political economy under French leadership.

Saint-Simonians played leading roles in the economic development of the Middle East.¹⁹ Many of the reforms implemented under Muhammad Ali were of French (and often of Saint-Simonian) inspiration. Charles Lambert, a Saint-Simonian graduate of the *École*, established an Egyptian *École Polytechnique* in Cairo.²⁰ The Suez Canal was originally a Saint-Simonian idea: its chief proponent, Ferdinand de Lesseps, was a dissident Saint-Simonian. Saint-Simonians were also intimately involved in all aspects of

¹⁷ Berkes, *Rise of Secularism in Turkey*, 75-76, 111, 177.

¹⁸ Phillippe Régner, *Les Saint-Simoniens et Egypte, 1833-1851* (Cairo: Banque de l'Union Européenne, 1989).

¹⁹ Magali Morsy, *Les Saint-Simoniens et l'Orient* (Aix-en-Provence: Editions Edisud, 1989).

²⁰ Ghislaine Alleaume, "Linant de Bellefonds (1799-1883) et le Saint-Simonisme en Egypte." In Magali Morsy, ed., *Les Saint-Simoniens et l'Orient* (Aix-en-Provence: Edisud, 1989), 113-132; and *L'École polytechnique du Caire et ses élèves. La formation d'une élite technique dans l'Égypte du XIXe siècle* (Lyon: Thèse de doctorat en histoire, 1993).

the conquest (1830-1848) of Algeria. They provided the only coherent vision of how Algeria's colonization might be linked to a larger strategic vision of the role of French capital in the world. Under the spell of the Saint-Simonian vision, the Middle East (and the entire Mediterranean) came to modernity.

In Egypt, engineering schools have an almost unbroken history dating from the early Muhammad Ali period.²¹ The number of graduates was so numerous that by 1882 most irrigation engineers were Egyptian nationals. By the interwar period, Egyptian engineering schools were producing more than 100 graduates a year. As elsewhere in the Mediterranean and Latin America, the title of Engineer (*Muhandis*) became a much coveted honorific. So numerous were engineers that in the 1920s a residential quarter of modern Cairo, the *Muhandisin*, was constructed according to the latest urban planning standards to house engineers and their families. By 1945 modern university engineering schools were almost entirely Egyptianized.²² Under Nasser, engineers provided the regime with a large, prestigious, and strategically located segment of the political administrative elite.²³ Indeed, Egypt alone among the countries in the region produced engineers far in excess of the ability of the local job market to absorb them. By the 1970s, Egyptian engineering schools were producing more than 5000 engineering graduates a year. Egypt's nearest rival in the production of professional engineers in the post-1945 Third World was Mexico.²⁴

After World War I, France opened the *École Polytechnique* and the other *grandes écoles* to foreign and colonial applicants, who previously had been admitted only as external students. With the coming to power of Reza Shah (1925-1941) in Iran, a series of student missions were sent to Paris to study at the *École*. More than 640 Iranian engineers were trained over the course of the program. Upon their return to Iran they played an important role in devising and implementing the modernization policies of the Pahlavi regime. In 1945 they took the lead in establishing the Association of Iranian Engineers, which later played a role in the politics of the post-war era, notably under Mohamed Mossadegh.²⁵ A smaller number of North African engineers were trained at the *École Polytechnique* in the inter-war period, but in the colonial context were unable to secure adequate employment until after 1945.²⁶ After World War II, graduates of the *École Polytechnique* and the *École des Mines* helped found the professional associations

²¹ On the history of the engineering profession in Egypt, see J. Heyworth-Dunne, *An Introduction to the History of Education in Modern Egypt* (London: Cass 1968); Clement Henry Moore, *Images of Development: Egyptian Engineers in Search of Industry* (Cambridge: MIT Press, 1980); Joseph Szyliowicz, *Education and Modernization in the Middle East* (Ithaca and London: Cornell University Press, 1973); and Bill Williamson, *Education and Social Change in Egypt and Turkey* (London: Macmillan, 1987).

²² Moore, *Images of Development*, 11.

²³ Moore, *Images of Development*, 4.

²⁴ Moore, *Images of Development*, 6.

²⁵ Anousheh Karvar, "Les Polytechniciens étrangers et les mouvements nationaux," *Revue de l'Occident Musulman et de la Méditerranée*, vols. 73-74, nos. 3-4 (1994), 120-123.

²⁶ Karvar, "Les Polytechniciens étrangers," 123.

of engineers in Lebanon, Tunisia, and Morocco. Once independence was achieved, French-trained engineers took the lead in establishing national engineering schools.²⁷ As in Iran, they provided an important source of expertise to newly independent national governments. A more complete history of the engineering profession in the Middle East might shed much light on the development policies of post-1945 states, and thereby enable us better to understand the connections between colonial and post-colonial policies and their impacts upon the environment.

Modern Egypt: The Role of Hydraulic Engineering

The Egyptian case is central to a study of irrigation and water management regimes in the Middle East for a number of reasons. To begin with, the continuity of water management in the Nile valley over more than five millennia is unmatched anywhere. Large-scale irrigation projects did not begin with the liberal project, but with the Pharaohs. Since 1750, Egypt has been the best example of successful agricultural modernization in the region, starting with Muhammad Ali (1805-1841), under whose rule the plan to construct a dam on the Nile at Aswan (1834) was developed with French assistance but not implemented.²⁸ The Suez Canal (1867) remains a showcase of the progress-oriented ideology of the liberal project, as does that second icon of agricultural modernity, the Aswan High Dam. Since the 1980s the stagnation of Egyptian agriculture has exposed the limits of this particular development strategy.

A pioneer ruler in the image of the liberal project, Muhammad Ali adopted policies that dramatically transformed Egypt in the nineteenth century.²⁹ Under his rule the Egyptian economy was opened to the world market and converted to the production of cotton for export.³⁰ In the first half of the nineteenth century, the mechanized production of cotton textiles was the leading industry in the world economy, and cotton supplies were inadequate. Egypt was well positioned to take advantage of the situation because of its convenient location and because it possessed abundant fertile land and an industrious peasantry. Nonetheless, there were a number of important bottlenecks in the agricultural economy of Egypt. These included problems with the existing irrigation system, the variable quality and the numerous varieties of cotton produced, and the social organization of labor. Under Muhammad Ali, efforts were made to address each of these bottlenecks.

The discovery of long staple cotton by a French technical advisor, Louis Alexis Jumel (1785-1823), was crucial to what came next.³¹ The fibers of the Jumel variety of

²⁷ Karvar, "Les Polytechniciens étrangers," 126.

²⁸ Alleaume, "Linant de Bellefonds," 125-127.

²⁹ Afaf Lutfi al-Sayyid Marsot, *Egypt in the Reign of Muhammad Ali* (Cambridge: Cambridge University Press, 1984).

³⁰ Roger Owen, *Cotton and the Egyptian Economy, 1820-1914* (Oxford: Oxford University Press, 1969); and Alan Richards, *Egypt's Agricultural Development, 1800-1980* (Boulder: Westview Press, 1982).

³¹ Owen, *Cotton and the Egyptian Economy*, 28-57.

cotton were longer and stronger than other common varieties, making them capable of being processed by machine. By standardizing the production of Jumel (also known as Egyptian long-staple) cotton, Egypt rapidly became the leading producer of premium cotton for the mills of Manchester and Liverpool. Egyptian cotton soon set the world standard. French experts laid down strict rules on how to grow Jumel cotton and devised a hierarchical labor organization to enforce its cultivation. Egypt became a vast cotton plantation for the world market, and peasants were not permitted to grow subsistence crops on land allocated to cotton production.³² In order to maximize production, it was necessary to end the traditional basin system of irrigation and its reliance on the annual floods, and move to a system of perennial irrigation. Perennial irrigation, by adding a summer growing season, enabled cotton production to continue year-round. New canals were constructed (240 mi. by 1833), notably the Mahmudiya canal in the Delta (1817), and others were deepened so that they would be below the level of the river even in the dry season. Barrages were built on the main Nile Delta canals to retain water and facilitate the provision of water to secondary and tertiary irrigation networks.³³

Under the British, the Muhammad Ali system was upgraded several times. In the 1880s, three major off-take canals were built in the Delta, and in 1902 the first Aswan dam was constructed under the direction of Sir Colin Montcrieff. The height of the dam was raised several times by the British and by 1933 the storage capacity had reached 5.7 billion cubic feet.³⁴ To facilitate the movement of cotton to the world market, railroads were constructed along the Nile corridor (1519 km by 1877). As a result of perennial irrigation, the area devoted to cotton production was greatly expanded. From 3 million cantars in 1880, production rose in 1914 to 7.3 million cantars. Land use intensified greatly under the regime of perennial irrigation and led to new cultivation practices, notably the widespread plowing of fields (not practiced under the basin system, in which the silt laid down by the annual flood fertilized the fields). The confirmation of the state's responsibility for the development of the irrigation infrastructure was perhaps the most important consequence of the widespread adoption of perennial irrigation.

The Egyptian environment was affected in important ways by these innovations. For one thing, the advent of perennial irrigation was accompanied by human health problems, notably an increase in schistosomiasis and other water-borne diseases. More crucial was the inadequate investment in drainage. Water laden with mineral salts, if not regularly flushed and drained away, tended to accumulate in the soil. The leaching of mineral salts into the soil also led to the cumulative loss of much productive land to agriculture. As I have discussed in a companion essay,³⁵ the problem of lack of drainage

³² Richards, *Egypt's Agricultural Development*.

³³ Richards, *Egypt's Agricultural Development*; and John Waterbury, *Hydropolitics of the Nile Valley* (Syracuse: Syracuse University Press, 1979), 31-33.

³⁴ Willcocks, *Egyptian Irrigation* (London: E. & F. N. Spon; New York: Spon & Chamberlain, 1899).

³⁵ Edmund Burke III, "The Deep History of the Middle Eastern Environment, 1500 BCE – 1500 CE," *UC World History Workshop. Essays and Positions from the World History Workshop*, Paper 3, <http://repositories.cdlib.org/ucwhw/ep/3>

is as old as the Pharaohs. Before the Muslim era, more than 1.5 million feddans of cultivated land in the northern Delta are estimated to have been lost to cultivation due to salt intrusion.³⁶ However, perennial cultivation (especially after the construction of the 1902 Aswan dam) lessened a second age-old problem, the irregularities of the Nile flood, which had caused important shortfalls in cereal production and induced periodic famines.

The British approach to irrigation also had regressive social consequences. The consolidation of private property rights in land and labor together with the transformation to perennial irrigation worked to the advantage of wealthy landowners. It intensified pressures on landless peasants, however, igniting the endemic peasant land hunger that is featured in Sharkawi's classic 1930s novel of social protest, *Egyptian Earth*.³⁷ By the inter-war period, the stark contrast between the small class of wealthy landowners (known as *umdahs*) and the vast numbers of landless peasants had begun to have political consequences. At the risk of being overly schematic, one could say that the adoption of perennial irrigation generated the social tinder that led to the Free Officers coup in 1952.

The construction of the Aswan High Dam under Nasser took place entirely within the logic of the nineteenth century hydrological engineering projects. It completed the move to perennial irrigation begun in the nineteenth century. By providing a vast new source of irrigation water, the Aswan High Dam enabled Egypt to achieve a higher level of food sufficiency relative to its neighbors while preserving it from devastating famine. In this sense, it can be said to have bought time for the regime. Socially, it has furthered the emergence of a class of middle peasants who were able to afford the investments in inputs of all kinds, while also increasing the numbers of landless peasants.

Previously, Egypt had been exposed to El Nino-intensified drought situations. The famine of the 1877 in which thousands perished, witnessed by Ulysses S. Grant, was but one dramatic example.³⁸ Without the Aswan High Dam, Egypt might have been hard hit by the Sahel famine of the 1980s, which devastated the Saharan fringes from West Africa to northern Africa. Given the relentless demographic pressures to which Egypt is exposed, this is no small achievement. Only recently has Egypt had once again to enter the international grain market to feed its people. In this sense we can say that a major achievement of the High Dam was to buy Egypt thirty years of respite from relentless population pressures.

The High Dam has had a number of important environmental impacts. First, the continued lack of investment in drainage has led to land being taken out of production due to salination, with a further decline in productivity. Siltation is another major problem. As the flood no longer brings silt downstream, it has accumulated in the vast man-made lake (Lake Nasser) on the upstream side of the dam, where it has threatened to

³⁶ Waterbury, *Hydropolitics*, 35-37.

³⁷ Abdel Rahman Sharkawi, *Egyptian Earth* (Austin TX: University of Texas Press, 1990).

³⁸ Mike Davis, *Late Victorian Holocausts: El Nino Famines and the Making of the Third World* (London and New York: Verso, 2001), 103-105.

obstruct the outlets of the dam and to compromise the lake itself. Third, in the absence of the annual deposit of silt on their fields, Egyptian farmers have become dependent upon commercial fertilizers. Finally, the fisheries of the eastern Mediterranean have been deprived of their principle source of nutrients, found in the silt, and as a result fish stocks have declined precipitously. Again, this record must be balanced against the gains in food security the High Dam has afforded. It also needs to be set in the long-term historical context of human intervention in the environment of the Nile valley over the past five millennia.

The modern history of the Middle East contains a rich but mostly untold history of water management schemes. One that can be briefly evoked here involves the attempts of the three riparian states (Turkey, Syria, and Iraq) to erect dams across the Euphrates River. The absence of coordination between the three states (despite international agreements) has thus far not led to conflict, but the high political status of the dam projects in each state does not augur well for future cooperation. In Turkey, the Ataturk dam on the Euphrates, which was completed in 1992, is intended to jump-start the economic development of eastern Anatolia as well as facilitating government control over separatists in Turkish Kurdistan. The full project calls for the construction of over 80 dams and 66 hydroelectric power stations; costs will exceed \$20 billion, with part of the cost borne by the World Bank.³⁹ The centerpiece of the SEAP is the great Ataturk dam on the Euphrates. The ambitious Turkish plans for the headwaters of the Euphrates and its tributaries fit squarely within the developmentalist logic of the liberal project, but they are not the only ones for this major river system.

Syria's dependence upon the Euphrates is equally crucial to national development objectives, since the Euphrates is by far the largest river in Syria. The Tabqa dam, construction on which began in 1974, was conceived by Soviet engineers and built as a kind of Syrian counterpart to the Aswan dam. It has a planned storage capacity of 12 billion cubic meters, but has been plagued by numerous technical problems (land subsidence, seepage and evaporation). In the droughts of the 1980s, Syrian insistence on taking their full water rights provoked major conflicts with both Iraq and Turkey, the other riparian states. Conflicts are expected only to increase as the Turkish Southeast Anatolia Project is completed. Already there have been difficulties caused by the excessive (to Syrian eyes) levels of waters impounded by Turkish dams. Unless there is a negotiated solution, the reduction in the Euphrates flow is likely to compromise the Syrian irrigation projects.⁴⁰

The attempt to restore Iraqi irrigation to the level of ancient Assyria has gone through numerous phases since the period of the Ottoman *tanzimat*.⁴¹ The construction of the Hindiyah barrage before World War I was followed by the building of numerous

³⁹ Daniel Hillel, *Rivers of Eden: The Struggle For Water and the Quest For Peace in the Middle East* (Oxford and New York: Oxford University Press, 1994).

⁴⁰ Hillel, *Rivers of Eden*.

⁴¹ For a long view of Iraqi irrigation schemes, Willcocks, *Sixty Years in the East* and Hillel, *Rivers of Eden*.

dams, canals, and artificial lakes under the British and Iraqi governments in the years that followed. As in Egypt, the modernization of Iraqi irrigation has been undermined by insufficient investment in drainage, which has led to the loss of land to agriculture from salination. For this reason a major project of the Saddam Hussein regime has been the “Third River”—an attempt to open a vast drainage canal to collect and drain away saline waters from irrigation canals fed by the Tigris and Euphrates. The project originated in studies conducted in the 1950s by American engineers and was completed by the Iraqi government in 1994. The Third River project represents a classic form of developmentalist thinking about rivers as drains.⁴² In general, attempts at international management of the Euphrates remind one of nothing so much as the struggles among riparian states over the waters of the Colorado River.⁴³ The lack of cooperation is likely to have similar consequences.

The Middle East of Dry-Farming and Rangelands

The Middle East of dry farming and pastoralism stand in contrast to the Fertile Crescent experience. Because of a lack of major rivers and streams, this zone has had a divergent history of water management in the modern period. Here I briefly review the North African case. A more complete development of this survey would address in greater detail the situations of the Iranian plateau, geographic Syria, and the Arabian peninsula. Like other parts of the region dependent upon rain-fed agriculture, the Maghrib (Libya, Tunisia, Algeria, Morocco) has a rainfall regime that averages 250 mm per year or less (much less in the case of Libya). There is also considerable annual local variability depending upon the relief and the season. In pre-colonial times, water management schemes focused upon small-scale interventions rather than ambitious hydrological engineering projects.⁴⁴ Examples discussed in my companion essay⁴⁵ include the *qanat*-style irrigation tunnels in the Tafilalet oasis area and the diffusion of the tank system of irrigated gardens to Umayyad Syria, Fatimid Tunisia, and Almohad Marrakech. The pre-colonial North African economy focused upon cereal production (barley and wheat) and cultivation with the archaeo-technological scratch plow. This style of agriculture was relatively drought tolerant. At the pre-colonial population levels, it was largely in balance with the environment.

Mindful of the legacy of Rome, when North Africa was allegedly the granary of Rome, the French fashioned for themselves a progressive narrative in which France would restore the Maghrib to its former agricultural wealth through enlightened colonial

⁴² See Marc Cioc, *The Rhine : an Eco-biography, 1815-2000* (Seattle : University of Washington Press, 2002).

⁴³ Mark Reisner, *Cadillac Desert* (New York: Penguin Books, 1993).

⁴⁴ Paul Berthier, *Les anciennes sucreries du Maroc et leurs reseaux hydrauliques*, 2 vols. (Rabat: Imprimeries françaises et Marocaines, 1966); Will D. Swearingen, *Moroccan Mirages: Agrarian Dreams and Deceptions 1912-1986* (Princeton: Princeton University Press, 1987).

⁴⁵ Burke, "Deep History"

rule. With a bit of historical distance, we can now see that French attitudes toward agriculture and forests reflected nineteenth century environmentalist concerns with deforestation and conservation. George Perkins Marsh's forest-centrism echoed French scientific concern with the environment of the Middle East and North Africa.⁴⁶ An early expression of the latter was the French Forest Code of 1827.⁴⁷ A product of research on tropical islands and on the French Alps, it was exported unchanged to the very different environment of North Africa.⁴⁸ Arid environments, unlike tropical ones, are well adapted to drought and disturbance and recover well from dramatic vegetation changes. Even though the North African environment was well adapted to fire and grazing, the Forest Code imposed strong limits on both. In general it regarded pastoralists as suspect, and criminalized pastoralism in the forests and steppes instead of seeing them as a viable way of life with historical sustainability. Recent work on range ecology in Africa has sharply challenged the French colonial view of pastoralist behavior, which ascribes land degradation to over-grazing and to overshooting the carrying capacity of the land. Instead of an equilibrium, range ecologists now view the arid and semi-arid rangelands of the Maghrib as in permanent disequilibrium due to the harsh nature of the climate.⁴⁹

French colonial rule in North Africa began in 1830 in Algeria, 1881 in Tunisia, and 1912 in Morocco. The coming of the French marked a major change in the agrarian economy of the Maghrib, and brought about a gradual shift to forms of high input agriculture based upon production for an export market rather than self-sufficiency. Fixated upon the myth of North Africa as the granary of Rome, the French sought to "make the desert bloom" by fostering the dry-farming of grain in the central regions. By the 1880s, the high plateaus of the Algerian interior, long a zone of pastoral transhumance, had been opened to grain farmers using tractors and combine-harvesters to dry-farm wheat and barley for the French market. Mechanized production was encouraged by a program of subsidies and bonuses, and by high crop prices in the French metropole. Europeans occupied roughly 30 percent of Algeria's arable land and lesser percentages of arable land in Tunisia (20 percent) and Morocco (13 percent). Throughout colonial North Africa, environmentally anomalous modern high-input agriculture was accompanied by extreme concentration of land ownership. This shift devastated the flocks and herds of the pastoralists while exposing the thin soils of the Tellian Atlas to erosion.

⁴⁶ George Perkins Marsh, *Man and Nature* (Cambridge: Harvard University Press, 1965 [1864]).

⁴⁷ Theodore Woolsey and William Greeley, *Studies in French Forestry* (New York: John Wiley & Sons, Inc., 1920).

⁴⁸ Richard H. Grove, *Green Imperialism: Colonial Expansion, Tropical Island Edens and the Origins of Environmentalism, 1600-1860* (Cambridge: White Horse Press, 1995); and S. Ravi Rajan, "Foresters and the Politics of Colonial Agroecology: The Case of Shifting Cultivation and Soil Erosion, 1920-1950," *Studies in History*, 14, 2, (N.S. 1), (1998), 218-236.

⁴⁹ Diana Davis, "Environmentalism as Social Control? An Exploration of the Transformation of Pastoral Nomadic Societies," *The Arab World Geographer*, 3, 3, (2000), 182-198.

In Morocco, French protectorate authorities were similarly enamored of the granary of Rome myth, and encouraged wheat farming by a select group of wealthy French and Moroccan farmers in the central coastal plains known as “le Maroc utile.” As a result there were significant gains in cereal production. Planted area increased from 1.9 million hectares in 1918 to nearly 3 million hectares in 1929. While cereal production increased, so did vulnerability to drought.⁵⁰ The favoring of wheat over barley (which is much more drought tolerant) further exacerbated the effects of drought. A major crisis in 1929-1933 coincided with the great depression to economically devastate French cereal farmers in Morocco and Algeria. It was only later that agronomists came to recognize that the “granary of Rome” ideology had blinded the French to the environmental realities of the Maghrib: rain-fed agriculture was an environmentally perilous undertaking. According to one recent study, serious droughts have been recorded in twenty-five of the last hundred years⁵¹.

After the failure of the granary of Rome experiment in Morocco, French protectorate authorities sought to tap the hydrological resources of the Atlas mountains, the westward slopes of which received seasonal rainfall averaging 30 inches annually. Through the ambitious Beni Amir plan (and related other projects) a series of dams were constructed that aimed at boosting Morocco’s irrigated land to one million hectares. In the words of the ideology of the moment: “not a single drop of water to the sea!” By 1949, the irrigated area in the Kasba Tadla/Beni Amir area had expanded from 2000 to 13000 hectares. By the 1950s the French had completely reorganized production in the modern sector of the Moroccan agricultural economy and devised a new strategy: to produce fruits and early vegetables for the European market. In this, they were heavily influenced by the California model of agriculture, which linked irrigation, pesticides, and scientific agricultural methods. The Organisation Chérifien de Contrôle et d’Exportation was modeled on the California Fruit Growers Exchange. It was charged with setting quality standards, researching new varieties, analyzing market conditions, and establishing the Moroccan brand name in the European market.⁵² The French decision to modernize Moroccan agriculture in the 1940s and 1950s left a permanent legacy to post-colonial Moroccan agriculture. Since the 1960s the independent North African states have continued to push cereal production into increasingly marginal agricultural lands despite the evident folly of such a strategy.

In this context, post-independence Morocco launched a major development project that sought to increase the reach of modern agriculture via the creation of tractor cooperatives and the establishment of model farms. Drawing upon French colonial plans, it aimed at irrigating one million hectares of land. That there have been some successes is

⁵⁰ Will D. Swearingen, “Is Drought Increasing in Northwest Africa? A Historical Analysis,” in Will D. Swearingen and Abdellatif Bencherifa, eds., *The North African Environment at Risk* (Boulder: Westview Press, 1996), 117-133.

⁵¹ Swearingen, “Is Drought Increasing?”

⁵² Will D. Swearingen, *Moroccan Mirages: Agrarian Dreams and Deceptions 1912-1986* (Princeton: Princeton University Press, 1987).

evident from the record. By 1986 Morocco was the second exporter of oranges in the world (13 percent of world market), and 80 percent of all its agricultural exports were fruits and vegetables. However, only a portion of Moroccan agricultural land is suitable for California-style agriculture. The Moroccan state (both colonial and post-colonial) has also lacked the means to fully implement the California model. More recently, the California model has come to look increasingly like a Faustian bargain even in California, as siltation and salination have led to a secular pattern of decreased yields in large sections of the Imperial valley. Neither the French nor the independent Moroccan state was able to counter the influence of the vested interests that are a legacy of the colonial land system. Crucially, the strategy of concentrating on modern irrigated agriculture has failed to address the dramatic demographic increase (more than 3 percent per annum). Instead of fostering the emergence of a broad base of self-sufficient peasants, the adoption of the California model has worsened existing inequalities. Most of the investment has gone to enrich the already wealthy, while poor peasants have continued to lag. In the opinion of some experts, the California model has been as big a failure as the granary of Rome experiment.⁵³ It has failed to provide food security, to raise rural standards of living, or to provide adequate foreign exchange earnings. Given the environmental realities, the new goal of food security is, in the opinion of many agronomists, equally mythical. Only the driving myth has changed. Yet paradoxically, faith in modern high-input agriculture continues unabated.

In the nineteenth century, farmers on the central plains of the United States believed that “rain follows the plow.” Family farms were planted on the prairie, and for a time the bumper crops rolled in. It seemed like the American Dream come true. Farmers were only disabused of this notion by the devastating droughts of the 1920s that created the Dust Bowl. Nothing daunted, a generation of developmental economists and agronomists exported the rain-follows-the-plow ideology to the Third World after World War II. For a time, it seemed as though the strategy was working: high-input agriculture dependent upon pesticides, fertilizers and hybrid seeds led to record harvests and soaring hopes of food security throughout the Third World. But a darker side soon became evident. Because much of the gains came from the extension of agriculture into marginal land in Africa, Asia, and Latin America, it took some time before agronomists paid much attention to the depleted ground water, pesticide-fouled aquifers, and socially skewed gains for the some at the expense of ruin for the many. By the 1970s, record famines (sometimes intensified by El Nino events) brought disaster to the West African Sahel, northeast Brazil, East Africa, and a host of other places. This prompted a major reassessment. The new mantra from agronomists became “drought follows the plow.”⁵⁴ Those charged with planning the development strategies of third world countries have been left in a quandary. Confronted by unrelenting demographic pressures, they believe that they have little option but to persist with the new ways. These questions are especially acute for Middle Eastern states lacking major river systems, such as the North African cases we’ve just explored. Even Egypt and states along the riparian corridor of

⁵³ Swearingen, *Moroccan Mirages* and “Is Drought Increasing in Northwest Africa?”

⁵⁴ Michael H. Glantz (ed.) *Drought Follows the Plow: Cultivating Marginal Areas* (Cambridge: Cambridge University Press, 1994).

the Euphrates, like Turkey, Syria and Iraq, although they are more fortunately situated, are already facing the same pressures. Egypt is no longer self sufficient in food production. Most of the rest of the region has not been for some time, and the food deficits get bigger with each passing year, even as populations continue to rise. Once again the long-term view is telling. Here the words of Peter Christensen, referring to Iran, can be applied to the Middle East region as a whole:

[I]n spite of considerable investments and the transfer of modern, western agrarian technology, [Iran] has not increased productivity – rather the opposite, if we look at productivity per unit area. The point is that resource scarcity, primarily lack of water, has imposed fundamental limits on production, limits which until now neither more capital nor improved technology nor alternative forms of social organization have been able to transcend. In this sense Iran differs from both pre-industrial Europe and the wet-rice societies of Asia.⁵⁵

Conclusion

From the perspective of the deep history of the Middle Eastern environment, the modern history of the region looks substantially different. One point I have developed elsewhere⁵⁶ is that Middle Eastern states and peoples have been transforming the regional environment for millennia, not just since the onset of modern times. Already by the first millennium B.C.E., if not before, human actions had substantially remolded the Mesopotamian environment through a series of major hydraulic engineering projects, including massive dams, canals and artificial rivers. In this context modern engineering marvels like the Aswan High Dam no longer seem so original, while the assumption that modern people are alone in their capacity to adversely affect the environment seems questionable. The graph of environmental decline needs to be redrawn. Instead of a curve rising sharply only at the onset of the modern era, the new shape would show important up-ticks in environmental degradation to coincide with the origins of civilization, the age of metallurgy and the early modern period, before the fossil fuel revolutions completely altered the game.

There is a second way that attention to the environment has the potential to change the way we think about Middle Eastern history. It helps us realize that the roots of modernity lie deep in the common past of Afroeurasia, and not just in the past of the West. Already by the tenth century, most of the components of the military/fiscal revolution that transformed warfare across Afroeurasia (gunpowder weapons, new forms of organization, tactics and strategy) were already in place in East Asia. They subsequently spread westward with the Muslims and the Mongols. Muslim rulers were quick to see the advantages of gunpowder weapons and were among the first to deploy

⁵⁵ Christensen, *The Decline of Iranshahr*, 249.

⁵⁶ Burke, "Deep History."

them on a large scale. Using this technology, the Ottomans were able to lay siege to Vienna twice in the period from 1500 to 1800. The military/ fiscal revolution was but the most recent mutation of the developmentalist project we have been tracking all across Eurasia from the beginnings of complex societies. When linked to the fossil fuel revolution and to the silver and other resources of the Americas, this development increasingly permitted Europe to gain the upper hand over other world regions, including the Middle East. However, the Ottomans did not need the authorization of the West to adopt the fruits of this phase of the developmentalist project. They already internalized it from the start.

The emergence of the most recent mutation of the developmentalist project--the bundle of political and economic reforms I call the liberal project gradually unfolded throughout the long nineteenth century. The liberal project was not just imposed from without. Middle Eastern governing elites took an active hand shaping the forms that modernity has taken in the region. If we are interested in the impact of modernity upon the Middle Eastern environment, it matters less whether or not the Middle East was colonized than whether state-builders and economic actors (indigenous and colonial alike) pursued similar policies. The infrastructural changes that were introduced in the Middle East mirrored those introduced elsewhere: paved roads, railroads, dams, canals, and modern irrigation technologies. The same is true for the adoption of capital (and technology) intensive mining, greatly increased consumption of wood (both as a construction material and as biomass energy), and the turn to fossil fuels. The liberal project, especially as boosted by the fossil fuel revolution, led to a permanent change in the way in which both elites and peoples conceived of their relations to the natural world. Following the overthrow of colonialism, no Middle Eastern state elected to forego modern medicine, military weapons, or communications technologies and return to the past relationship to nature. In this sense, we are all modern. Perhaps the most important contribution of an environmental perspective on the history of the Middle East is to reveal the underlying continuity between the pre-colonial, colonial, and post-colonial periods. Faced with the environmental crises that loom on the horizon, this may be the most valuable lesson of all. Let us hope that it has come in time.

In conclusion, as a consequence of its fragile and over-burdened environment with its deep history of human intervention, the Middle East today plays the role of the canary in the mineshaft for the rest of the world. Environmental degradation of all kinds is more visible there than in the temperate and tropical zones. Also, the legacy of squandered water resources, deforestation and pollution of all kinds is far longer. Its consequences are perhaps also particularly visible because of evident vulnerability of Middle Eastern semi-arid and arid landscapes. The flayed Middle Eastern environment is a distilled essence of the rest of the world as it will be, if not as it is at present. For this reason, the Middle Eastern case is of particular relevance to all those who are concerned about the global environment.