Flows of colonial power: water as environmental governmentality in nineteenth-century French Algeria

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INTRODUCTION

> We know that this region has been the theater, in recent years, of colonisation efforts of an entirely new kind. Artesian wells have brought out water where it was lacking, and made it possible to irrigate and develop land hitherto deemed sterile: around these new sources of spring water, the ground has been covered with immense plantations of date palms, and we have seen French settlers create from scratch large oases in the middle of the desert.[1]

When the French first laid siege to Algeria in 1830, they encountered a land that appeared 'sterile' and arid, as recalled by the French engineer Georges Rolland in his *La Conquête du désert.* But, as Rolland suggest, this supposed sterility was accompanied by the promise that French hydraulic engineering, as the emblem of a form of colonisation 'of an entirely new kind', was capable of restoring the land by returning its water. This depiction of Algeria's hydrology is reminiscent of a much broader environmental narrative that emerged in the decades following the French conquest of Algiers. Previous studies have outlined how this French narrative, which revolved largely around an imagined environmental history of North Africa, depicted Algeria's natural environment as degraded and neglected by the native population. Several authors have demonstrated how French environmental discourses in turn shaped disciplinary environmental policies in colonial Algeria and aided the seizure of land from Algerian landowners.[2] The role of water has yet received considerably less attention in these inquiries, even when the opening lines by Rolland suggest that hydrology was equally of concern in these narratives and the first decades of French colonisation witnessed sweeping interventions in

[1] Georges Rolland, *La Conquête du désert. Biskra, Tougourt, L'Oued Rir'* (Paris: Challamel, 1889), 12: "On sait que cette région a été le théâtre, dans ces dernières années, d'entreprises de colonisation d'un genre entièrement nouveau. Des sondages artésiens ont fait jaillir l'eau où elle manquait, et permis d'irriguer et de mettre en valeur des terrains jusqu'alors réputés stériles: autour de ces nouvelles sources d'eau vives, le sol s'est couvert d'immenses plantations de palmiers-dattiers, et l'on a vu des colons français créer de toutes pièces de grandes oasis au milieu du désert."

[2] See, in particular, Diana K. Davis, "Desert 'Wastes' of the Maghreb: Desertification Narratives in French Colonial Environmental History of North Africa," *Cultural Geographies* 11 (2004), 359-387; Diana K. Davis, *Resurrecting the Granary of Rome: Environmental History and French Colonial Expansion in North Africa* (Athens, OH: Ohio University Press, 2007); Caroline Ford, "Reforestation, Landscape Conservation, and the Anxieties of Empire in French Colonial Algeria," *The American Historical Review* 113 (2008), 341-362; Henry Sivak, "Legal Geographies of Catastrophe: Forests, Fires and Property in Colonial Algeria," *Geographical Review* 103 (2013), 556-574.

Algeria's rivers, marshlands and aquifers.[3] The objective of this thesis, therefore, is to explore how Algeria's hydrology figured in French colonial environmental narratives. More importantly, following an initial impetus by Diana K. Davis, this study aims to elucidate how discourses and policies about water served as and produced a form of 'environmental governmentality'.[4] The research question guiding this study is worded as follows: how did water figure in the dominant environmental discourse construed by the French in colonial Algeria and how was this discourse intertwined with the instruments of power of the colonial state?

The existing scholarship about environmental narratives in French Algeria hinges around four main arguments. The first, which has been excellently pictured by Diana K. Davis, is that there existed a dominant belief among the French that the Arab invasion of North Africa had prompted colossal environmental change, leaving large parts of the territory arid and ostensibly infertile.[5] Algeria's pastoral and largely Arab population, with its supposedly destructive land use practices, was particularly held responsible for the deforestation and desertification at a grand scale, as Henry Sivak and Caroline Ford have demonstrated.[6] The second element is the invocation of the Roman history of the region, which loomed large in French environmental histories and often praised the agricultural abundance and lush forests that supposedly existed under Roman rule.[7] Thirdly, the French drew an image of themselves as the rightful inheritors of the land, who were best suited to restore the region to its former Roman splendour.[8] Finally, the extant scholarship suggests that constructed environmental histories and narratives were linked to colonial power and justified the manifold material trajectories along which the colonial state was expanded, consolidated and contested.[9] By characterising French environmental discourses of Algeria as symptomatic of 'eco-governmentality', Davis has suggested that the ways in which natural resources figured in colonial discourses may confer valuable insights about the environment as part of colonial power constellations.

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[3] Brock Cutler has looked into interventions in Algiers' urban water provision in the nineteenth century as part of efforts to turn the colonial capital into a profoundly modern city: Brock Cutler, "Imperial Thirst: Water and Colonial Administration in Algeria, 1840-1880," *Review of Middle East Studies* 44 (2010), 167-175.

[4] Diana K. Davis has suggested that French discourses of Algeria's environment, together with their material repercussions, constituted a form of 'eco-governmentality' or 'environmental governmentality' as I will term it in the remainder of this study. Diana K. Davis, "Eco-Governance in French Algeria: Environmental History, Policy, and Colonial Administration," *Proceedings of the Western Society for French History* 32 (2004), 328-345.

[5] Davis, "Eco-Governance," 339;

[6] Davis, "Desert 'Wastes'," 366-367.

[7] Davis, *The Granary of Rome*.

[8] Patricia Lorcin, "Rome and France in North Africa: Recovering Algeria's Latin Past," *French Historical Studies* 25, no. 2 (2002), 295-329.

[9] Davis, "Desert 'Wastes'," 368; Ford, "Reforestation," 351.

Much scholarship on techniques of power and systems of order in European colonies has failed to take into account the pre-eminence of relations between colonial subjects and the natural environment. Likewise, unlike the many studies on irrigation and hydraulic engineering in imperial India, the association between colonial imaginations of water and state power have been left unaddressed in the literature about French Algeria. I employ the concept of 'environmental governmentality' – as a synonym of eco-governmentality – as a theoretical lens to understand how knowledge production, environmental discourses and modern forms of state power are enmeshed. By shifting the focus to water in the French Algerian context, this study contributes to the existing scholarship in three important ways. First, it adds to our understanding of previously studied colonial environmental narratives, as it demonstrates how a crucial yet understudied resource figured in invented environmental histories of the region. In addition, the study elucidates the particularities of French hydrological narratives about Algeria, thus expanding our knowledge of imperial imaginations of water. Second, this research aims to reveal how hydrological discourses, scientific knowledge and colonial power were intertwined in French Algeria. As such, it contributes to a comprehension of how discourses about the environment and particular imaginations of 'nature' interacted with the formation of modern state power. It highlights how an integration of Foucauldian theories of modern state power and natural resource politics can be employed to explain in which ways colonial state-building and resource extraction were entangled. Hence, the findings also add to a burgeoning body of scholarship on water politics in colonial societies, which to date has been dominated by discussions of water in British India.[10] Finally, even though it is concentrated on hydrological discourses and policies in the nineteenth century, this study contributes to an understanding of the roots of 'hydro-modernities' that came to full fruition throughout the twentieth century.[11] I will demonstrate that the intellectual and discursive basis for an imagination of water in colonial Algeria that emphasised a neglected and degenerate hydrology, had been laid in the first decades after the French occupation. As such, my analysis offers a much-needed contextualisation of twentieth century discourses of hydrological development by elucidating its roots in particular colonial and Orientalist imaginations of water and water infrastructure.

The corpus of primary sources in this study consists primarily of scientific publications in the field of geology and geography, comprehensive encyclopaedias, scientific reports, and other relevant publications by French government institutions. These sources enable both the reconstruction of a hydrological discourse about Algeria and the mapping of its materialisation in the form of hydraulic infrastructure. My focus is on material published between 1850 and the fin de siècle, as it was during

[10] See, for example, John Broich, "Engineering the Empire: British Water Supply Systems and Colonial Societies, 1850-1900," *Journal of British Studies* 46, no. 2 (2007), 346-365; Rohan D'Souza, Water in British India: The Making of a 'Colonial Hydrology', *History Compass* 4, no. 4 (2006), 621-628.

[11] Erik Swyngedouw, *Liquid Power: Contested Hydro-Modernities in Twentieth-Century Spain* (Cambridge, MA: MIT Press, 2015).

this time that Algeria experienced the first wave of vigorous land use transformations and expansion of colonial power in all its manifestations.[12] Importantly, this period witnessed the emergence of a broader French environmental narrative, as Diana Davis has laid out, and simultaneously gave rise to a first 'generation' of French hydraulic politics in North Africa. The majority of the primary material has been retrieved from the collections of the *Bibliothèque Nationale de France* (BNF) in Paris, who have made a tremendous body of sources digitally available. In addition, I am thankful to the digital collections of the Harvard University Library and the British Library. Initially, my intention was to corroborate the corpus of scientific and administrative publications with archival material of the French colonial authorities and relevant metropolitan ministries, to develop a more in-depth understanding of the decision making processes behind colonial hydraulic policies. Material limitations, however, withheld me from accessing the *Archives Nationales d'Outre-Mer (ANOM)* in Aix-en-Provence adjoining the Mediterranean, where the vast majority of Algeria-related material is held and whose collections have only scarcely been digitised and made public. Nevertheless, extensive secondary writings by colonial engineers and administrators proved adequate to draw an ornate picture of scientific and technological intervention in Algeria's hydrology in the second half of the nineteenth century.

I made an initial comprehensive selection of primary sources from the second half of the nineteenth century based on search queries associated with Algeria's hydrology and hydraulic infrastructure in the *Gallica* digital catalogue of the BNF, followed by a further selection of sources using a snowballing approach. Of great value has also been Justin Savornin's overview of geological scholarship in Algeria and North Africa, especially for identifying relevant source material on underground hydrology in the Algerian Sahara. Through a close-reading of the sources, I have identified and synthesised emergent themes, together comprising the dominant aspects of a French hydrological discourse. In the second step, I have studied what material implications followed from narratives about water, particularly with respect to government policies and infrastructure projects aimed at restoring Algeria's hydrological abundance through technological and institutional interventions. Translated quotations have been translated from French by me, unless stated otherwise in the notes.

Even though the objective of the study is to outline French hydrological discourses and related French colonial policies, the overall absence of indigenous voices in the selection of primary material hinders a more detailed understanding of the impacts of French policies on socio-environmental relations and their contestations. When it comes to the regulation of water-society relations, as I will develop further in the first chapter, the examination of subjectivities is crucial to draw a comprehensive

[12] On land use transformation in nineteenth century Algeria and the subsequent transfer of indigenous lands to the colonial state and private landowners, see for example André Nouschi, *Enquête sur le niveau de vie des populations rurales constantinoises de la conquête jusqu'en 1919* (Paris: Presses universitaires de France, 1961); Charles-André Julien, *Histoire de l'Algérie contemporaine* (Paris: Presses universitaires de France, 1964); James McDougall, *A History of Algeria* (Cambridge: Cambridge University Press, 2017).

image of how existing relations changed over the course of colonial intervention. I witnessed that every now and then, French authors do include Algerian voices in their writings, but it should generally be assumed that these were advantageous to colonial objectives. Overall, the source material does provide a good sense of how French hydrological policies were at least striving to affect 'environmental subjectivities' and the relations between water and colonial subjects, but it is key to keep in mind Ann Laura Stoler's assertion that archives are active sites of knowledge production that mirror colonial power hierarchies.[13]

In what follows, I will first embed the study in the scholarship on environmental history and discourses in colonial Algeria and establish the theoretical foundation by discussing how the notion of 'environmental governmentality' can be envisaged within a context of colonial power. Starting from a discussion of Foucault's concept of 'governmentality', I outline how previous authors have proposed to incorporate nature and the environment into Foucault's theories of modern state power. Furthermore, I touch upon theories of colonial knowledge production and the conceptual linkages between water as a socio-cultural phenomenon and colonial power. The second chapter discusses the institutional foundations that facilitated the introduction of new hydrological discourses in Algeria after the French occupation. By tracing how French hydrological scholarship emerged in Algeria and was intimately tied to political and economic objectives of colonial and metropolitan institutions, I demonstrate how new, disruptive forms of studying and representing water entered colonised Algeria. The particular hydrological discourse which emerged in the second half of the nineteenth century is the subject of the third chapter. Here I identify some of the most recurring themes in French discourses about Algeria's water resources, revealing how Algeria's hydrology was often perceived as different, unpredictable and in need of restoration to serve the agricultural development of the colony. These narratives consequently called for French hydrological intervention and took the Roman occupation as a model. Furthermore, this chapter suggests a clear awareness in nineteenth-century France that water and hydraulic infrastructure could profoundly serve political goals and effect societal changes. In the final chapter, I am concerned with the material ramifications that these discourses gave rise to or legitimised, and argue that in the decades following the occupation, the French made a first attempt at instituting a 'hydraulic politics' in Algeria. By constructing large-scale storage dams and irrigation canals and establishing wells across the Sahara, the French brought about vast socio-environmental changes that preluded the more systematic and even grander hydraulic engineering of the twentieth century.

[13] Ann Laura Stoler, "Colonial Archives and the Art of Governance," *Archival Science* 2 (2002), 87.

CHAPTER I

COLONIAL ENVIRONMENTAL DISCOURSES AND THE REGULATION OF SOCIO-ENVIRONMENTAL RELATIONS

The objective of this thesis is to study how knowledge production, water and colonial power were entangled in nineteenth century French Algeria. This chapter opens with a discussion of the existing scholarship on environmental discourses in colonial Algeria, particularly with regard to the supposed deterioration of Algeria's environment as a result of deforestation and pastoral land habits. Starting from Diana K. Davis' suggestion that these discourses represented a form of environmental governmentality, I then embark on a discussion of Foucault's theory of 'governmentality' as a way of tracing how modern forms of state power came into being. Subsequently, I discuss the work of a number of scholars who have argued that Foucault's concept lacks an adequate engagement with nature – or 'territory and its qualities' in Foucault's own words. As such, these authors have expanded Foucault's concept to account for the relations between subjects and the environment as a crucial part of modern political rationalities and the establishment of systems of knowledge production that have allowed the naturalisation of specific 'truths' about nature. In addition, I engage with theories of colonial environmental epistemologies and their general tendency to dismiss existing forms of knowledge production while introducing 'rational', scientific regimes of truth about nature. What emerges is a theoretical framework that explains the dialectical interactions that I am concerned with in the remainder of this thesis: those between knowledge production, environmental discourses and the establishment of a colonial state apparatus in nineteenth-century French Algeria. In the latter part of the chapter, I demonstrate how political ecologists have previously applied a similar lens to the study of water in colonial and imperial contexts. As such, the concept of environmental governmentality can be narrowed down to elucidate relations between colonial power, colonised subjects and the socio-cultural production of this fluid resource.

Imagined environmental histories

We owe much to the geographer Diana K. Davis for the most comprehensive writings on French environmental discourses of Algeria.[14] Central to Davis' work is the argument that an anachronistic narrative about Algeria's environmental history was construed in the decades following the French occupation. She argues that this narrative was a 'declensionist' environmental narrative, as it was premised on the assumption that the condition of Algeria's natural environment had severely declined

[14] Diana K. Davis, "Desert 'Wastes' of the Maghreb: Desertification Narratives in French Colonial Environmental History of North Africa," *Cultural Geographies* 11 (2004).

after the Roman era, and specifically after the Arabs had conquered the region.[15] An often reiterated myth at the time was that Algeria, and North Africa more broadly, had once functioned as the 'granary of Rome' which was subsequently destroyed by the hostility and environmental indifference of the pastoral Arabs and their flocks. The supposed deterioration of Algeria's environment was thus ascribed to civilisational decay and collapse.[16] The French narrative predominantly depicted indigenous land use systems as irrational and destructive, and hence in need of improvement, correction and regulation. Davis shows that the majority of these nineteenth century assumptions about Algeria's environment have now been refuted and that both the 'granary myth' and the supposed environmental destruction were inaccurate.[17]

In reconstructing this narrative, Davis pays particular attention to the role of forests and pastoralism. As outlined by Caroline Ford, the French imagined Algeria to have been covered by dense forests in the past and argued that indigenous land use habits, and particularly those of the 'uncivilised' Arab nomads, were responsible for the large-scale deforestation. Forests, in turn, were associated with Biblical imaginations of untouched and fertile lands and reforestation became a principal occupation for the colonial authorities. Ford argues that this justified the dispossession of indigenous pasture lands, the criminalisation of existing relations with the forest and the subsequent transfer of land and forests into the hands of the colonial state and private landowners.[18] Correspondingly, Henry Sivak argues that in the 1860s and early 1870s, forest fires were seen as a consequence of harmful indigenous land use practises such as controlled burning, and as acts of sabotage against the colonial state. French settlers and forestry companies conflated their fear of forest fires with a general sentiment of territorial insecurity to demand reforms of property rights and exclusive control over the land concessions awarded to them by the state. The colonial authorities eventually responded by cementing the private property rights of French settlers and intensifying the regulation and criminalisation of indigenous uses of the forest.[19] Forests were expropriated in great numbers from forest-dwelling communities and were conceded to French private businesses and the French subsequently applied the French forest code to Algeria.[20] According to Prochaska, pasturing livestock and cutting firewood were criminalised and

[15] Diana K. Davis, "Eco-Governance in French Algeria: Environmental History, Policy, and Colonial Administration," *Proceedings of the Western Society for French History* 32 (2004), 339.

[16] Diana K. Davis, *Resurrecting the Granary of Rome: Environmental History and French Colonial Expansion in North Africa* (Athens OH: Ohio University Press, 2007).

[17] Davis, "Desert 'Wastes'," 372-374.

[18] Caroline Ford, "Reforestation, Landscape Conservation, and the Anxieties of Empire in French Colonial Algeria," *The American Historical Review* 113 (2008), 351.

[19] Henry Sivak, "Legal geographies of catastrophe: forests, fires and property in colonial Algeria," *Geographical Review*, 103 (2013), 556-563.

[20] David Prochaska, "Fire on the mountain: resisting colonialism in Algeria," in *Banditry, Rebellion and Social Protest in Africa,* ed. Donald Crummey (London: James Currey, 1986), 233.

thousands of Algerians were fined by the forest service for violating the forest code and in some cases land was confiscated as a form of collective punishment.[21]

Within the narratives that Davis describes, French *colons* were deemed capable of restoring Algeria's former Roman glory and of developing a fertile Mediterranean colony suitable for French and European settlement. To that end, according to Jennifer Sessions, a 'fertility myth' was constructed and disseminated among the French population by colonial officials and advocates of colonisation. Emigrant handbooks and guides were published in the first decades of the occupation to spread a pastoral vision of a fertile and highly cultivable land to attract prospective emigrants to the colony, whose European settler population was growing at a moderate pace in those early years.[22] Davis argues that one of the implications of the declensionist environmental narrative was the production of racial and ethnic hierarchies in which some – especially French, but also some indigenous – bodies were deemed guardians or stewards who could help revive the environment's former glory, whereas others were portrayed as irrational and backwards and therefore destructive to the landscape. The environmental narrative specifically inspired an anti-nomad sentiment which led to a systematic and dogmatic policy to pacify and forcefully sedentarise the nomadic populations of colonial North Africa.[23] As the nomadic communities and their herding practises were held responsible for the destruction of forests and the acceleration of desertification, the desire to control their relation to the environment in part justified the enforcement of laws that served the French imperial ambitions of gaining control over land, resources and the indigenous population.[24] As both Ford and Sivak suggest, the dominant environmental narrative therefore had very material repercussions based on these constructed hierarchies within which French colonists were depicted as the principle guardians that could recover the 'granary of Rome'. Davis situates this environmental narrative explicitly in the context of the birth of a colonial capitalist state that the French envisaged in nineteenth century Algeria and argues that the 'declensionist' narrative served the "appropriation of land and resources, social control (including the provision of labour), and the transformation of subsistence production into commodity production."[25] Davis notes that, together, this environmental discourse and its material ramifications could be understood as a manifestation of Michael Goldman's 'eco-governmentality'.[26] Eco-governmentality or environmental governmentality, as I will name it in the remainder of this thesis, evolved from a critique of Foucault's theory of governmentality and forms the theoretical backbone of this study.

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[21] *Ibid*., 235; 244-245.

[22] Jennifer Sessions, *By Sword and Plow: France and the Conquest of Algeria* (Ithaca, NY: Cornell University Press, 2011), 218.

[23] Davis, "Desert 'Wastes'," 366-367.

[24] *Ibid.*, 368; Ford, "Reforestation," 351.

[25] Davis, "Eco-Governance," 339.

[26] *Ibid.*, 329.

Foucault's governmentality

Michel Foucault developed his concept of governmentality principally in his lecture series at the *Collège de France* in Paris in 1977 and 1978.[27] By tracing the historical development of governmentality, his main argument was that in Europe between the sixteenth and nineteenth centuries, a major shift took place with regards to the question of 'how to rule'. The shift that took place was from a problematic of 'sovereignty' to a problematic of 'governmentality'. According to Foucault, the first is premised on the idea that the sovereignty of the Prince is exercised on a territory and the subjects who inhabit that territory, which meant that territory was the principle target of power in a Machiavellian understanding of rule. Then from the sixteenth century onwards, this target of power changed with the onset of the debate that ultimately began to define government as 'the right disposition of things'. Government from this perspective was no longer principally directed at protecting the fragile connection between the Prince and his principality, but instead became concerned with what Foucault terms 'a sort of complex composed of men and things'. He argues that "the things with which in this sense government is to be concerned are in fact men, but men in their relations, their links, their imbrication with those other things which are wealth, resources, means of subsistence, the territory with its specific qualities, climate, irrigation, fertility, etc."[28] In this complex of men and things which becomes central to this new form of government, the state is no longer essentially defined by "its territoriality, by the surface occupied" but by "the mass of the population, with its volume, its density, and, for sure, the territory it covers, but which is, in a way, only one of its components." Foucault thus stresses that although the territory covered by the population is part of the new regime which operated principally through techniques of government, property and territory are only two of the many variables in the relation between men and things that was to be regulated by the state.[29]

With this transformation of political rationality, new objectives as well as instruments to achieve them entered the realm of the state. Sovereignty's end was chiefly the submission to this very sovereignty, and its instruments took the shape of the laws that were to be obeyed by the population. Now government, considered as the correct manner of disposing things, came to possess a plurality of objectives and finalities with a range of instruments and techniques to achieve them. Government became a question not of imposing the law on men, but of employing tactics rather than laws in order

[27] Previously, many of Foucault's ideas on his concept of governmentality were mostly handed down through interviews and lecture notes. In 2009 Michel Senellart published an edited book that bundled Foucault's lectures on the topic at the Collège de France: Michel Foucault, *Security, Territory, Population. Lectures at the Collège de France, 1977-78*, ed. Michel Senellart (London: Palgrave Macmillan, 2009).

[28] Michel Foucault, "Governmentality," in *The Foucault Effect: Studies in Governmentality*, ed. Graham Burchell, Colin Gordon and Peter Miller (Chicago: The University of Chicago Press, 1991), 93.

[29] Foucault, *Security, Territory, Population*, 97.

to arrange things in such ways that a multitude of ends could be accomplished.[30] Foucault finally defines governmentality as

> the ensemble formed by the institutions, procedures, analyses and reflections, the calculations and tactics that allow the exercise of this very specific albeit complex form of power, which has as its target population, as its principal form of knowledge political economy, and as its essential technical means apparatuses of security.[31]

For Foucault, it was with the onset of 'the problem of the population' that the historical conditions emerged for the displacement of the problematic of sovereignty by governmentality at the end of the eighteenth century. The population rather than the Machiavellian Prince became the principal focus of government, reflecting a political rationality that Foucault named 'biopolitics'. Through statistics, the state could now gain knowledge of the population's "regularities, its own rate of deaths and diseases, its cycles of scarcity, etc."[32] The new mechanisms and tactics of power associated with governmentality had by the nineteenth century become concerned with "administering life".[33] Together these transformed mechanisms of power constituted what Foucault termed 'biopower' or "a power that exerts a positive influence on life, that endeavours to administer, optimize, and multiply it, subjecting it to precise controls and comprehensive regulations."[34]According to Foucault, biopower, and its disciplining nature in particular, played a profound part in the development of capitalism, as it enabled "the controlled insertion of bodies into the machinery of production and the adjustment of the phenomena of population to economic processes."[35]

Governmentality and socio-environmental relations

One of the critiques of Foucault's governmentality thesis argues that he occasionally implied but did not adequately theorise the role that nature and 'territory' play in modern forms of power and in the genealogy of state rationality. It is sometimes argued that, even if Foucault himself attended predominantly to the problem of population, when the population emerged as the state's principle target of power, government became equally concerned with the question of the relationship between population and the availability of resources. Paul Rutherford maintains that with the emergence of the

[30] *Ibid.*, 95.

[31] *Ibid.*, 102-103.

[32] Foucault, "Governmentality," 99.

[33] Michel Foucault, *The History of Sexuality*, trans. Robert Hurley (New York: Pantheon Books, 1978), 139.

[34] *Ibid.*, 137.

[35] *Ibid*., 140-141.

problem of the population, "not only does the idea of a measurable and manageable population come into existence, but so also does the notion of the environment as the sum of physical resources on which the population depends."[36] One way to address this problematic is to expand Foucault's conceivably anthropocentric notion of biopower to account for its implications for non-human life and natural resources. In short, if the modern state's new objective was to govern the population by way of knowing its statistical trends, it necessarily had to produce knowledge of and administer the natural resources that sustain that population. Timothy Luke has attempted to stretch, or rather to substantiate, Foucault's notion of government as the conduct of a complex web of 'men and things', to account for the political agency of non-human and non-organic actors in the realm of political rationality. Luke adopts the concept of 'environmental governmentality' to refer to a set of practices concerned with "the exertion of control over the complex interrelations of humans and things", which pay particular attention to the interrelated activities of citizens and sovereigns in addition to "the not-citizen, non-organic, not-resident, or non-human elements of societies."[37] Michael Goldman's analogous notion of 'eco-governmentality' entails the process of "*making* […] the modern rational subject and the efficient state that s/he would help build" and the "intensified regulation of the relation of these subjects to their natural territory."[38] In a similar vein, Arun Agrawal's 'environmentality' is predominantly concerned with how "technologies of self and power are involved in the creation of new subjects concerned about the environment."[39] The concept of 'environmental governmentality' thus helps to eludicate how the state becomes concerned with administering and regulating the relations between the population and the natural resources it depends on. As such, it shapes the formation of rational subjects that relate to nature in a way that corresponds to the political and economic objectives of the state, just as Foucault hinted at the role of biopower in forming subjects that acted in accordance with capitalism's demands.

Yet even if the above-mentioned scholars have usefully reintroduced or expanded 'nature' and 'territory and its qualities' in Foucault's theories, Bruce Braun holds that these accounts tend to insufficiently engage with the fundamental ontological category of 'nature'. The result, according to Braun, was "that the cultural practices through which the land and territory took objective form remained

[36] Paul Rutherford, "The Entry of Life into History," in *Discourses of the Environment*, ed. Éric Darier (Oxford, Blackwell Publishers, 1999), 39.

[37] Timothy Luke, "Environmental Governmentality," in *The Oxford Handbook of Environmental Political Theory*, ed. Teena Gabrielson, Cheryl Hall, John M. Meyer and David Schlosberg (Oxford: Oxford University Press, 2016), 461.

[38] Michael Goldman, "Constructing an Environmental State: Eco-governmentality and other Transnational Practices of a 'Green' World Bank," *Social Problems* 48 (2001), 500-501.

[39] Arun Agrawal, "Environmentality: Community, Intimate Government, and the Making of Environmental Subjects in Kumaon, India," *Current Anthropology* 46 (2005), 166.

unthought."[40] 'Territory' – or nature if you will – appears in Foucault's work as an *a priori* or pre-existing category instead of culturally and socially contingent. Braun, rather, discusses the complex relationship between the social construction of nature and governmentality in the modern West and calls into question exactly how 'territory with its qualities' has come to be understood as "a given, [as] something that lies outside history."[41] The state and state power, he argues, "[do] not prefigure nature's 'simplification' so much as emerge concurrently with, and in a dialectical relation to, forms of knowledge like scientific forestry and geology."[42] Braun's work therefore helps to scrutinise how certain discourses of 'territory and its qualities' have emerged and have been naturalised while fundamentally shaping forms of state power. Importantly, Braun touches upon the role of knowledge production in the construction of 'nature' by establishing certain 'facts' and 'truths' about it, which are then naturalised as referents of a supposedly ahistorical natural environment. A 'regime of truth', according to Foucault, is the "ensemble of rules according to which the true and the false are separated and specific effects of power [are] attached to the true."[43] This notion can elucidate how the colonial state employs its techniques of power to instigate new understandings of the relation between subjects and nature that align with its political rationality and economic objectives.

Colonial environmental regimes of truth

Even though Foucault's concept of governmentality can be applied to colonial contexts and contribute to an understanding of how European colonial projects were politically organised, Braun stresses that in studying the colonial state, we should "recognise the concurrent presence of multiple modernities which cannot be conflated with a European norm."[44] To reckon with these parallel modernities, David Scott has sought to historicise the political rationalities that underpin European colonial power. According to Scott, colonial power operated "in such a way as to produce not so much extractive effects on colonial bodies as governing-effects on colonial conduct." What Scott terms 'colonial governmentality' was concerned with dismantling the conditions for non-modern forms of life while rearranging them in such a way as to discipline and compel subjects to behave in ways that are analogous to the political rationality of the colonial state.[45] One example is the attempt by the French colonial authorities in Algeria to "subject the forests to a full measure of Cartesian rationalization and control" as part of a more general

[40] Bruce Braun, "Producing vertical territory: geology and governmentality in late Victorian Canada," *Ecumene* 7 (2000), 12.

[41] *Ibid.*, 15.

[42] *Ibid.*, 41.

[43] Michel Foucault, "Truth and Power," in *Power/Knowledge: Selected Interviews and Other Writings, 1972-1977*, ed. Colin Gordon (New York: Pantheon Books, 1980), 132.

[44] Braun, "Vertical territory," 40.

[45] David Scott. "Colonial Governmentality," *Social Text* 43 (1995), 191-220.

tendency to rationalise and order socio-environmental relations in a colonial milieu.[46] Similarly, Timothy Mitchell argues in *Colonising Egypt* that during the British occupation, an attempt was made to actively instil in the Egyptian population the principles of order and techniques of power characteristic of the modern state. The regulation and disciplining of Egypt's social space, for instance through urban programming, came to be linked to individual discipline.[47]

Dismantling the conditions of colonised forms of life included the introduction of new regimes of truth. The anthropologist Bernard Cohn, for example, argued that imperial Britain did not only invade and conquer India in a territorial sense, but invaded an 'epistemological space' as well. During their conquest of India, the British employed their conventional forms of knowing and thinking in an attempt to comprehend the new world which they encountered.[48] In his genealogy of a 'forest environmentality', Agrawal pays detailed attention to the central role played by new forms of representation (numbers, measurements and statistics) in strategies of power/knowledge in the production and perception of forests in nineteenth century British India. Numerical representations and systematic classification of forests in turn reinforced technologies of government and helped the state to exercise control and govern at a distance. The making of forests, Agrawal argues, consisted of a 'double erasure': scientific and statistical representations displaced prior understandings and views of the forest, and statistics and numbers erased and reshaped the referents of previously existing ideas and perceptions.[49] By instigating new languages through which nature was to be imagined and known, imperial science and knowledge production were intimately tied to processes of colonial state-building and the regulation of socio-environmental relations.[50]

From the above, it becomes clear that the theory of environmental governmentality can be elaborated to account for the regulation of human-environment interactions within the context of a colonial political rationality. This is precisely what Orazio Irrera labels 'colonial environmental governmentality': a political rationality concerned with the "customary ways of life, regulating the

[46] Sivak, "Legal Geographies," 561.

[47] Timothy Mitchell, *Rule of Experts: Egypt, Techno-Politics, Modernity* (Berkeley: University of California Press, 2002), 67.

[48] Bernard S. Cohn, *Colonialism and its Forms of Knowledge: The British in India* (Princeton, NJ: Princeton University Press, 1996), 53.

[49] Agrawal, *Environmentality*, 34; 62.

[50] For more elaborate discussions of the intimations between science and empire, see Andrew Goss, *The Routledge Handbook of Science and Empire* (London: Routledge, 2021) and David Gilmartin, "Scientific Empire and Imperial Science: Colonialism and Irrigation Technology in the Indus Basin," *The Journal of Asian Studies* 53, no. 4 (1994), 1127-1149.

ecological exchanges between a local rural population and natural resources."[51] European colonial projects generally involved the implementation of a specific regime of truth with regard to nature, establishing what is regarded as true and false about it. Irrera asserts that the Western colonial regime of truth is premised upon scientific criteria aimed at manipulating nature in order to assure the exploitation of ecological resources for commercial ends. Colonial environmental governmentality therefore entails a regime of truth that serves the 'technical mastery of nature'.[52] Hydraulic engineering, as I discuss in the final section, became the ultimate embodiment of European empire's triumph over nature and the materialisation of a modern, imperial discourse of water.

Water and colonial governmentality

Although water has been scarcely addressed in previous studies on environmental discourses in French Algeria, a significant body of literature exists on the topic of modern hydrological discourses and water engineering in other imperial contexts. Linton argues that "[b]ringing water under epistemological and material control in colonial settings was a major imperial undertaking." Modern conceptions of water were imposed on people in the European colonies of the nineteenth and twentieth centuries. 'Imperial water', as Donald Worster calls it, profoundly affected the social relations that existed around water in these territories.[53] These existing indigenous relations with water were often replaced by colonial water discourses – "including the water control structures by which they achieved material from". The birth of hydrology as a discipline brought about the epistemological construction of the hydrologic cycle, a theoretical model which established the domain of water and nature separate from society. According to Linton, the hydrologic cycle represents water as a 'natural fact' that can be made readily available for human use."[54] Linton argues how modern science – and specifically the emergence of hydrology with its notion of the hydrologic cycle – established a scientific, abstract conception of water, deprived of its social, cultural and environmental meanings and contexts. By rendering water an abstract, readily available fact, modern society has given itself *carte blanche* to utilise it as it sees fit, by diverting, damming and manipulating water, seemingly without consequence. This was the kind of hydrological imagination that European colonial states introduced to the lands they colonised.

In the second half of the nineteenth century, new hydrology discourses emerged, including discourses of hydraulic engineering, which "translated 'nature' into mathematical formulae," advocating

[51] Orazio Irrera, "*Environmentality* and Colonial Biopolitics: Towards a Postcolonial Genealogy of Environmental Subjectivities," in *Foucault and the History of our Presence*, ed. Sophie Fuggle, Yari Lanci and Martina Tazzioli, 179-194 (Basingstoke: Palgrave MacMillan, 2015), 185.

[52] *Ibid.*, 185-186.

[53] David Worster, "Water in the Age of Imperialism – and Beyond," in *A History of Water Vol. 3*, ed. Terje Tvedt and Terje Oestigaard (London: I.B. Tauris, 2006), 13.

[54] Jamie Linton, *What is Water? The History of a Modern Abstraction* (Vancouver: UBC Press, 2010), 184.

an engineered hydraulics that could be imposed across the globe and that replaced local forms of hydrological knowledge. This mathematical view corresponds to Agrawal's writings on numerical and quantitative representations of nature in India. Central to European scientific hydrological discourses were hydraulic infrastructures that came to be seen as symbols of progress and the modern state's technological triumph over nature. Hydraulic engineering, including dams, canals and headworks, was among the most important 'tools of empire', as Daniel Headrick has termed them.[55] Such technological advances underpinned imperialism and contributed to the establishment of "European power through the command of nature."[56] Colonial hydrology thus introduced a new regime of truth about water, one that was devoid of the social and cultural values assigned to water previously. At the same time, modern hydrological discourses often simultaneously classified imaginaries of water that did not suit with these newly established discourses almost automatically as degenerate or in need of restoration. Yi-Fu Tuan has, for example, pointed out the northern temperate bias that is ingrained in the modern scientific notion of the hydrologic cycle.[57] Landscapes and hydrological systems that were contrary to such an imaginary of water, in particular deserts and arid lands, were and are often portrayed as "barren, poor, uncivilized places that must be hydraulically re-engineered in order to be made civilized."[58] Such hierarchical discourses, which in the words of Linton are reminiscent of a sort of 'hydrological Orientalism', have motivated and legitimised material interventions in colonial landscapes, based on modern perceptions of water.[59] Summing up the theoretical discussion that I have attempted to delineate in this chapter, John Broich argues that the deeper effect of hydraulic engineering projects across the British empire was to "modify native people's behaviour, to guide and, as traditional water sources disappeared, to indirectly enforce behaviour that the colonial state defined as 'civilized' or modern."[60]

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As Diana K. Davis has suggested, French 'declensionist' environmental discourses were interlinked with material policies aimed at regulating the relations between colonial subjects and their natural environment. The above discussion outlines how such dialectical interactions could be theorised. I

[55] Daniel Headrick, *The Tools of Empire: Technology and European Imperialism in the Nineteenth Century* (New York: Oxford University Press, 1981).

[56] Worster, "Water in the Age of Imperialism," 9.

[57] Yi-Fu Tuan, *The Hydrologic Cycle and the Wisdom of God: A Theme in Geoteleology* (Toronto: University of Toronto Press, 1968).

[58] Linton, *What is Water?*, 123.

[59] *Idem.* See also Suzana Sawyer and Arun Agrawal, "Environmental Orientalisms," *Cultural Critique* 45 (2000), 71-108. Sawyer and Agrawal discuss how colonial imaginations of nature legitimised and motivated the exploitation of colonised bodies and lands.

[60] John Broich, "Engineering the Empire: British Water Supply Systems and Colonial Societies, 1850-1900," *Journal of British Studies* 46, no. 2 (2007), 363.

demonstrated how Foucault's concept of governmentality can be rethought by expanding his category of 'territory and its qualities' in its relation to techniques of government. Even though Foucault argued that 'territory and its qualities' are one of the components within the complex scheme of 'men and things' that government concerns itself with, a number of authors have pointed out that he did not engage thoroughly with the relation between the environment, population and power. By putting the relation between subjects and their natural environment at the centre, environmental governmentality offers a theoretical lens to study how natural resources and state power are intertwined. At the same time, Braun emphasises the socio-cultural contingency of knowledge production about nature, suggesting that exactly how nature is made intelligible matters for the ways in which the state shapes and regulates the relations between subjects and natural resources. Particularly in a colonial context, environmental governmentality often works by introducing environmental discourses that operate as new regimes of truth about nature, while displacing or erasing existing epistemologies. Newly introduced forms of knowing and representing nature in turn enable the state to better regulate the relations between subjects and the environment. This explains how narratives about forests in French Algeria, as discussed by Sivak and Ford, were translated into tangible environmental policies that supplanted existing uses of and relations with the forest. In a similar vein, the hierarchical nature of French environmental discourses is explained by Scott's assertion that a colonial form of governmentality is premised upon the dismissal of 'non-modern' forms of life, inter alia, pastoral land use practices in Algeria that were labelled as backwards and destructive. Likewise, colonial and imperial discourses of water, as Worster points out, introduced new hydrological imaginations and inaugurated a revision and reorganisation of existing social relations around water. This theoretical discussion informs the structure of the remainder of the study, in which I elucidate how discourses about water in French Algeria were associated with colonial forms of governmentality. I consecutively discuss the development of an imperial apparatus of hydrological knowledge production in Algeria, the specific discourses emerging from this new scholarship, and the materialisation of French imaginations of Algeria's hydrology.

CHAPTER II

‘EPISTEMOLOGICAL EXPANSION’: INTRODUCING NEW WAYS OF KNOWING AND SEEING WATER

> If the Algerian soil is in need of colonisers who cultivate and develop it, then the intellectual domain requires, for its part, labourers who lead discoveries, utilise the gathered material and build an institution [of knowledge] beyond all its predecessors.[61]

The establishment of a French agricultural settler colony in Algeria required the unremitting manual labour of European colonisers – and a far greater indigenous labour force – to revive a once allegedly fertile and abundant land. But, as François Charveriat, a professor at the *École de droit* in Algiers, wrote in the annual school report of 1886-1887, this painstaking work in the field demanded an equivalent endeavour by scholars and scientists in the academies. The colonisation of Algeria first by military conquest and then by expanding agricultural and industrial exploitation had to be sustained by particular forms of knowledge pertaining to a territory previously largely unknown to its colonisers. As Bernard Cohn noted, colonial territorial expansion in the nineteenth century was necessarily accompanied by forms of epistemological expansion and conquest.[62] The main objective of this chapter is to explore how knowledge production about water and the facilitation of new articulations of the conquered territory developed alongside France’s military expansion in Algeria. While the French imagination of the land had been nourished by earlier, mostly eighteenth century travel reports, new perceptions of the colony’s water resources after 1830 were increasingly fed by scientific missions and expeditions directed by the military government or metropolitan institutions. Hydrological knowledge production, as an offshoot of geology and geography, retained a strong connection to territorial expansion in Algeria and was deemed pivotal to the political and economic objectives of the French state. Throughout the nineteenth century, military expansion made accessible a growing part of the territory to scientists and engineers, who in turn rendered it legible for the state by transferring new modes of representation from the metropole. Beginning with the multidisciplinary *Mission Scientifique* in the 1840s, I will argue that French

[61] As cited by Jean Mélia in *L’Épopée Intellectuelle de l’Algérie: Histoire de l’Université d’Alger* (Algiers: La Maison des Livres, 1950): “Si le sol algérien a besoin de colons qui le défrichent et le mettent en valeur, le domaine intellectuel réclame, de son côté, des travailleurs qui poussent les découvertes, utilisent les matériaux accumulés et construisent un édifice en dehors de tous les modèles.”

[62] Bernard S. Cohn, *Colonialism and its Forms of Knowledge: The British in India* (Princeton, NJ: Princeton University Press, 1996), 53.

geological and hydrological knowledge over the course of the nineteenth century forged a 'modern colonial' vision of water, increasingly articulated in a mathematical and quantitative language.

The early years of occupation and the *mission militaro-scientifique*

In the early nineteenth century, the main sources of environmental knowledge about Algeria were classical texts and early modern travel accounts. As Jennifer Sessions notes, these sources stood at the basis of what she terms the 'fertility myth', or the widespread narrative that North Africa had once been blessed with an unparalleled fertility.[63] Books such as the French translation of *Travels, or Observations Relating to Several Parts of Barbary and the Levant* by the English physician Thomas Shaw, fed nineteenth century perceptions of Algeria's agricultural abundance.[64] Shaw's observations of water resources in the Sahara spurred calls by later French scientists for further geological and hydrological explorations in the wake of the French occupation.[65] Probably not by coincidence, Shaw's travel account from 1738 was republished in French in 1830, the year that France launched its military occupation of Algeria. In June 1830 the government of the Bourbon king Charles X dispatched a military expedition across the Mediterranean to occupy the city of Algiers, until then ruled by Husayn Dey. The king's decision was motivated by an attempt to both bolster domestic support for the monarchy and enhance France's international standing.[66] The occupation of Algiers was followed by a 'period of uncertainty' and chaos, during which the French remained undecided over the sort of colonial rule they envisioned and the extent of the territory they expected to bring under their control. In July 1834, a royal decree delegated the government to a military governor-general who would be answerable to the Ministry of War, in effect formalising the military administration of occupied Algeria.[67] By the end of the first decade after the invasion, when the French had laid siege to all the major port cities along the

[63] Jennifer Sessions, *By Sword and Plow: France and the Conquest of Algeria* (Ithaca, NY: Cornelll University Press, 2011), 208-209; Diana Davis, *Resurrecting the Granary of Rome: Environmental History and French Colonial Expansion in North Africa* (2007), 16-23; Patricia Lorcin, "Rome and France in North Africa: Recovering Algeria's Latin Past," *French Historical Studies* 25, no. 2 (2002), 297-299.

[64] Thomas Shaw, *Voyage dans la régence d'Alger, ou Description géographique, physique, philologique, etc. de cet état*, trans. Jacques MacCarthy (Paris: Marlin, 1830). Thomas Shaw's *Travels, or Observations relating to several parts of Barbary and the Levant* was published in English in 1738 and first translated into French in 1743.

[65] Jean-Baptiste Élie de Beaumont, "Instructions pour la géologie," *Comptes rendus hebdomadaires des séances de l'Académie des sciences* 7, no. 1 (1838), 148.

[66] For a discussion of the political motivations behind the French monarchy's decision to invade and occupy Algiers, see James McDougall, *A History of Algeria* (Cambridge: Cambridge University Press, 2017) or Charles-Robert Ageron, *Histoire de l'Algérie Contemporaine* (Paris: Presses Universitaires de France, 1990), 50-52.

[67] McDougall, *A History of Algeria*, 58.

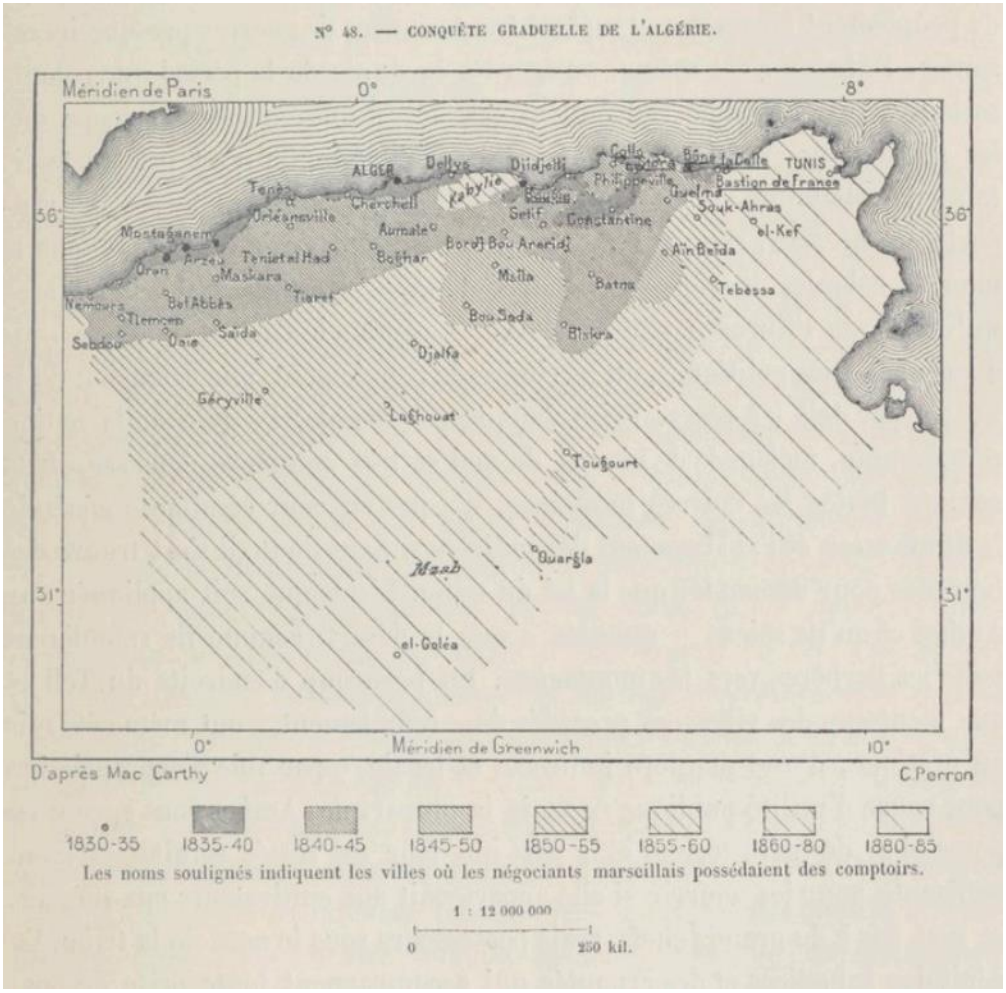

Figure 2.1. C. Perron. *Conquête graduelle de l'Algérie* (Gradual conquest of Algeria). Published in Elisée Reclus, *Nouvelle géographie universelle: la terre et les hommes*, vol. 11 (Paris: Hachette et Cie, 1886), 295.

Mediterranean and overthrown the cities of Constantine and Sétif (Fig. 2.1), appeals arose in France for the establishment of a scientific mission to study the newly acquired territory.[68]

Accordingly, the *Commission d'Exploration Scientifique d'Algérie* was established in 1839, which was put in charge of arranging a scientific expedition in the form of what Bernard Lepetit termed a *mission militaro-scientifique*.[69] The Algerian mission explicitly followed the example of Bonaparte's grand scientific survey of Egypt, when a military expedition was likewise accompanied by a flock of *savants* and artists. The affiliation between cultural and scientific knowledge and power politics

[68] *Ibid*., 68.

[69] Bernard Lepetit, "Missions scientifiques et expéditions militaires: remarques sur leurs modalités d'articulation," in *L'Invention Scientifique de la Méditerranée*, ed. Marie-Noëlle Bourguet, Bernard Lepetit, Daniel Nordman and Maroula Sinarellis (Paris: Éditions de l'École des Hautes Études en Sciences Sociales, 1998), 97.

presaged by the Egyptian expedition loomed large in the Algerian mission four decades later.[70] The expedition had a multidisciplinary nature and was aimed at gathering geological, geographical, medical and botanical as well as linguistic and archaeological knowledge. The *Commission* had a specific mandate to direct research into Algeria's hydrological resources and to collect information on the current state of irrigation systems and the potential for hydropower, river navigation and modern irrigation infrastructure.[71] In the instructions for the expedition, the geologist Jean-Baptiste Élie de Beaumont recalled Shaw's observations about groundwater reserves in the Sahara and noted that he could not recommend enough to the commission member who would be in charge of geology to dedicate himself to retrieving these aquifers.[72]

The expedition generated 39 comprehensive volumes of results, published over the course of more than two decades.[73] One of these was Henri Pellissier's *Mémoires historiques et géographiques sur l'Algérie*, published in 1844, which is an extensive historiography of the ancient geography of the region, including ancient geographical descriptions of rivers by classical authors such as Pliny and Strabo.[74] Lengthy accounts of Algeria's contemporary hydrological system, its rivers and artesian wells, appeared in Ernest Carette's *Recherches sur la géographie et le commerce de l'Algérie méridionale* from the same year.[75] Émilien Jean Renou, the mission's geologist and meteorologist who published his observations of the mission in 1848, was attentive to water sources, waterways and different sorts of wells, as well as to hydropower and the desiccation of marshlands, which in his eyes were indispensable to facilitate the establishment of French settlements.[76] Even though the scientific survey of Algeria far from equalled the infamous Egyptian expedition in terms of its grandeur or the results that were accomplished, it nevertheless laid the intellectual and institutional groundwork for knowledge production in Algeria in subsequent decades. Michael Heffernan notes that in the decades following the expedition, a lot of the fieldwork carried out in Algeria largely drew upon these early publications and

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[70] Charles Coulston Gillispie, "Scientific Aspects of the French Egyptian Expedition 1798-1801," *Proceedings of the American Philosophical Society* 133, no. 4 (1989), 473.

[71] In an 1838 letter to the Minister of War, colonel Bory-de-Saint-Vincent listed that the expedition members should bring "proper instruments to unearth from the arid soil [water] sources that must surely circulate in its depths." Jean-Baptiste-Geneviève-Marcellin Bory-de-Saint-Vincent, *Note sur la commission exploratrice et scientifique d'Algérie: présentée à Son Excellence le Ministre de la Guerre par le Colonel Bory-de-Saint-Vincent* (Paris: Imprimerie de Cosson, 1838), 19.

[72] Jean-Baptiste Élie de Beaumont, "Instructions pour la géologie," 148.

[73] Michael Heffernan, "An imperial utopia: French surveys of North Africa in the early colonial period," in *Maps and Africa*, ed. J. Stone (Aberdeen, Aberdeen University African Studies Group, 1994), 84-107.

[74] Henri Pellissier, *Mémoires historiques et géographiques sur l'Algérie* (Paris: Imprimerie Royale, 1844).

[75] Ernest Carette, *Recherches sur la géographie et le commerce de l'Algérie méridionale* (Paris: Imprimerie Royale, 1844).

[76] Émilien Jean Renou, *Géologie de l'Algérie* (Paris: Imprimerie Nationale, 1848).

therefore "invariably reinforced the same assumptions and values," particularly the assumptions about Algeria's fertile Roman era.[77] Furthermore, the interdependence of knowledge production and military objectives portended the character of later scientific endeavours in nineteenth-century Algeria.[78]

Geography, geology and the colonial political economy

> If one wants to have a good impression of the region that we want to bring under civilisation, one has to know its configuration, its soil, its climate, its production.[79]

In his 1853 study of the colonisation of Algeria, The naturalist Thémistocle Lestiboudois assumed an explicit connection between France's civilising mission, colonial expansion and the production of knowledge. To colonise a territory and to impose French civilisation onto its population was, in the eyes of Lestiboudois, clearly linked to the production of knowledge of that very territory and its qualities. Lestiboudois' credo came true as the middle of the nineteenth century, when the early decades of the occupation gave way to an increasingly institutionalised and 'orderly' era, witnessed the emergence of a network of scholars and a blossoming of scientific research in Algeria.[80] A decade before Lestiboudois' publication, Algeria's urban centres had been brought under French military control. In 1848, after nine years of 'total' conquest under general Thomas-Robert Bugeaud, accompanied by a structural policy of raids and ecological devastation, the French had defeated the armed resistance led by the religious and military leader Abd al-Qadir. In the same year, The Second Republic's constitution proclaimed that Algeria became an integral part of France and would be divided into three *départements*.[81]

In the nineteenth century, before the discipline of hydrology had been neatly demarcated, the study of freshwater operated largely under the wings of geography and geology.[82] Hydrological studies were especially conducted by engineers concerned with the mathematical study of water flows and the

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[77] Michael J. Heffernan, "A State Scholarship: The Political Geography of French International Science during the Nineteenth Century," *Transactions of the Institute of British Geographers* 19 (1994), 37.

[78] Numa Broc, "Les grandes missions scientifiques françaises au XIXe siècle (Morée, Algérie, Mexique) et leurs travaux géographiques," *Revue d'histoire des sciences* 34 (1981), 319-320.

[79] Thémistocle Lestiboudois, *Voyage en Algérie, ou Études sur la colonisation de l'Algérie* (Lille: L. Danel, 1853), 131: "Si l'on veut avoir une idée nette de la région que, nous voulons rendre à la civilisation, il faut connaître sa configuration, son sol, son climat, ses productions."

[80] See, for example, Pauline Romera-Lebret and Norbert Verdier, "Faire des sciences en Algérie au XIXe siècle: individus, lieux et sociabilité savante," *Philosophia Scientiæ* 20, no. 2 (2016), 33-60.

[81] McDougall, *A History of Algeria*, 73.

[82] For a detailed overview of geological studies on Algeria published between 1830 and 1930, see Justin Savornin, *La géologie algérienne et nord-africaine depuis 1830* (Paris: Masson et Cie, 1931).

correction of supposed irregularities in the hydrological system.[83] Both geography and geology arose in France in the first half of the nineteenth century as professional scientific disciplines that were recognised early on by the state as cradles for crucial knowledge about natural resources needed for the regulation of socio-environmental associations. The colonial geographer Jules Duval argued that successful colonisation demanded solid geographical knowledge. The main task of geographers in the colonial project, according to Duval, was to identify natural resources that could be exploited and traded, and geography therefore was an important instrument in the development of the colonial political economy.[84] Yamina Bettahar contends that, like geography, French geological research in Algeria over the course of the nineteenth century was increasingly acknowledged as an instrument in the service of the economic and industrial development of the metropole. Geology became a privileged emerging discipline and was strongly connected to the colonial political economy, for example through the production of a comprehensive geological map of Algeria, which outlined the mineral resources available for economic exploitation.[85]

The intimate alliance between state power and colonial geography and geology in France was mirrored institutionally. In Algeria, a large portion of the scholarship in these early decades took place alongside military expeditions or was commissioned or facilitated by the Ministry of War – a symbiotic understanding for which the scientific mission was the prototype. In their publications, scholars often expressed their gratitude to the military for facilitating their scientific expeditions and providing protection in recently subjugated areas.[86] At the time, research in these fields was primarily the fruit of *ingénieurs savants* ('engineer-scholars'), as Ivor Grattan-Guinness has named them, who had been seconded to North Africa from the metropole.[87] Engineers of the national *Corps des Mines*, the majority of them educated at the renowned Parisian *École Polytechnique*, were particularly active in conducting research in the exact and natural sciences, including hydrology, in Algeria. The mining corps was primarily charged with the supervision of the French mining industry, but also regularly tasked itself

[83] Numa Broc, *Une histoire de la géographie physique en France (XIXe – XXe siècles): Les hommes – les œuvres – les idées* (Perpignan: Presses Universitaires de Perpignan, 2010), 159.

[84] Pascal Clerc, "La « géographie coloniale » en France : Une catégorie à déconstruire," *Terra Brasilis* 8 (2017), 3.

[85] Yamina Bettahar, "La géologie en Algérie (1880-1940): Enjeux coloniaux, démarche scientifique et dispositif académique," *La revue pour l'histoire du CNRS* 18 (2007), 1.

[86] Ludovic Ville, *Notice minéralogique sur les province d'Oran et d'Alger* (Paris: Imprimerie Impériale, 1857), VII-VIII. That Ville's scientific work was to a certain extent facilitated by the assistance of the military also becomes clear from the report he published in 1852, in which he extends his gratitude to several army generals: Ludovic Ville, *Recherches sur les roches, les eaux et les gîtes minéraux des provinces d'Oran et d'Alger* (Paris: Imprimerie Nationale, 1852), III-IV.

[87] Ivor Grattan-Guinness, "The *ingénieur savant*, 1800–1830: A Neglected Figure in the History of French Mathematics and Science," *Science in Context* 6, no. 2 (1993), 405-433.

with factories, railways, geology and freshwater resources.[88] After Algeria had become an integral part of France, other metropolitan institutions such as the Ministry of Agriculture and the Ministry of Public Works also commissioned scientific expeditions related to hydrological research.[89]

Introducing new visions of water

> [C]olonial scientists and investigators, from botanists to anthropologists, played crucial roles in the colonial project of 'civilizing' through translation. More than creating power through knowledge for the imperial masters based in the colonies, these practices helped foster the idea of modernity through state- and institution-building in both the colonies and the metropole.[90]

In the previous chapter, I referred to Arun Agrawal to argue how in a colonial context scientific and statistical representations of nature tended to erase existing environmental imaginations, in other words how colonial knowledge production was premised upon the introduction of new forms of perceiving and representing nature.[91] As I have attempted to outline in the current chapter, the production of hydrological knowledge was strongly connected to metropolitan political, military and economic interests and French epistemological conventions. Their education in renowned academic institutions in the metropole and their position in an expanding colonial context undoubtedly shaped – to borrow from Bernard Cohn – the 'investigative modalities' of *ingénieurs savants* dispatched from the metropole. According to Cohn, an investigative modality entails "the procedures by which appropriate knowledge is gathered, its ordering and classification, and then how it is transformed into usable forms such as published reports, statistical returns, histories, gazetteers, legal codes, and encyclopedias" – in short, the predefined, European forms and categories of knowledge that these scholars brought with them to the colony.[92]

While French geographers in Algeria in the 1840s and 1850s had particularly been interested in the availability and mineral composition of surface water and the careful description of rivers and streams, geology introduced an entirely new hydrological vision that became increasingly quantitative

[88] Louis Aguillon, "L'oeuvre du corps des mines au XlXe siècle," in École Polytechnique, *Livre du Centenaire (1794-1894), Tome III* (Paris: Gauthier-Villars, 1897).

[89] Georges Rolland, *Hydrographie et Orographie du Sahara Algérien* (Paris: Société de Géographie, 1886), 3.

[90] Michael Goldman, "Constructing an Environmental State: Eco-governmentality and other Transnational Practices of a 'Green' World Bank," *Social Problems* 48, no. 4 (November 2001), 502.

[91] Arun Agrawal, *Environmentality: Technologies of Government and the Making of Subjects* (Durham, NC: Duke University Press, 2005), 34.

[92] Bernard S. Cohn, *Colonialism and its Forms of Knowledge: The British in India* (Princeton, NJ: Princeton University Press, 1996), 5.

and mathematical. In particular the rapidly growing scholarship on underground water reserves in the Sahara testifies to this new hydrological imagination.[93] This burgeoning field reflected French territorial expansion into the more remote desert regions after the 1860s and 1870s and the widely shared assumption that the Sahara could be brought 'back to life' so long as its water reserves could be discovered and put to use. During expeditions in the desert, *ingénieurs savants* performed numerous geological drillings and reported the different strata of rock and sediment they encountered, while indicating in which layers and at which depths freshwater could be found, in what quantities per minute.[94] These studies were largely led by the engineer-geologists Ludovic Ville and Georges Rolland who were associated with the French *Corps des Mines.* In their extensive surveys of the desert regions' water reserves, Ville and Rolland discussed at length their hydrological observations in a quantitative and mathematical fashion.[95] Their heavily detailed tables of results listed hundreds of wells, the oases irrigated by them, the temperature and flow rate of the waters and their mineral composition (Fig. 2.2). In addition to these elaborate tables, both Ville and Rolland drew geological cross-sections representing a vertically-oriented imagination of the landscape that was facilitated by the use of 'modern' drilling equipment imported from France (Fig. 2.3 and 2.4). The production of stratigraphic sections and geological maps became principal aspects of the discipline of geology as it was evolving in nineteenth-century France, yielding new ways of representing nature and mapping resources that could be commodified.[96] This mathematical and quantitative perception of hydrology supported technical interventions aimed at regularising and increasing the volume of available water, since the envisioned

[93] See, for example, Charles Laurent, "Puits artésiens du Sahara oriental," *Bulletin de la Société Géologique de France* 14, no. 2 (1857), 615; Ludovic Ville, Etude des puits artésiens dans le bassin du Hodna et dans le Sahara des provinces d'Alger et de Constantine *Bulletin de la Société Géologique de France* 12, no. 2 (1864), 106; Henri Jus, *Les forages artésiens de la province de Constantine: résumé des travaux exécutés de 1856 à 1878* (Paris: Imprimerie Nationale, 1878); Charles Grad, *Sur la géologie et le régime des eaux du Sahara algérien* (Paris: Delagrave, 1873); Ludovic Ville, *Notice sur les puits artésiens des provinces d'Alger, d'Oran et de Constantine* (Algiers, 1876); Georges Rolland, *Sur le régime des eaux artésiennes de l'Oued Rir et du Bas-Sahara en général* (Paris: Gauthier-Villars, 1885).

[94] Charles Auguste Laurent, *Mémoire sur le Sahara oriental: au point de vue de l'établissement des puits artésiens dans l'Oued-Souf, l'Oued-R'ir et les Zibans* (Paris: Bourdier et Cie, 1859).

[95] For an impression of Ville and Rolland's publications on underground water reserves in Algeria, see Ludovic Ville, *Recherches sur les roches, les eaux et les gites minéraux des province d'Oran et d'Alger* (Paris : Imprimerie Nationale, 1852); Ludovic Ville, *Voyage d'Exploration dans les Bassins du Hodna et du Sahara* (Paris: Imprimerie Imperiale Challamel Ainé, 1868); Ludovic Ville, *Exploration géologique du Beni Mzab, du Sahara et de la Région des steppes de la province d'Alger* (Paris: Imprimerie Nationale, 1872); Georges Rolland, *Hydrologie du Sahara algérien* (Paris: Imprimerie Nationale, 1894).

[96] Pierre Rat, "Regards sur deux siècles de stratigraphie," in L'essor de la géologie française, ed. Jean Gaudant (Paris: Presses des Mines, 2009), 17.

agricultural settler colony, based on a European view of industrial agricultural production and abundance, was ill-suited to the hydrological conditions the French colonisers encountered in North Africa. According to David Gilmartin, "mathematically modelling water flow, so as to maximise the productive work that water could perform," was central to nineteenth-century water engineering.[97] Quantification thus enabled French engineers and decision makers in centres of political and economic calculation to draw temporal comparisons and, for example, to demonstrate achievements in increasing flow rates through modern hydraulic technology or to improve methodologies and efficiency.

The implications of geological observations such as those by Ville and Rolland become clear when compared with Bruce Braun's work on colonial geology in nineteenth-century Canada. Braun argues that "the emerging discourse of 'geology' in the early 1800s […] enabled landscapes to be visible in new ways, bringing into view the 'verticality' of the state's territory" and in addition "allowed new sets of instruments and practices to be devised by the state which were designed to compel inhabitants to optimize the use of the state's territory."[98] In the same way, geological explorations in Algeria from the middle of the nineteenth century onwards involved a new way of viewing and articulating the territory's hydrology. By mapping and drawing the different geological layers of the earth and the water reserves among them, these observations contributed to the production of a particular vertical imagination of the landscape, in addition to more conventional horizontal imaginations introduced by geography. Geological discourse made these territorial qualities legible by casting them into a language of flow rates and other numerical 'facts'. Braun argues that by "enumerating the wealth and resources of the nation," geological surveys brought the qualities of the state's territory into the domain of political rationality.[99] In the same way, Ville and Rolland's innumerable collections of quantified hydrological data not only made water visible for the state, but also facilitated its administration and manipulation, just as statistics had enabled the state to exert power over the population. These novel ways of imagining and representing water thus fostered new instruments of power that enabled the state to enforce the optimisation of the use of the territory's water resources by its population. Referring to the promises of exploiting Algeria's underground water, Henri Fournel thus argued that "it is from below that we will achieve the final conquest of the above."[100]

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[97] David Gilmartin, "Water and Waste: Nature, Productivity and Colonialism in the Indus Basin," *Economic and Political Weekly* 38, no. 48 (2003), 5059.

[98] Bruce Braun, "Producing vertical territory: geology and governmentality in late Victorian Canada," *Ecumene* 7, no. 1 (2000), 13.

[99] *Ibid.*, 28.

[100] As quoted in Jean Baptiste Auguste Barny, *Du régime des eaux en Algérie* (Algiers: Bouyer, 1860), 5: "c'est par le dessous que nous arriverons à la conquête définitive du dessus."

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This chapter has attempted to reveal the intimate ties that existed between hydrological knowledge production and the coming-of-age of the colonial state in French Algeria. The early scientific mission provided the foundation, both institutionally and intellectually, for the further dissemination of French geography and geology in the colony and the latter's parallel epistemological and territorial expansion. The model of the *mission militaro-scientifique* would be emulated endlessly in the following decades, mirroring the entanglement of military territorial expansion and the simultaneous opening up of areas to be conquered in an epistemological sense. Analogous to Bruce Braun's work, I demonstrated the cultural and historical contingency of hydrological knowledge production. Rather than taking 'water' as an ahistorical fact, my analysis emphasises that exactly how water comes to be viewed and imagined relates dialectically to the political and economic objectives of the utilitarian colonial state. The connection of knowledge production to metropolitan institutions and interests undoubtedly shaped the 'investigative modalities' of French scientists in Algeria, sustaining the generation of a specifically 'modern' and quantitative vision of water. Geological drillings, moreover, moulded a vertical perception of the landscape that made visible 'underdeveloped' underground water resources – especially in the Sahara – which in turn urged the authorities, European settlers and indigenous Algerians to undertake responsible action. As I argued by engaging with Braun and Agrawal's work in the previous chapter, quantified and mathematical representations of the environment enabled the colonial state to enumerate its natural resources and facilitated the regulation of socio-environmental relations. The close ties between hydrological research and colonial state power in Algeria reflect a fundamental aspect of environmental governmentality, namely the avenues by which knowledge of the 'territory and its qualities' was brought into the domain of political rationality. Knowledge of Algeria's hydrology had become as essential to colonial and metropolitan authorities as statistics about its indigenous and settler populations, and was regarded as quintessential for the development of a European-style agricultural society. In the next chapter, I engage more thoroughly with the discourses that emerged out of this growing body of hydrological scholarship in nineteenth-century Algeria. These discourses established a particular understanding of water that fomented and legitimised hydrological intervention in the decades following the French occupation. Exactly how scientific knowledge was utilised by the state to optimise the use of the territory's water resources is central to the discussion in the final chapter.

Numéros d'ordre.	NOM DES SOURCES NATURELLES.	Date des observations faites par M. Ville en 1861.	Diamètre de la nappe d'eau.	Profondeur de la nappe d'eau.	DÉBIT EN LITRES par minute.	DÉBIT EN LITRES par seconde.	Température de la source.	Température de l'air.	Situation géologique du point d'émergence de la source.	OBSERVATIONS.
	I. Route de Bone à Constantine.									
	ÉDOUGE (Environs de Bone).		Mètres.	Mètres.	Litres.	Litres.	Degrés.	Degrés.	Termes.	
1	Source du ravin des Princes	8 février.	.....	.....	30	0,50	12,66	13,00	Cristallin.	
2	Source des Sapins	*Idem.*	.....	.....	15	0,25	13,00	"	*Idem.*	
	ENVIRONS DE JEMMAPES.									
3	Source de Ras el-Ma	13 février.	.....	.....	60	1,00	19,50	21,00	Nummulitique.	
	ENVIRONS DE CONSTANTINE.									
4	Source thermale à 1 kilom. nord du village du Hamma	15 février.	.....	.....	3,000	50,00	35,00	19,00	Pliocène.	
5	Sources thermales du Hamma	22 février.	.....	.....	420,000	700,00	33,10	"	*Idem.*	
6	Source froide du Hamma	*Idem.*	.....	.....	30	0,50	16,50	"	*Idem.*	
7	Ain Bergli	*Idem.*	.....	.....	600	10,00	34,33	"	*Idem.*	
8	Sources de Salah Bey	28 février.	.....	.....	2,400	40,00	27,66	"	*Idem.*	
9	Source thermale de Sidi Rached	22 février.	.....	.....	240	4,00	28,33	14,66	Crétacé.	
10	Source thermale d'Ain Clechka	*Idem.*	.....	.....	1,080	18,00	28,00	"	*Idem.*	
	SOURCES THERMALES DE SIDI MIMOUN.									
11	Source supérieure	25 février.	.....	.....	150	2,50	29,00	9,00	*Idem.*	
12	Source inférieure	*Idem.*	.....	.....	900	15,00	28,00	13,50	*Idem.*	
	SOURCES D'AÏN BABA SUR LE DJEBEL MSID.									
13	Source *a*	22 février.	.....	.....	3,000	50,00	15,33	"	*Idem.*	
14	Source *b*	*Idem.*	.....	.....			30,50	"	*Idem.*	
15	Source de Bil Grats sur le Djebel Ouach	23 février.	.....	.....	6	0,10	15,00	"	Nummulitique.	
16	Ain Koudiat Aïï	20 février.	.....	.....	6	0,10	16,00	"	Pliocène.	
17	Ain el-Hadj Baba	*Idem.*	.....	.....	6	0,10	15,00	"	*Idem.*	
	II. Route de Constantine à Batna.									
18	Ain Bou Merzoug, à 28 kilom. sud de Constantine	28 février.	.....	.....	32,280	538,00	23,75	7,10	Crétacé.	
19	Ain Haddada	*Idem.*	.....	.....	240	4,00	13,50	11,66	Quaternaire.	
20	Ain Melila	*Idem.*	.....	.....	400	6,66	10,50	11,33	*Idem.*	
	AÏN FESGUIA.									
21	Source a_1	*Idem.*	.....	.....			20,00	"		
22	Source a_2	*Idem.*	.....	.....			19,50			
23	Source a_3	*Idem.*	.....	.....			19,00			
24	Source a_4	*Idem.*	.....	.....	12,000	200,00	19,33	8,50	Crétacé.	
25	Source a_5	*Idem.*	.....	.....			19,00			
26	Source a_6	*Idem.*	....	.....			18,66			
27	Source a_7	*Idem.*	.....	.....			18,66			
	Température moyenne de l'Aïn Fesguia	.....	.....	.....	.....	.....	19,16			
28	Ain Jakout	2 mars.	.....	.....	.....	.....	16,75	1,33	Crétacé.	

Figure 2.2. *Toutes les observations faites par M. Ville sur les sources naturelles de la province de Constantine* (Observations by M. Ville on natural sources in the province of Constantine). Published in Ludovic Ville, *Voyage d'Exploration dans les Bassinss du Hodna et du Sahara* (Paris: Imprimerie Imperiale, 1868), 748.

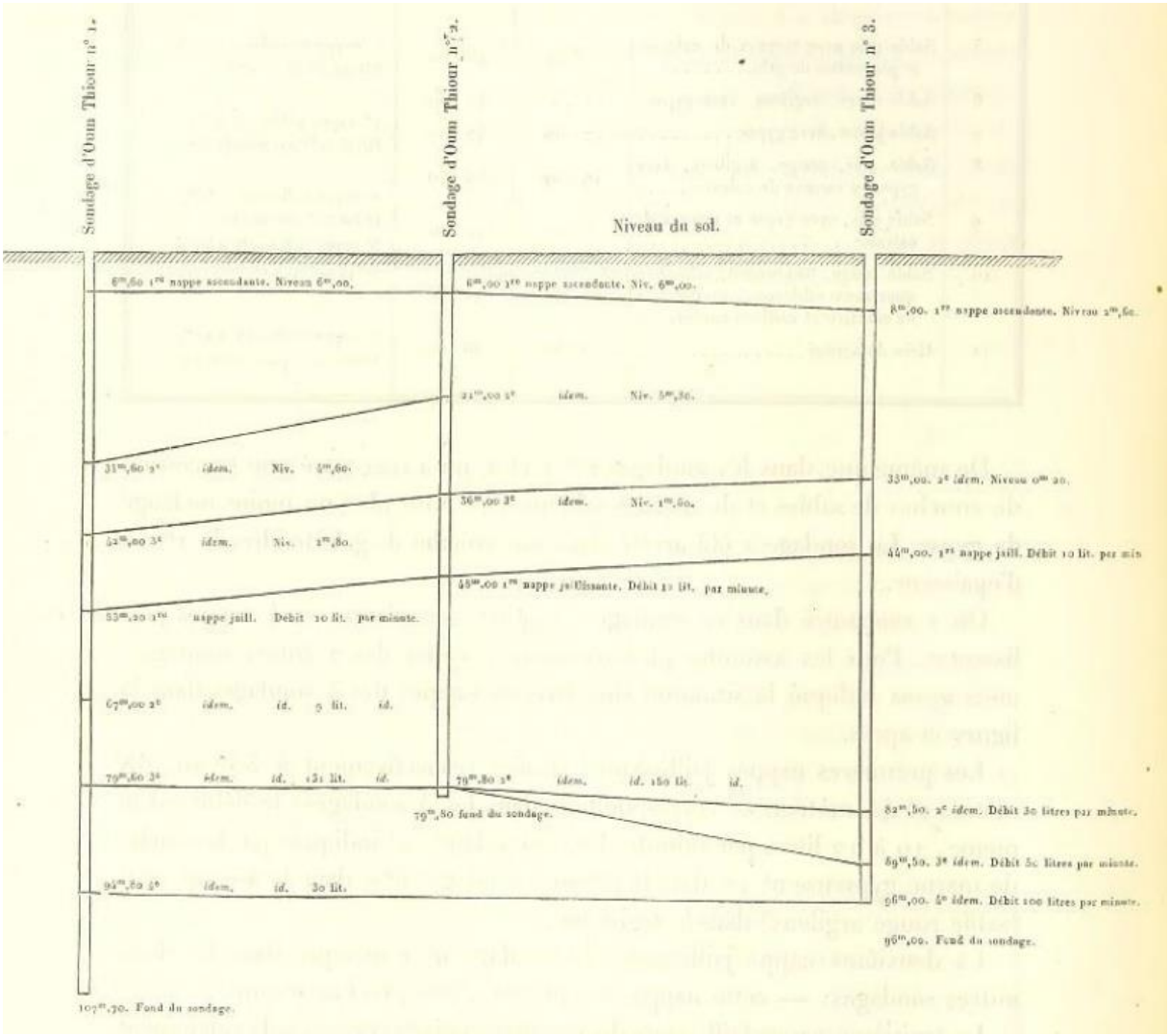

Figure 2.3. Cross-section of three drillings in the Sahara, incidating layers of water reserves. Published in Ludovic Ville, *Voyage d'Exploration dans les Bassinss du Hodna et du Sahara* (Paris: Imprimerie Imperiale, 1868), 318.

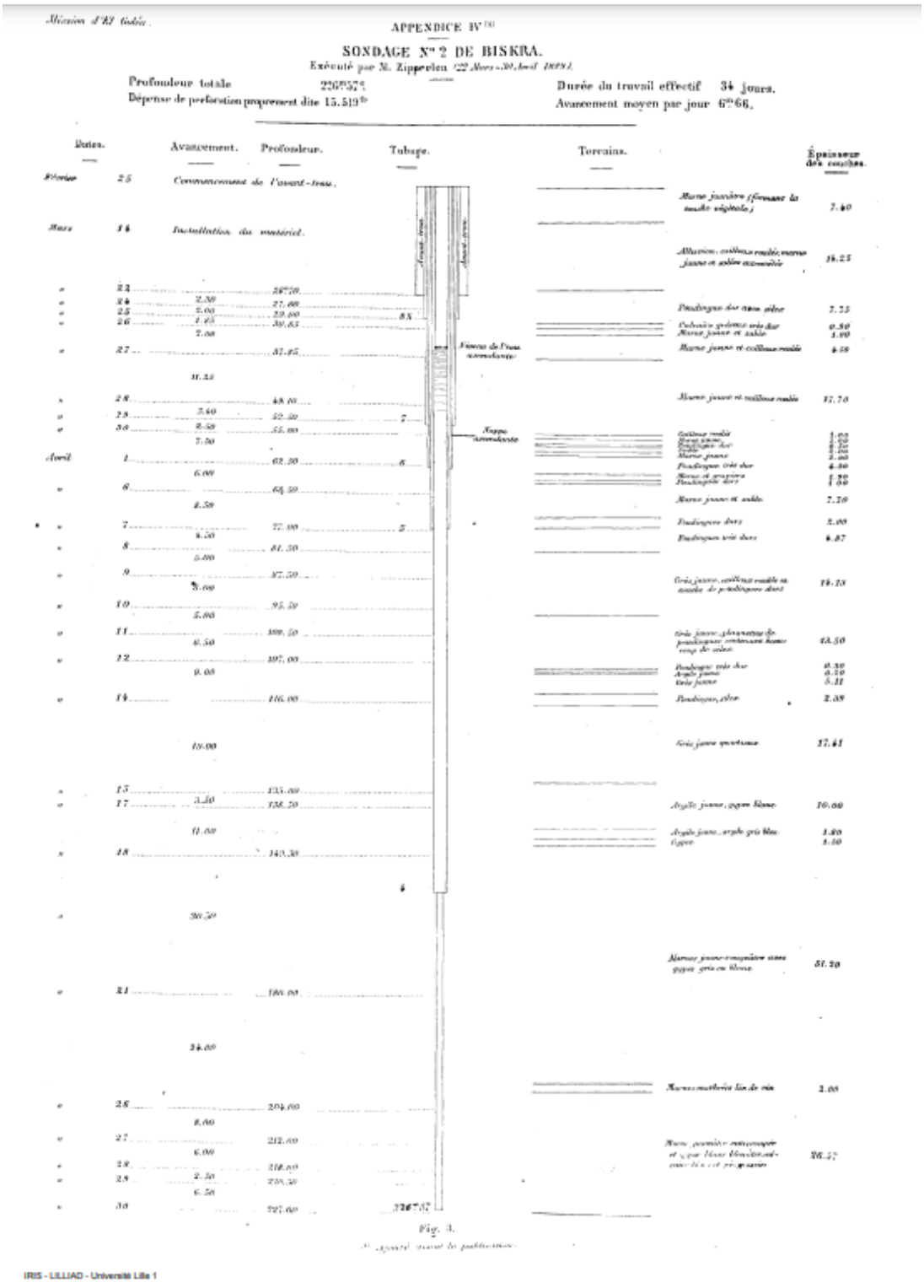

Figure 2.4. *Sondage N° 2 de Biskra* (Drilling N° 2 at Biskra). Published in Georges Rolland, *Hydrologie du Sahara algérien* (Paris: Imprimerie Nationale, 1894), Appendice IV.

CHAPTER III

RETURNING LIFE TO THE DESERT: THE CONSTRUCTION OF A FRENCH COLONIAL DISCOURSE OF WATER

As Diana Davis has convincingly shown, there existed in the nineteenth century a complex invented French narrative about Algeria's environmental history, which hinged around the supposed deterioration – predominantly at the hands of the Arab invaders – of the abundance and fertility that had once characterised the land. In the previous chapter, I have outlined how the production of hydrological knowledge facilitated the introduction of new epistemologies stemming largely from modern French science. The generation of hydrological knowledge expanded over the course of the nineteenth century, as the availability of freshwater was seen as crucial for the accomplishment of a thriving agricultural settler economy. Geological and geographical studies were largely sponsored by the metropolitan and colonial governments, often took place in tandem with military objectives, and served both metropolitan and colonial-administrative objectives. In the current chapter, my aim is to look more closely at the particular discourses about water in Algeria that were brought about by this growing geographical and geological scholarship following the French occupation. I examine a variety of scientific publications from the middle towards the end of the nineteenth century, that range from comprehensive encyclopaedias to scientific publications and detailed expedition reports and. To demonstrate how a particular hydrological imagination of Algeria came about, I will first discuss the contours of a water discourse that resembled the fertility narrative retold by Jennifer Sessions and Diana Davis, but simultaneously established a distinction between Algeria's hydrology and water in France.[101] Such narratives of hydrological abundance often referred to the Roman history and ancient geographical imaginations of the land. This is the theme of the second part of the chapter, which uncovers how the Roman occupation of the region was perceived as the model for contemporary hydrological intervention. It forms the bridge to the final part, where I outline the narratives surrounding technical intervention in Algeria's water system, which were cloaked in a language of colonial modernisation and French scientific rationalism and imbued with promises of socio-political transformation. In all, this chapter reconstructs a paradoxical colonial discourse of water, one that emphasised latent hydrological abundance on the one hand and the need for sweeping, restorative measures on the other: a geographical imagination that simultaneously advocated for very material and tangible action.

[101] Jennifer Sessions, *By Sword and Plow: France and the Conquest of Algeria* (Ithaca: Cornell University Press, 2014.

Imagining 'violent' landscapes

> The [river] *Rummel* plunges into a precipice a hundred feet high, comes crashing out, white and frothy, from this grandiose hole carved like the vault of a gothic cathedral, rushes from cascade to cascade over steep rocks, reaches the valley located immediately below the town and resumes its normal course.[102]

Especially from the middle of the nineteenth century, extensive and imaginative descriptions like these were commonplace in French geographic and encyclopaedic works discussing Algeria's rivers and waterways (Fig. 3.1). These works usually divided Algeria's territory into two geographical zones separated more or less by the *Hauts Plateaux*, a steppe-like plateau: the *Tell* in the north and the *Sahara* in the south. The Tell – according to Arthur-Alexandre Behaghel one of the most fertile lands in the world and the 'granary' of the Roman Empire – was often described as a mountainous area characterised by untamed rivers and fertile valleys. In accordance with the 'fertility myth', many geographers generally wrote positively about the rivers of the Tell region, which they often presented as nurturers of fertile and picturesque valleys that harboured great agricultural potential.[103] As articulated by Jennifer Sessions, the 'fertility myth' was actively promoted by the French government in the first decades of the occupation of Algeria as a means to support the expansion of French settlement.[104] The fertility narrative invoked an image of an abundant landscape with remarkable agricultural potential, aimed at attracting necessary *colons* from the metropole "to people and to fertilise" the land.[105] But although many writers pointed to the abundance of water in the Tell region, they simultaneously made clear that Algeria's hydrological system was vastly different from the 'predictable' and more regular rivers of the metropole. To emphasise the distinct character of Algeria's hydrology, geographers often drew comparisons with the rivers and streams of the French mainland. The river Chélif, according to Paul

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[102] Arthur-Alexandre Behaghel, *L'Algérie : histoire, géographie, climatologie, hygiène, agriculture, forêts, zoologie, richesses minérales, commerce et industrie, moeurs indigènes, population, armée, marine, administration* (Algiers: Tissier, 1865), 104: "Le Rummel s'engouffre dans un précipice d'une centaine de pieds, sort avec fracas, blanc et écumeux, de cet autre grandiose traille comme la volte d'une cathédrale gothique, se précipite de cascade en cascade sur des rochers abruptes, atteint la vallée située immédiatement au-dessous de a ville et reprend son cours normal."

[103] Ferdinand Quesnoy, *L'Algérie* (Paris: Jouvet, 1885), 47. The most notable rivers, according to French geographers, were the Tafna, Sig, Habra, Chélif, Mina, Chiffa, Oued Arrach and Oued Hamiz. Paul, Leroy-Beaulieu, *L'Algérie et la Tunisie* (Paris: Guillaumin, 1887), 24.

[104] Jennifer Sessions, *By Sword and Plow: France and the Conquest of Algeria* (Ithaca, NY: Cornell University Press, 2011), 214.

[105] Ministère de la Guerre, *Tableau de la situation des Établissements français dans l'Algérie (1843-1844)* (Paris: Imprimerie Royale, 1845), 220.

Leroy-Beaulieu, was "longer than the Garonne, but it is said that it often contains less water than the lesser rivers of the Pyrenees."[106] In a generalised description of Algeria's rivers, Behaghel argued that they "run confusedly in tormented lands, without direction, without a riverbed, even without a name."[107] In his 1856 treatise on agriculture in Algeria, Théophile Guérin equally noted the irregularity of the Tell's streams and rivers, which "flow sometimes to the north, sometimes to the east, sometimes towards the west or the south."[108] Algeria's rivers were thus often described as somehow possessing a certain violence and irrationality compared to those of France.

Clearly, the waters encountered by the French in Algeria did not correspond to the hydrological imagination they had of the French mainland. Jules Duval argued that the absence of large rivers in Algeria was a clear cause of inferiority compared to Europe, Asia, America and even a part of Africa.[109] Especially the seasonal variability and relative unpredictability of rivers in Algeria caught the attention. Compared to the latter, for example, none of Algeria's rivers were navigable and most were, according to Behaghel, "just dry torrents during the summer", pointing to their seasonal fluctuation.[110] Odilon Niel pointed out that the "biannual alternation of rains and droughts is the fundamental law of the Algerian climate," strictly distinguishing it from the hydrological cycle of northern temperate climates.[111] Their seasonal variability and irregularity made these river basins prone to destructive and unforeseeable floods, and therefore at present unsuitable for the projected economic and agricultural development of the colonial economy. Most of Algeria's rivers would swell up in the winter, and they were often described as destructive and horrendous once they did. These imaginations, which commonly classified the hydrology of the Tell region as dysfunctional and underdeveloped, could be gathered under Linton's notion of 'hydrological Orientalism'.[112]

This discourse of the Tell region's hydrology as underdeveloped yet nurturing a high potential in its core did not differ notably from discourses about water in the Sahara. Perhaps to magnify its attractiveness to their audiences, similar to what Sessions writes about eager attempts to make French

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[106] Leroy-Beaulieu, *L'Algérie*, 24 : "Le Chélif est plus long que la Garonne, mais on a dit qu'il a souvent moins d'eau que le moindre gave des Pyrénées."

[107] Behaghel, *L'Algérie,* 101 : "elles roulent confusément dans des pays tourmentés, sans direction, sans lit, même sans nom."

[108] Théophile Guérin, *L'Algérie au point de vue de l'agriculture* (Rochefort: Imprimerie Ch. Thèze, 1856), 17: "Dans leur course irrégulière, ces ruisseaux ou rivières se dirigent tantôt au nord, tantôt à l'est, tantât vers l'ouest ou le sud."

[109] Jules Duval, "Tableaux de la situation des établissements français dans l'Algérie*," Bulletin de la Société de Géographie* 5, no. 10 (1865), 103-104.

[110] Behaghel, *L'Algérie*, 101: "la plupart ne sont que des torrents à sec pendant l'été."

[111] Odilon Niel, *Géographie de l'Algérie (2e éd.)* (Bône: L. Legendre and R. Gauvy, 1876), 55: "l'alternance semestrielle de pluies et de sécheresses est la loi fondamentale du climat algérien."

[112] Jamie Linton, *What is Water? The History of a Modern Abstraction* (Vancouver: UBC Press, 2010), 123.

settlement more alluring, many writers emphasised that the Sahara was not the parched and barren plain of sand that many in France generally imagined it to be. It is less monotonous and uniform than is often assumed, wrote Abrégé in a schoolbook on colonial geography, and rather represents a "rugged soil that may have been fertile in the past, but has become sterile by the scarcity of rains, combined with a torrid climate, drying winds, perhaps also the negligence of the inhabitants [and] the teeth of goats and sheep."[113] In an attempt to 'translate' the Saharan landscape and speak to the imagination of his French audience, Rolland wrote "I believe I could compare the Oued Rir to a sort of *Little Egypt* with a *subterranean Nile*."[114] It was indeed in the subterranean layers of the Sahara where, many authors pointed out, the hydrological abundance of the desert was to be found. "It is indeed well proven today that the Sahara once had water," Henry Lemonnier noted.[115] Likewise, Pierre Foncin argued that in the past, the Sahara used to receive abundant rains that nurtured rivers of which only dry riverbeds remained.[116] According to Lemonnier, the sandy riverbeds one could find throughout the desert regions had once all contained water that still existed abundantly at the time of writing, but was now deposited in underground reserves.[117] "Go fetch it and the Sahara will be transformed," the author further proclaimed as a call to action.[118] The many oases that covered the Algerian desert – the "islets of palm trees and gardens that tiger the wild surface of the Algerian Sahara like a panther's skin" – proved that such an environmental transformation was possible.[119]

According to Pierre Foncin, deforestation had stripped the Sahara and was the main cause of the desert's water scarcity.[120] Likewise, Joachim Mathieu Raynard argued that "the number and volume of springs, the flow of rivers and streams have gradually diminished together with the overall deforestation" and that therefore "the main cause of the current drought is the disappearance of the

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[113] F.J. Abrégé, *Géographie des Colonies françaises. Cours spécial pour l'enseignement primaire supérieur* (Tours: A. Mame et fils, 1887), 41: "un sol accidenté qui a pu être fertile jadis, mais stérilisé par la rareté des pluies, jointe à un climat torride, à des vents desséchants, peut-être aussi à l'incurie des habitants, à la dent des chèvres et des moutons."

[114] Georges Rolland, *La Conquête du désert. Biskra, Tougourt, L'Oued Rir'.* (Paris: Challamel, 1889), 40: "J'ai cru pouvoir comparer l'Oued Rir' à une sorte de petite Egypte avec un Nil souterrain."

[115] Henry Lemonnier, *L'Algérie* (Paris: Librairie Centrale des Publications Populaires, 1881), 98:
"Il est en effet bien prouvé aujourd'hui, que le Sahara eut autrefois de l'eau."

[116] Pierre Foncin, *Géographie générale : relief du sol, hydrographie, voies de communication, agriculture, industrie, commerce, statistique* (Paris: A Colin, 1887), 187.

[117] Lemonnier, *L'Algérie*, 98.

[118] *Ibid.*, 99: "aille la chercher et le Sahara sera transformé."

[119] Foncin, *Géographie générale,* 187: "les taches noires des îlots de palmiers et de jardins tigrent comme une peau de panthère la surface fauve du Sahara algérien."

[120] *Idem.*

wooded massifs which once covered the whole region."[121] The Arabs' responsibility for the supposed large-scale deforestation of the desert, which according to Diana Davis[122] was a central part of the declensionist environmental narrative, thus also entered narratives about water: some authors argued that Algeria's aridity could partly or even primarily be ascribed to deforestation in mountainous areas and in the Sahara.[123] This view is reminiscent of the 'forest-centric' bias of the nineteenth century environmental worldview, according to which lush forests – associated with the image of the garden of Eden – had once covered the entire landmass of the earth. Within this perception, deserts were deemed anomalous and even 'sinful' ecologies.[124] But the phenomenon of deforestation was simultaneously held responsible for the turbulent and torrential character of Algeria's rivers.[125] This idea can be traced back to the writings of Jean Antoine Frabre and Alexander Surell, who attributed destructive floods in the French Alps to deforestation and subsequent erosion. Large replanted forests, in turn, were regarded as 'natural reservoirs' that could prevent the runoff of rainwater in Algeria in order to preserve it for irrigation purposes.[126]

The deteriorated and inferior condition of Algeria's hydrology, both in the desert regions and the more fertile valleys, was accompanied by an optimistic belief that there existed a great hydrological wealth that was bound to be restored. Duval noted that Algeria's water table was generally found close to the surface, which facilitated the construction of *norias* for irrigation.[127] Guérin also optimistically noted that even if compared to Europe, Algeria's rivers, streams and springs contained very small volumes of water, they nevertheless held the potential to irrigate a considerable portion of the arable

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[121] Joachim Mathieu Raynard, *Restauration des forêts et des paturages du sud de l'Algérie (province d'Alger)* (Algiers: Typographie Adolphe Jourdan, 1880), 6: "le nombre et le volume des sources, le débit des fleuves et des rivières y ont diminué graduellement avec le déboisement général. Cette idée est corroborée par des traces nombreuses d'anciennes forêts. On est donc en droit de conclure que la cause principale de la sécheresse actuelle est la disparition des massifs boisés qui couvraient autrefois toute la contrée."

[122] Diana Davis, "Eco-Governance in French Algeria: Environmental History, Policy, and Colonial Administration," *Proceedings of the Western Society for French History* 32 (2004), 328-345; Caroline Ford, "Reforestation, Landscape Conservation, and the Anxieties of Empire in French Colonial Algeria," *American Historical Review* (April, 2008); Henri Sivak, "Legal Geographies of Catastrophe: Forests, Fires, and Property in Colonial Algeria," *Geographical Review* 103, no. 4 (October, 2013), 556-574.

[123] Ernest Lalanne, *La France & ses colonies au XIXe siècle* (Paris: A. Picard et Kaan, 1893), 15; Henri Mager, *Atlas colonial, avec notices historiques et géographiques* (Paris: C. Bayle, 1886), 6; Raoul Postel, *Le Sahara: Sol, productions et habitants* (Paris: A. Degorce-Cadot, 1883), 7; Niel, *Géographie*, 55.

[124] Diana Davis, "Desert 'wastes' of the Maghreb: desertification narratives in French colonial environmental history of North Africa," *Cultural Geographies* 11, no. 4 (2004), 367-368.

[125] Paul Leroy-Beaulieu. *L'Algérie et la Tunisie* (Paris: Guillaumin, 1887), 24-25.

[126] Lalanne, *La France & ses colonies*, 17-18.

[127] *Ibid.*, 104.

soil, as they were so numerous and because "the value of irrigation water is such in Algeria, that the smallest, well-developed stream can produce the most fruitful and unexpected results."[128] Both Duval and Guérin seemed to suggest, therefore, the existence of a hydrological potential that could be tapped into once the limitations imposed by water scarcity had been nullified through careful hydrological intervention by French *colons*. Hence, even when in the French perception a stark contrast predominated between areas of – albeit seasonally – overabundant surface water and rugged drylands rich in underground water, the fact of the matter is that either was associated to some extent with negligence and regression and thus necessitated French intervention.

[128] Théophile Guérin, *L'Algérie au point de vue de l'agriculture* (Rochefort: Imprimerie Ch. Thèze, 1856), 17.

Figure 3.1. The river *Rummel* as illustrated by Henri-Alfred Darjou (1832-1874) in *Collection de Vinck. Un siècle d'histoire de France par l'estampe, 1770-1870*, date unknown. Source: Bibliothèque nationale de France, département Estampes et photographie, RESERVE FT 4-QB-370 (157).

The model of the Roman occupation

The Roman Empire ruled over varying parts of present-day Algeria between the first century B.C. and the seventh century A.D. The Roman role model, which as Diana Davis and Patricia Lorcin have shown played an instrumental role in the French 'declensionist' environmental narrative, also appears in discourses about the revival of available water resources.[129] The Roman past was often invoked in geographic accounts of Algeria's rivers. French authors made regular comparisons with the classical texts of Ptolemy and Strabo in their speculations about the ancient names and geography of rivers. According to Odilon Niel, for example, the Oued Igharghar in the north-eastern Algerian Sahara was "probably the Gir of Ptolemy."[130] Some scholars eagerly embarked on expeditions with the objective of retrieving the ancient rivers described in these classical works. One of the most sought after was the ancient basin of the river Triton, which a number of French authors associated with contemporary *chotts* (salt lakes) and *oueds* (rivers) they encountered in Algeria (Fig. 3.3).[131] There existed, in short, a serious endeavour to associate the French occupation of Algeria with the Roman presence in the area and to locate the French as the inheritors of this prosperous and illustrious past.

For some authors, invoking the Roman geographical imagination was connected to the French colonial project in a more material sense, particularly regarding the ancient history of hydraulic technology in Algeria. A decade after the conquest of Algiers, Adolphe Blanqui lamented the state of French public works in the town of Stora in comparison with the elaborate cisterns which the Romans had built there:

> What a people these Romans were! And what a difference between their innumerable cisterns and our unnoticeable well! But unfortunately the thirst is no less today, under this same sky of fire against which they had taken such careful precautions.[132]

[129] Patricia Lorcin, "Rome and France in North Africa: Recovering Algeria's Latin Past," *French Historical Studies* 25, no. 2 (2002), 295-329.

[130] Niel, *Géographie*, 107. See also Claudius Ptolemy, *The Geography*, trans. and ed. Edward Luther Stevenson (New York: Dover Publications, 1991), 105.

[131] Alphonse-Marie-Ferdinand Rouire, *La découverte du bassin hydrographique de la Tunisie centrale et l'emplacement de l'ancien lac Triton (ancienne mer intérieure d'Afrique)* (Paris: Challamel Ainé, 1887).

[132] Alphonse Blanqui, *Algérie. Rapport sur la situation économique de nos possessions dans le nord de l'Afrique* (Paris: W. Coquebert, 1840), 87: "Quel peuple que ces Romains et quelle différence entre leurs innombrables citernes et notre puits imperceptible! Mais malheureusement la soif n'est pas moindre aujourd'hui, sous ce même ciel de feu contre lequel ils avaient pris de si prudentes précautions."

Figure 3.2. *Aqueduc romain, près Constantine* (Roman aqueduct near Constantine), photographed and published by Félix Jacques Antoine Moulin (1802-1879) in *L'Algérie photographiée: Province de Constantine*, 1856-1857. Source: Bibliothèque nationale de France, RESERVE BOITE FOL-OZ-110 (3).

Blanqui clearly admired the Romans and considered their hydraulic engineering the perfect example for the French to emulate. "No, it is not as the Romans did; everywhere we recognise them through their works, still almost intact after eighteen hundred years. And us, who would recognise us by our [works]?" he further bemoaned.[133] Some, therefore, disenchanted by Algeria's current hydrological conditions, advocated to translate the Roman example into tangible policy. The French colonial administrator and writer Pierre Charles Fournier de Saint-Amant proclaimed, for example, that more resources should be directed towards the management of Algeria's waterways by means of building 'intelligent' dams:

> The Romans have left us examples of that kind, and while admiring, like blissful archeologists, the solid construction of these ruins of aqueducts and dams, we

[133] *Ibid.*, 87-88: "Non, ce n'est pas ainsi qu'agissaient les Romains; partout on les reconnaît à leurs œuvres." encore presque intactes 88 après dix-huit cents ans : et nous, qui nous reconnaîtrait aux nôtres?"

> would also do well to work towards multiplying [such infrastructure] throughout Algeria.[134]

De Saint-Amant appears to imply that the large-scale archaeological studies which had begun during the scientific mission of the 1840s could be made productive for the greater economic and political objectives of the colonial project. A few decades later, Odilon Niel argued how resorting to the ancient example of the Romans had already paid off in Algeria:

> The example of the Romans, who, at the cost of centuries-old and gigantic [public] works, traces of which can be found everywhere, had transformed into lands of tremendous fertility plateaus or sandy regions that are so poor today, has already borne its fruits.[135]

Niel in particular pointed out the aqueducts of the Romans and the "splendid irrigation systems of Numidia."[136] Reflecting on the hydraulic infrastructure constructed by the army and the *Service des Ponts et Chaussées* in the previous decades, such as the dams at Sig and Oued-el-Hammam, Oscar Mac Carthy in 1879 went even further by claiming that these projects "already constitute as a whole an undertaking far greater than anything the Romans did in ancient Africa."[137] These examples illustrate that the Roman history of the region played an important role in the way French writers and geographers gave meaning to the landscape and its water resources. In other words, the French hydrological imagination of Algeria was partly defined by invoking Roman spatial inscriptions. Similar to what Davis points out, these geographical perceptions in turn gave rise to a narrative in which the French state and European *colons* were entrusted as the desirable saviour of an impoverished territory. To restore the land to its former glory and abundance first and foremost implied to follow the precedence that the

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[134] Pierre Charles Fournier de Saint-Amant, *L'Algérie. Aperçus sur son état actuel et sur son avenir* (London: W. Allen, 1862), 27: "Les Romains nous ont laissé des exemples dans ce genre, et, tout en admirant, en béats archéologues, la-solide construction de ces ruines d'aqueducs et de barrages, nous ferions bien aussi de travailler à multiplier par toute l'Algérie."

[135] Niel, *Géographie*, 100: "L'exemple des Romains, qui, au prix d'efforts séculaires et de travaux gigantesques, dont on retrouve partout les traces, avaient transformé en terres d'une fertilité prodigieuse des plateaux ou des régions sablonneuses si pauvres aujourd'hui, a déjà porté ses fruits."

[136] *Ibid.*, 55: "L'exemple des Romains qui élevaient partout de superbes aqueducs, les splendides irrigations de la Numidie." Numidia was the name of the Roman province along the coast of North-Africa, corresponding roughly to the territory of today's Algeria.

[137] Oscar Mac Carthy, *Esquisse d'un programme destiné à la session que l'Association française pour l'avancement des sciences doit tenir à Alger en 1881* (Algiers: A. Rouyer, 1879), 15: "[…] constituent déjà dans leur ensemble une œuvre bien autrement grande que tout ce qu'ont fait les Romains dans l'ancienne Afrique."

Romans had set in their province of Numidia, where they had supposedly succeeded in transforming barren lands into fertile soils through ingenious water engineering.

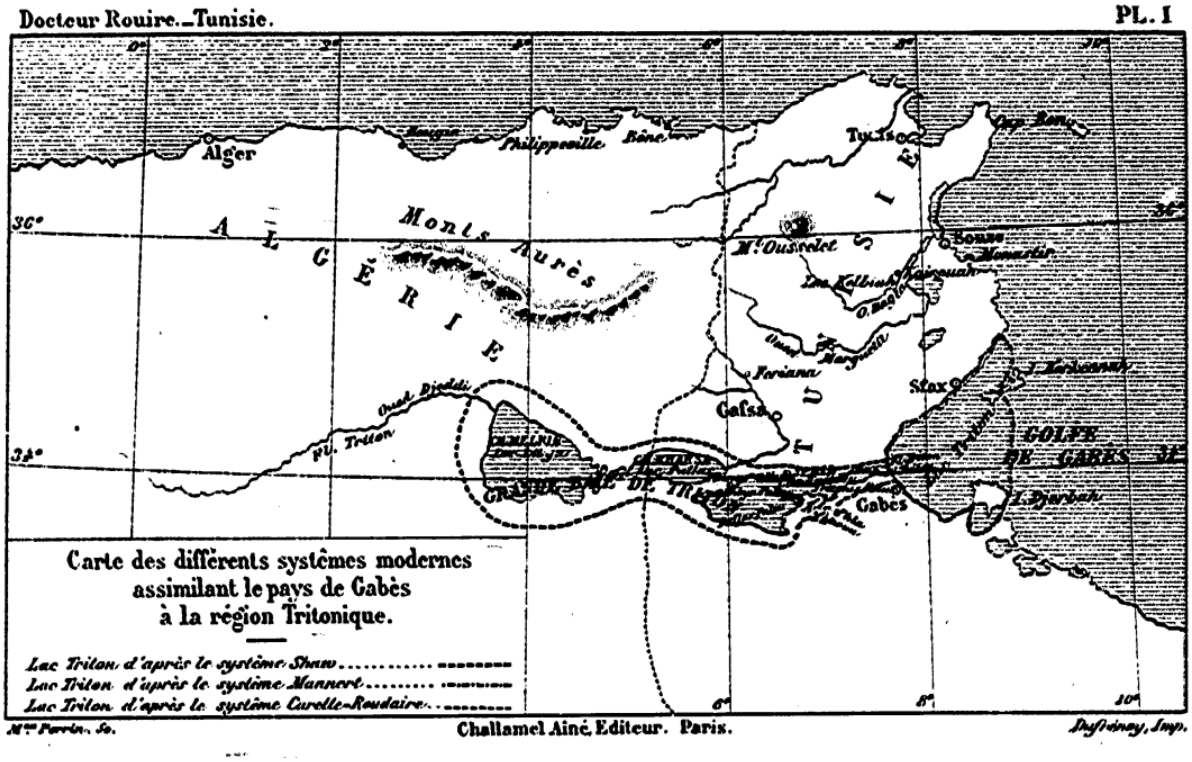

Figure 3.3. Three suggestions for the location of the ancient Lake Triton. Published in Alphonse-Marie-Ferdinand Rouire, *La découverte du bassin hydrographique de la Tunisie centrale et l'emplacement de l'ancien lac Triton (ancienne mer intérieure d'Afrique)* (Paris: Challamel Ainé, 1887), PL. 1.

The promises of French science and technology

Odilon Niel stated that, given the preciousness of water in Algeria, a wise administration would concern itself first of all with the retention of overabundant rainwater in the winter in order to supply the needs of the summer.[138] Niel's writings conveyed the desire to make Algeria's hydrology more predictable and less dependent on seasonal variations. The French dams that were under construction in the Mitidja plain in the North of Algeria would, according to Niel, in the future be a new source of fertility "in this 'granary of Algiers'."[139] It was generally argued that dams and other water works should be employed to overcome the 'instability' and irregularity of Algeria's rivers.[140] Much recent scholarship has been devoted to the construction of dams as symbols of modernisation and state power, particularly to how

[138] Niel, *Géographie*, 55.

[139] *Ibid.*, 80: "Les barrages en cours d'exécution seront, dans un avenir prochain, un nouvel élément de fécondité pour ce « grenier d'Alger»."

[140] Paul Leroy-Beaulieu, *L'Algérie et la Tunisie* (Paris: Guillaumin, 1887), 25.

dams were perceived as vehicles for modern society's conquest of nature.[141] Jules Duval's view in 1865 that the Dam "of Sig in the province of Oran, is the most remarkable monument of industrial power and colonial intelligence," mirrors a similar perception of hydraulic engineering as the emblem of the promises of colonial modernity. [142] Meanwhile, the existing dams that had been erected by the indigenous population of the Mitidja were described as deficient and inefficient, as they were "simple fleeting dams [that were] washed away annually by the floods, and restored each summer," and which allowed large parts of the river water to escape.[143]

Whereas dams were seen as the panacea for the Tell's rivers, the drilling rig was regarded as the technical fix *pur sang* to bring water back to the Sahara. French authors often likened this instrument to "Moses's marvellous wand," attesting to Larkin's 'poetics of infrastructure', or the idea that infrastructures serve as vehicles of aesthetic and cultural values separate from their purely technical function.[144] Rigs were used to drill through layers of rock and sediment, while installing iron pipes to reach aquifers deep in the ground. While acknowledging that the practice of drilling wells had been common among various cultures for millennia, the engineer-geologists Degousée and Laurent argued in their *Guide du sondeur* that it was only in nineteenth century France that theoretical studies had given a new impulse to this technology, turning it into a proper 'art' founded on rational scientific laws.[145] With the use of probes, hidden underground waters could be retrieved to "bring life where death once reigned and bring green to the oases long abandoned following the obliteration of native wells."[146] The notion that France, by means of its rationality and technological superiority, had accomplished to 'breathe life' into a territory suffering from death and thirst as a result of the 'unsophisticated' knowledge and practices of its native population, was often reiterated.[147] By extending their technological expertise into

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[141] Maria Kaika, "Dams as Symbols of Modernization: The Urbanization of Nature Between Geographical Imagination and Materiality," *Annals of the Association of American Geographers* 96, no. 2 (2006), 276-301.

[142] Duval, "Tableaux," 157: "En fait de BARRAGES, celui du Sig dans la province d'Oran, est le monument le plus remarquable de la puissance industrielle et de l'intelligence colonisatrice."

[143] Maurice Aymard, "Étude sur les irrigations de la Metidja et les cours d'eau de l'Atlas," *Annales des ponts et chaussées* (2nd semester, 1853), 91-92.

[144] Niel, *Géographie*, 56: "la sonde, comme jadis la merveilleuse baguette de Moise"; Brian Larkin, "The Politics and Poetics of Infrastructure," *Annual Review of Anthropology* 42 (2013), 329.

[145] Joseph Degousée and Charles-Auguste Laurent, *Guide du sondeur: traité théorique et pratique* (Paris: Garnier Frères, 1861), 4-5.

[146] Niel, *Géographie,* 100: "Arrachées de leur lit souterrain, elles portent la vie là où régnait la mort et font reverdir les oasis abandonnées depuis longtemps par suite de l'oblitération des puits indigènes."

[147] Achille Fillias, *Géographie physique et politique de l'Algérie* (Algiers: Imprimerie V. Aillaud et Compagnie, 1875), 76; Georges Rolland, *La Conquête du désert. Biskra, Tougourt, L'Oued Rir'*. (Paris: Challamel, 1889), 47; M.E. Lacroix, *Visites d'un ingénieur à l'Exposition universelle de 1878: notes pour servir de souvenir à l'exposition de 1878* (Paris: Librairie Scientifique, Industrielle et Agricole, 1878), 481.

Algeria's desert regions, it was argued that French engineers were capable of retrieving underground water resources that contradicted the European hydrological imagination of abundant and unremitting surface waters. Although it was acknowledged that the inhabitants of the desert had managed to utilise underground water reserves for centuries, their relation to water was nevertheless often described as backwards. Quesnoy, for example, noted the "primitive" procedures used by the Arabs of the Sahara to drill wells to access groundwater. These operations, which had traditionally been executed by collectives of *r'tassin* or 'divers', were time-consuming and dangerous and yet their results regrettable, according to the author.[148]

French hydraulic technology was thus praised for increasing the volumes of water derived from aquifers to support agricultural development in the desert, but some were convinced that these technologies at once served political objectives. In 1865, Arthur-Alexandre Behaghel praised the great potential of French technical intervention in the Oued Rir':

> The Oued Rir' provides a striking example of the beneficial role that the French drilling rig can accomplish in the Sahara, both from the point of view of the development of existing oases, the improvement of the lot of the natives and the pacification of the South, as well as from the point of view of the creation of new oases by Europeans and the extension of French colonisation.[149]

The engineer M.E. Lacroix likewise argued after a visit to the *Exposition Universelle* of 1878 that French engineers had managed to restore the "fertility and life in the oases of the Sahara region and [were] a powerful aid to maintain [French] domination over the desert tribes."[150] By drawing an explicit association between French water works and colonial power, Quesnoy, Behaghel and Lacroix evidently believed that French hydraulic engineering held more noble promises than merely improving agricultural production and facilitating European settlement, and above all as a means to consolidate the French presence by 'pacifying' the colony's southern desert regions. It was believed that the pacification

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[148] Quesnoy, *L'Algérie*, 147.

[149] Arthur-Alexandre Behaghel, *L'Algérie : histoire, géographie, climatologie, hygiène, agriculture, forêts, zoologie, richesses minérales, commerce et industrie, moeurs indigènes, population, armée, marine, administration* (Algiers: Tissier, 1865), 55: "L'Oued Rir' fournit un exemple éclatant du rôle bienfaisant que la sonde française peut accomplir dans le Sahara, tant au point de vue du développement des oasis existantes, de l'amélioration du sort des indigènes et de la pacification du Sud, qu'au point de vue de la création de nouvelles oasis par les européens et de l'extension de la colonisation française."

[150] M.E. Lacroix, *Visites d'un ingénieur à l'Exposition universelle de 1878: notes pour servir de souvenir à l'exposition de 1878* (Paris: Librairie Scientifique, Industrielle et Agricole, 1878), 481: "Ces travaux ramènent la fécondité et la vie dans les oasis de la région saharienne et sont d'un secours puissant pour maintenir notre domination sur les tribus du désert."

of the desert could be achieved by regulating the nomads' relations with water. The idea that hydrological conditions were intimately tied to forms of social organisation and vice-versa, became commonplace particularly in the later nineteenth century.[151] Some argued that these 'hydrosocial relations' could be rethought and reshaped, just as the French civilising mission was supposed to bring about a rigorous societal transformation [152] Antoinette Drohojowska wrote in 1888 that

> the drilling of artesian wells by our soldiers has multiplied, and if this civilising work is continued, it is reasonable to hope, in a relatively short time, for a complete transformation of country and customs."[153]

Like Drohojowska, Niel hoped that water infrastructure would transform the habits of desert populations, arguing that "the nomads of the Hodna and several other places in the Sahara can, from today, abandon their pastoral and wandering life in order to finally settle on the land."[154] Joachim Mathieu Raynard argued that sedentarisation as a result of water provision would incline the native population to restore the land and even lead to the "voluntary *cantonnement* of the natives", rendering available vast expanses of land for European colonisation.[155] The engineer Henri Jus argued that one day the seasonal migrations of nomadic communities, "who […] cause real disturbance along their passage," should be restricted by settling them in new oases in order to ease the development of the European population of the Tell region.[156] Once again reiterating the power of French technology, Jus

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[151] Quesnoy, *L'Algérie*, 103.

[152] For a more thorough definition of the term 'hydrosocial relations', see Linton and Budds' paper on how water-society relations could be theorised: Jamie Linton and Jessica Budds, "The hydrosocial cycle: Defining and mobilizing a relational-dialectical approach to water," *Geoforum* 57 (2014), 170-180.

[153] Antoinette-Joséphine-Françoise-Anne Drohojowska, *Les grandes entreprises au XIXe siècle (2e édition)*, (Lille: J. Lefort, 1888), 93-94: "Depuis ce moment […] les forages de puits artésiens faits par nos soldats se sont multipliés, et si cette œuvre de civilisation est continuée, il est permis d'espérer, dans un temps relativement rapproché, une transformation complète de pays et de mœurs."

[154] Niel, *Géographie*, 103: "En somme, grâce à ces immenses travaux hydrauliques, les nomades du Hodna et de plusieurs points du Sahara peuvent, dès aujourd'hui, abandonner leur vie pastorale et errante pour se fixer définitivement au sol."

[155] Raynard, *Restauration des forêts*, 7: "on amènerait le cantonnement volontaire des indigènes et on rendrait disponibles pour la colonisation européenne de vastes étendues."

[156] Henri Jus, *Les Forages Artésiens de la Province de Constantine (Algérie). Résumé des Travaux Exécutés de 1856 à 1878* (Paris: Imprimerie Nationale, 1878), 20: "Le développement de la population européenne dans le Tell forcera à restreindre un jour ces émigrations périodiques des nomades, qui, traînant à leur suite famille et troupeaux, causent sur leur passage une véritable perturbation; on pourra alors les établir dans les oasis nouvelles."

noted that "nothing had been able to make them renounce the habits of the shepherd life; it only took a few years of French domination, a few artesian wells, to breach an ancient civilisation."[157] These authors acknowledged that water infrastructure and technologically could assume the power to drastically transform the relationship between indigenous pastoral communities and their environment. By affecting and tapping into the apparent potential of the 'territory and its qualities', these hydrological interventions had the parallel effect of bounding nomadic peoples to the land and altering their livelihoods as a result of changing hydrological conditions. It was argued that through the provision of French hydraulic infrastructure, the nomadic tribes could abandon their wandering lifestyle and be transformed into rational and sedentary subjects by settling in villages, which in turn benefitted the evolution of a European settler population.

There was yet another way in which water infrastructure was thought to have aided the political objectives of the colony, namely by increasing the legitimacy of French rule:

> What an influence the accomplished progress can have on the natives! What gratitude do we not have the right to hope for, when we supply water, as if by a miracle, to these thirsty inhabitants of the country they call the country of heat![158]

Here, Henry Lemonnier attests to the belief that the provision of water by the French, as a miraculous phenomenon, would most definitely amplify the legitimacy of French colonial rule in the eyes of the indigenous population. French writers often noted how communities in the desert oases were filled with joy and admiration whenever French engineers had inaugurated a modern new wells with gushing water in the Sahara.[159] Given the colonial government's efforts to spread modern water technology and scientific knowledge to the desert, it is not surprising that the Arabs, Quesnoy reasoned, regarded the results of these French works with such immense joy. He noted that "[a] probing device and a team of labourers have brought them revival and wealth. The daily struggles for water were succeeded by abundance and peace." Rolland recalled how an Algerian in the Oued Rir' anxiously cried for God's help, without which the entire region would be abandoned and buried under the sand. But, the author argued, "the miracle was done and the French probe saved the Oued Rir' by returning its water, that is to say life," accompanied by an image of French army personnel digging and installing a well in

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[157] *Ibid*., 19-20: "rien n'avait pu les faire renoncer aux habitudes de la vie de pasteur; il a suffi de quelques années de la domination française, de quelques puits artésiens, pour faire brèche à une civilisation séculaire."

[158] Lemonnier, *L'Algérie*, 99: "De quelle influence ne peuvent pas être auprès des indigènes les progrès accomplis ! quelle reconnaissance n'avons-nous pas droit d'espérer, lorsque nous fournirons , comme par miracle, l'eau, à ces habitants altérés du pays qu'ils appellent le pays de la chaleur!"

[159] See, for example, Drohojowska, *Les grandes entreprises*, 93; Piesse, *Itinéraire historique*, 452-453; Quesnoy, *L'Algérie*, 147-148.

Tiguedidin, which bears the French tricolour waving at the top of the wooden drilling installation (Fig. 3.4).[160] Michael Adas argues that in the nineteenth century, it was generally thought that Europe's scientific and technological achievements proved that Europe represented the most progressive and advanced civilisation.[161] The French colonial theorist and administrator François-Jules Harmand was convinced that "science and technology alone accounted for whatever admiration non-Western peoples felt for European civilization."[162] In a similar vein, Henri Jus noted that French hydraulic achievements in the Sahara "demonstrated the superiority of the European over the native."[163]

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All in all, the texts examined in this chapter draw an image of an Algeria that is potentially rich in water resources, not unlike the fertility narrative that Diana Davis and Jennifer Sessions have studied. Nevertheless, many writers highlighted the stark contrast between the hydrology of the metropole and what they came across in Algeria. The highly variable nature of the hydrological system in North Africa, with rivers and streams that dried up in the summer and became turbulent and destructive in the wet season, was not consistent with a European imagination of moderate and permanently flowing waters. These discourses were moulded into a language that metropolitan audiences knew and which spoke to their imagination, especially when Algeria's Roman past was invoked or explicit comparisons were drawn with the geography of the French mainland. In doing so, correspondences were established that, in Bernard Cohn's words, could "make the unknown and the strange knowable."[164] Many of the texts convey the idea that Algeria's richness was but a great potential that had not been exploited since the Roman occupation of the region. Colonial France was regarded as the suitable heir to Roman rule, and it was commonly agreed that combining the Roman example with supposedly superior French science and technology could revive Algeria's hydrology to an extent never before realised. On the one hand, French technical knowledge was deemed capable of effecting considerable changes to the Algeria's inefficient and irregular hydrological cycle. At the same time, many of the authors I have discussed were aware of the political objectives that hydraulic engineering could serve. The dissemination of European scientific and technical knowledge, one could argue, was in this sense an integral component of the broader civilising mission. Interventions in the existing water regime could thus forge the indigenous

[160] Rolland, *La conquête*, 47: "Mais le miracle fut fait, et la sonde française sauva l'Oued Rir', en lui rendant l'eau, c'est-à-dire la vie."

[161] Michael Adas, Machines as the Measure of Men. Science, Technology, and Ideologies of Western Dominance (Ithaca: Cornell University Press, 1989), 203.

[162] *Ibid*., 204.

[163] Jus, *Les Forages Artésiens,* 1: "ces travaux d'utilité publique qui partout, et dans le Sahara plus qu'ailleurs, frappent l'imagination et démontrent la supériorité de l'Européen sur l'indigène."

[164] Cohn, *Colonialism and its Forms of Knowledge*, 4.

inhabitants of the land into rational subjects who adhered to a modern, scientific imagination of water and was at the same time an attempt to reproduce environmental conditions suitable for the settlement of Europeans. Within a governmentality framework, infrastructure is instrumental in shaping the 'complex of people and things' and in ordering the "relations between space, water and people."[165] As we have seen, parts of the nineteenth-century French discourse highlight infrastructure's disciplining potential when it is suggested that it is capable of improving the relationship between desert communities and their sources of water. "Material progress was followed by moral progress," Henri Jus claimed with respect to the extension of French wells in the desert.[166]

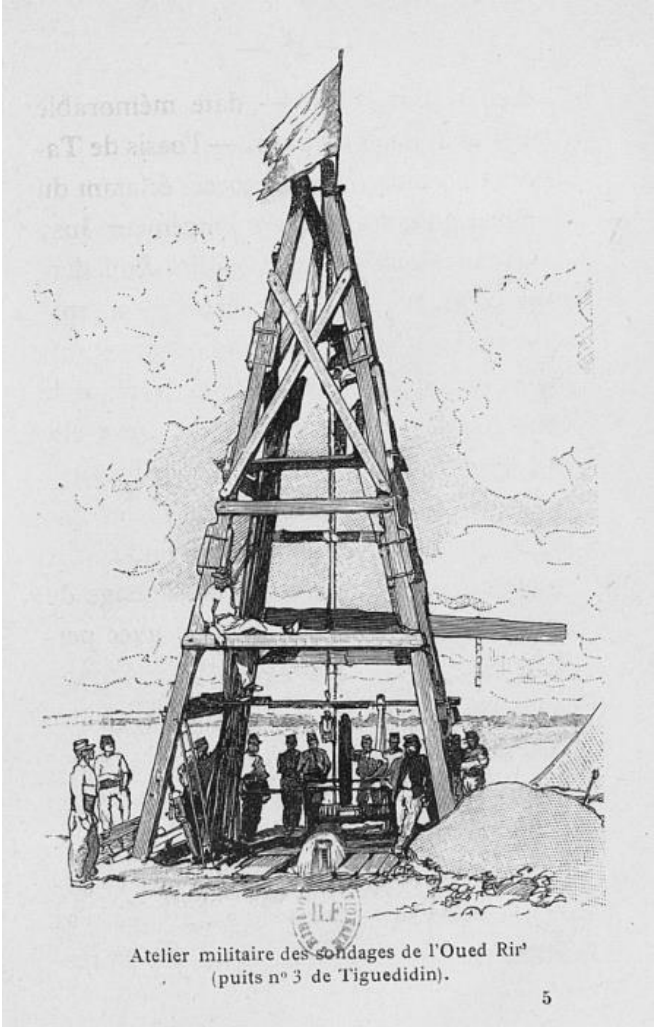

Figure 3.4. *Atelier militaire des sondages de l'Oued Rir'* (Military drilling workshop in the Oued Rir'). Published in Georges Rolland, *La Conquête du désert. Biskra, Tougourt, L'Oued Rir'* (Paris: Challamel, 1889), 49.

[165] Lena Hommes, Jaime Hoogesteger and Rutgerd Boelens, "(Re)making hydrosocial territories: Materializing and contesting imaginaries and subjectivities through hydraulic infrastructure," *Political Geography* 97 (August 2022), 1.

[166] Jus, *Les Forages Artésiens*, 20: "Le progrès matériel a été suivi du progrès moral."

CHAPTER IV

THE MATERIALISATION OF A HYDROLOGICAL DISCOURSE: THE FIRST ATTEMPTS AT A 'HYDRAULIC POLITICS'

> [We] hear the sound of a waterfall, breaking the surrounding silence. We approach: we believe we see a transparent crystal dome that is sparkling, and the eye, as if fascinated, is lost in the contemplation of this mass of clear water, bursting through the metal tube, one or two meters away above the ground, and falling around the orifice into a large basin, from which a rapid stream flows.[167]

Georges Rolland's description of a French well made of metal in the Oued Rir' region conveys the symbolism of European technical mastery and superiority, one of the elements of the hydrological discourse I have outlined in the previous chapter. Many scientists and writers advocated for far-reaching hydrological intervention to restore a supposedly irrational and inefficient water system so different from that of the French mainland. In this chapter, I am concerned with the material ramifications that were motivated or sustained by what Linton terms a form of 'hydrological Orientalism'. Since the availability of water was regarded as quintessential for the accomplishment and prosperity of a French agricultural settler-colony in arid and hydrologically 'neglected' North Africa, Jules Duval argued that in Algeria, "politics should be a hydraulic politics."[168] Early on, metropolitan and colonial authorities embarked on large-scale hydraulic engineering projects across the colony. This chapter concentrates on dam infrastructure and wells, as these represented the most emblematic symbols of colonial modernity, even though throughout the nineteenth century efforts to desiccate marshlands took place in parallel, which contributed to the sanitisation of the land and the population and at the same time added new cultivable land.[169] Soon after the occupation, the military government began to undertake steps to regularise rivers and streams and reduce the seasonal variability of water available for irrigation

[167] Georges Rolland, *La Conquête du désert. Biskra, Tougourt, L'Oued Rir'* (Paris: Challamel, 1889), 52: "[O]n entend le bruit d'une cascade, venant rompre le silence environnant. On s'approche: on croit apercevoir un dôme transparent de cristal qui scintille, et l'œil, comme fasciné, s'oublie dans la contemplation de cette masse d'eau limpide, faisant irruption par le tube métallique, à un ou deux mètres au-dessus du sol, et retombant autour de l'orifice dans une large cuve, d'où part un ruisseau rapide."

[168] As quoted in Paul Leroy-Beaulieu, *De la colonisation chez les peuples modernes (2e éd.)* (Paris: Guillaumin, 1882), 337.

[169] Ministère des Affaires Étrangères, *Exposé de la situation de l'empire, présenté au Sénat et au corps législatif: février 1867* (Paris: Imprimerie de Dupont, 1867).

purposes. As I demonstrate in the first section, from the middle of the nineteenth century the French turned towards the construction of large storage dams, which went hand in hand with the extension of irrigation canals, while effecting institutional reforms aimed at regulating social and economic relations with water. In the second part, I outline the development of artesian wells in Algeria's desert regions, an undertaking that the French regarded as one of their most prestigious advancements as it was aimed at returning life and agricultural production to the Sahara. The new vertical imagination introduced by geology enabled the authorities to map underground water reserves in an increasingly effective manner, prompting a swift extension of new wells across the colony, particularly in the province of Constantine. Although these interventions were part of what the French viewed as a sustained paradigm of socio-economic progress and civilisation, this chapter also demonstrates that transferring French technical expertise often was far from an uncomplicated one-way road.

Making water more predictable: dams and irrigation canals

Between the conquest of Algiers and the end of the nineteenth century, Algeria's rural economy had been drastically transformed as the French replaced the precolonial subsistence economy with a system of large-scale commodity production. Primary resources were to a large extent confiscated and redistributed to the increasing numbers of European immigrants. The impoverished Algerian peasants entered the newly established capitalist colonial economy as agricultural workers and wage labourers for European landowners.[170] The dissolution of existing property relations in Algeria led to the proletarianisation of the peasant population, who were drawn into newly imposed capitalist relations while forcibly abandoning pastoralism, subsistence farming and traditional uses of forests.[171] At the end of the century, between 1.5 and 1.9 million hectares of land had been transferred to European settlers, through a combination of expropriation, confiscation, cantonment and property regulations that transformed the soil into an individually owned commodity rather than a communal asset.[172] As new laws and arbitrary measures were instituted to regulate relations between colonial subjects and the land, governing water also became a legal and administrative concern for the colonial authorities.

The particularities of Algeria's geography and climate prompted the state to bring the management of its waters under its wing. The French jurist Rodolphe Dareste de la Chavanne, for example, argued that

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[170] Mahfoud Bennoune, "The Origin of the Algerian Proletariat," *Dialectical Anthropology* 1, no. 3 (1976), 216.

[171] *Ibid.*, 218.

[172] Charles-Robert Ageron suggested that more than 481,000 hectares had been transferred into the hands of *colons* between 1830 and 1870 and more than a million between roughly 1871 and 1891, whereas René Gallisoot gave an estimate of 1,9 million hectares. Charles-Robert Ageron *Modern Algeria: A History from 1830 to the Present*, trans. Michael Brett (London: Hurst & Company, 1991), 59; René Gallisoot, *L'Economie de l'Afrique du Nord* (Paris: P.U.F., 1964), 40; Bennoune, "The Algerian Proletariat," 212.

> in an arid and largely uncultivated country like Algeria, where the waters must be managed with particular care, it seemed necessary to assign to the public domain all the works carried out by the state or on its behalf, in order to distribute water over the territory.[173]

And thus the Algerian property law of 16 June 1851 declared irrigation canals, aqueducts, wells for public use, salt lakes, water sources and waterways of all sorts inherent aspects of the public domain that could best be managed by the state – a political and legal decision motivated by the perceived geographical qualities of the land. The law also stipulated conditions under which land expropriation by the state was legitimised, which included the establishment of water fountains and irrigation canals.[174] The 1851 law in fact constituted a legal instrument to regulate water-society relations and the state could now rapidly expand its work on irrigation and water retention, while further facilitating the expropriation of irrigated or irrigable lands, for example for the construction of irrigation canals by the state.[175] The adoption of new regulations concerning water resources that overruled existing understandings of how water was governed and used aided the initial era of hydropolitics in colonial Algeria, forestalling conflicts between existing indigenous water-society relations and the newly imposed legal system. Brunhes noted, for example, that in parts of northern Algeria, irrigation was a collective concern and very often was not regulated in the region's *qanun* or local customary laws.[176]

The 'hydropolitics' Duval had envisaged first came to fruition around the middle of the nineteenth century. This period witnessed the planning and execution of a first generation of hydraulic infrastructure that spearheaded a drastic technological incursion into the existing river system, representing a modern colonial attempt at securing control over nature. As Mitchell argues, large-scale hydraulic interventions were the ultimate instrument to rearrange both the social and natural environment.[177] On his journey to Algeria in 1865, emperor Napoleon III promised the *colons* at Sig that he would "take serious care of [their] province by providing [them] with dams," in line with the

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[173] Rodolphe Dareste de la Chavanne, *De la propriété en Algérie: loi du 16 juin 1851, Sénatus-consulte du 22 avril 1863 (2e éd.)* (Paris: Challamel Ainé and A. Durand, 1864), 32: "dans un pays aride et en grande partie inculte comme l'Algérie, où les eaux doivent être aménagées avec un soin tout particulier, il a paru nécessaire d'attribuer expressément au domaine public tous les travaux exécutés par l'État ou pour son compte, afin de distribuer les eaux sur le territoire."

[174] *Ibid.*, 30-31.

[175] Charles Grad, *Les travaux publics en Algérie* (Nancy: Imprimerie Berger-Levrault et Cie, 1883), 28.

[176] Jean Brunhes, *L'irrigation, ses conditions géographiques, ses modes et son organisation dans la Péninsule Ibérique et dans l'Afrique du Nord* (Paris: C. Naud, 1902), 164.

[177] Timothy Mitchell, *Rule of Experts: Egypt, Techno-Politics, Modernity* (Berkeley: University of California Press, 2002), 21.

prevailing hydropolitical mentality that viewed dam building as the instrument of progress for the colony.[178] In 1862, the engineer Maurice Aymard was dispatched to the south of Spain to study grand irrigation works suitable to be emulated in Algeria.[179] Keen to follow the Spanish example in hydraulic engineering, the colonial authorities envisaged a hydraulic politics that consisted largely of large-scale *barrages-réservoirs* (storage dams). These would be equipped with extensive networks of canals to irrigate the surrounding agricultural land. The rationale behind these infrastructures was that settlers could store excess river water in reservoirs during the wet season to be utilised for irrigation in the summer, when native farmers had in effect run out of conventional irrigation water.[180] This logic was supported by an understanding of water as a scarce 'resource' with a natural tendency to run to waste: any water not collected for industrial and agricultural use was regarded as an outcome of wasteful and inefficient management that could be countered through water engineering.[181]

In 1902, the geographer Jean Brunhes mentioned seven *grands barrages-réservoirs* that had been constructed by the French since the Algerian conquest.[182] The earliest of these – the Cheurfas dam at Sig and the dam on the Oued Meurad had already been erected in the late 1840s and early 1850s.[183] The industrialist Antoine Herzog, who advocated an expansive extension of cotton cultivation in Algeria when global production stagnated during the American Civil War (1861 – 1865), was convinced that the town of Sig owed its prosperity to its storage dam. Herzog therefore urged the colonial government to build similar reservoirs on the rivers Tafna, Saf-Saf, Isser, Mékerra, Habra, Riou, Mina and Djidiouïa in the province of Oran.[184] The *Corps des ponts et chaussées* undertook preparations to realise these projects proposed by Herzog, prompted by the economic promises accompanying cotton shortages in the US. But with the restoration of peace on the other side of the Atlantic came the near abandonment of cotton cultivation in Algeria and the ambitious plans for eight new reservoirs were for the most part revoked.[185] Nevertheless, several of the projects envisioned by Herzog were carried out in the following decades, drastically altering the landscape of the Tell region. The Tlélat dam in the province of Oran, originally built from earth in 1860 but destroyed in 1862, was re-erected in masonry between 1869 and 1870 and harnessed an initial capacity of 730,000 cubic meters. The development of the Habra valley in the province of Algiers was envisaged in three phases, from the construction of a dam and reservoir

[178] Unkown author, *Voyage de S.M. Napoléon III en Algérie* (Algiers: Bastide, 1865), 204-205.

[179] Maurice Aymard, *Irrigations du midi de l'Espagne: études sur les grands travaux hydrauliques et le régime administratif des arrosages de cette contrée* (Paris: Lacroix, 1864).

[180] Paul Lévy Salvador, *Hydraulique agricole* (Paris: P. Vicq-Dunod et Cie, 1898), 212.

[181] David Gilmartin, "Water and Waste: Nature, Productivity and Colonialism in the Indus Basin," *Economic and Political Weekly* 38, no. 48 (2003), 5059.

[182] Brunhes, *L'irrigation*, 180.

[183] Grad, *Les travaux publics*, 28.

[184] Antoine Herzog, *L'Algérie et la crise cotonnière* (Colmar: Hoffmann, 1864), 41.

[185] Grad, *Les travaux publics*, 29.

to the desiccation and sanitisation of the Habra valley and finally the construction of irrigation canals. Initially, the *Service des ponts et chaussées* envisaged an earthen dam near the village of Perregaux, but these plans were halted when the dam at Tlélat had been washed away by floods.[186] To fend off similar infrastructural failures, it was eventually decided to erect the Habra dam in masonry and when the dam had been finished in August 1871, it was the largest hydraulic infrastructure of its sort in Algeria at the time.[187] In the decades that followed, three additional storage dams were erected. Two more humble dams were completed on the Djidiouïa and the Oued Magoun near the port of Arzew in 1877 and 1887, respectively. The Hamiz dam on the Oued Hamiz, with a capacity of 14 million cubic meters, was finished in 1886 (Fig 4.1).[188]

Even though in these decades some of Algeria's major rivers were drastically altered, the results of this first era of *barrages-réservoirs* were feeble and did not respond to the greatly increased irrigation demand of settler farmland. Financial limitations and technical failures forced engineers in Algeria to return to a politics of small diversion dams, and only in the 1920s would the politics of large-scale

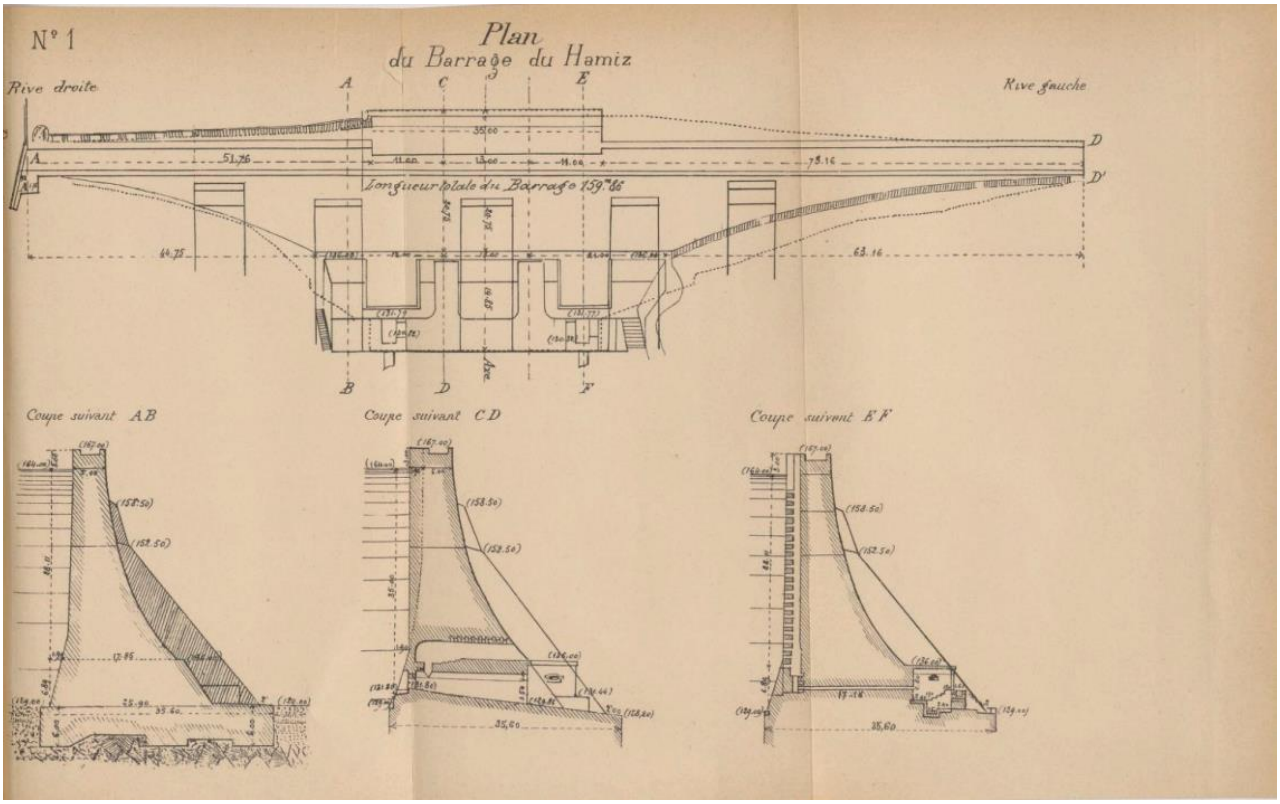

Figure 4.1. *Plan du Barrage du Hamiz* (Blueprint for the Hamiz dam). Published in M.A. Hanric, *Travaux d'hydraulique agricole en Algérie* (Algiers: Torrent et Miaux, 1894), no. 1.

[186] Léon Pochet, "Mémoire sur la mise en valeur de la Plaine de l'Habra (province d'Oran – Algérie)," *Annales des ponts et chaussées* 5, no. 9 (1875), 271.

[187] *Ibid.*, 328.

[188] M.A. Hanric, *Travaux d'hydraulique agricole en Algérie* (Algiers: Torrent et Miaux, 1894).

storage dams be resumed at an even grander scale.[189] Around the *fin de siècle*, some authors began to reflect on the first phase of large-scale hydraulic development in Algeria. Brunhes, for example, noted in 1902 that the *barrages-réservoirs* had failed to deliver their expected results. From a technical perspective, these dams had not been built in accordance with the specific requirements of the Algerian environment, Brunhes argued, and almost all of them had suffered from sudden floods.[190] The Habra dam was severely damaged by floods in December 1881 and the Cheurfas dam at Sig, which had been enlarged between 1880 and 1882, was likewise heavily injured in February 1885. Reconstruction of the latter began in 1886 and only in 1892 was it put back in service (Fig. 4.2). Another challenge was posed by sedimentation, due to which some of the reservoirs had lost considerable storage capacity during the first decades of their existence. The responsible authorities and engineers viciously sought out the most effective dredging techniques to restore the capacity of these reservoirs, but many of the reservoirs were operating far below their original capacities. The Djidiouïa dam, for example, retained a meagre one tenth of its original capacity of 700,000 m^3 around the turn of the century. Sedimentation thus had a significant impact on the acreage of land that could be irrigated by the ensemble of storage dams, which did not exceed 20,000 hectares or about 6 percent of the irrigable farmland at the time.[191]

[189] Jean-Jacques Pérennès, "La politique hydro-agricole de l'Algérie: données actuelles et principales contraintes," *Maghreb – Machrek* 1 (1986), 58.

[190] Brunhes, *L'irrigation*, 180-181.

[191] *Ibid*., 182.

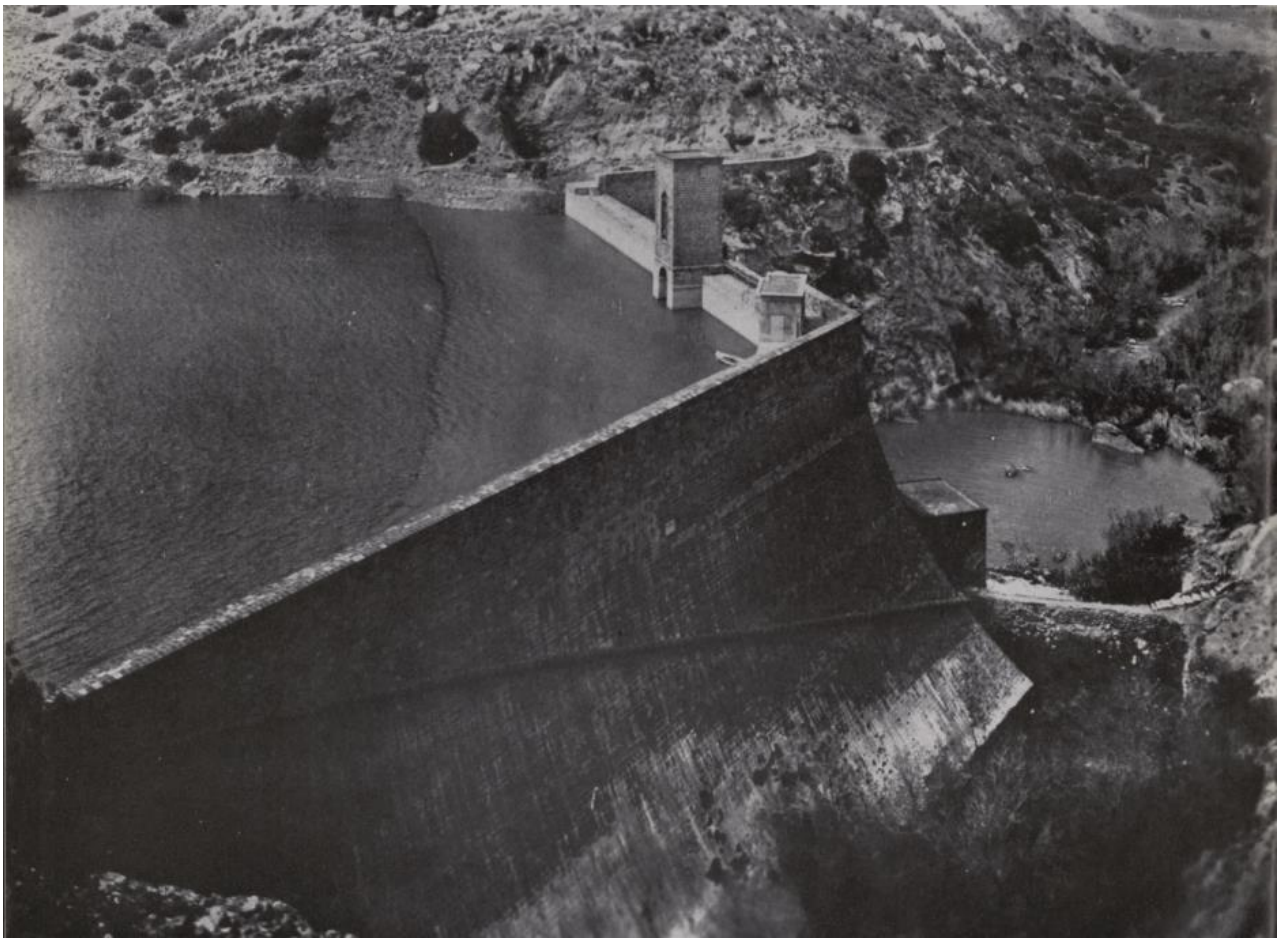

Figure 4.2. The Cheurfas dam at Sig after its partial destruction, in 1885. Published in Comité Algérien des Grands Barrages, *Les travaux de consolidation du barrage des Cheurfas* (Algiers: La Diffusion du Livre, 1951), Fig. 1.

The sort of 'environmental resistance' the French encountered in Algeria has been described by John Broich in the case of British India, where British hydraulic policies and technology were often transferred from the metropole without a sound understanding of local environmental conditions and where "landscapes […] never reacted like the blank canvases on which experts had drawn their designs."[192] The whimsical ways in which these nineteenth century projects had been carried out by engineers in Algeria resonates with Timothy Mitchell's thoughts about how techno-politics operates. In his chapter *Can the Mosquito Speak?*, Mitchell argues about the British engineering work on the Aswan Dam that "science did not direct the engineer's work as a preformed intelligence. The projects themselves formed the science."[193] Technical experts intended to learn from engineering failures and to solve them *in situ*, meaning that

[192] John Broich, "Engineering the Empire: British Water Supply Systems and Colonial Societies, 1850-1900," *Journal of British Studies* 46, no. 2 (2007), 349.

[193] Mitchell, *Rule of Experts*, 37.

> technical expertise did not work by bringing science and technology to develop natural resources. It happened just as much the other way around, and in ways that tended to be incomplete or unrealizable.[194]

As the preparations for the Habra dam demonstrate, the geographical qualities of the landscape and technological failures elsewhere were decisive in shaping the technical features of the dam. Brunhes even wondered around the turn of the century whether the geographical and climatological qualities of the territory were at all congruent with the type of large-scale dams that had been constructed in Algeria in the nineteenth century. Perhaps, he argued, it would be better to replace these enormous and expensive undertakings with small and inexpensive stone dams and wooden barriers similar to, "although more solid and more regular [than] those built by the natives."[195] Even when local knowledge and existing irrigation systems were dismissed in the hydraulic plans of the colonial government, which were supposedly grounded in a universal scientific rationality, local practices thus played a role in ensuing debates about a hydrological approach that best suited Algeria's geography. It is reminiscent of David Gilmartin's observations about imperial science and colonial irrigation technology in the Indus Basin, which, he argued, more often than not reflected an interaction between British expertise and local irrigation knowledge, rather than the all-encompassing European scientific intervention the British had envisioned in India.[196]

Meanwhile, more modest diversion dams yielded more satisfactory results than the costly and ailing storage dams. Already in the 1840s, French engineers were charged with the reconstruction and modernisation of existing diversions dams, such as the Ottoman-era dam in the vicinity of Saint-Denis-du-Sig (Fig. 4.3). Instead of storing excess water in the wet season for irrigation in the summer, these dams redirected water from larger rivers for the supply of irrigation networks. From 1865, communities of irrigators dependent on such dams in the Tell region were organised in so-called *syndicats*. These were associations of landowners, both indigenous and European, that assumed the responsibility to collect taxes among their users for the construction, maintenance and improvement of their irrigation networks, while receiving financial and technical support from the colonial authorities.[197] These institutional modes promised more economically efficient and self-reliant hydro-social relations for the

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[194] *Ibid.*, 42.

[195] Brunhes, *L'irrigation*, 182.

[196] David Gilmartin, "Scientific Empire and Imperial Science: Colonialism and Irrigation Technology in the Indus Basin," *The Journal of Asian Studies* 53, no. 4 (November 1994), 1128.

[197] Gouvernement général de l'Algérie, Direction des travaux publics et des mines, *Notice sur les routes et Chemins, les ports et l'éclairage des côtes, le fonctionnement des services maritimes, l'hydraulique agricole, les associations syndicale, le développement de l'industrie minérale en Algérie* (Algiers: Imprimerie Algérienne, 1906), 148.

growing settler population in a liberal colonial economy, while reconfiguring the existing water-society relations of the native population. The *syndicats* were charged with deciding who could become a member and thus receive irrigation water and in what amounts. Around 1900, 576 irrigation *syndicats* and 35 irrigation companies had been established across the colony, together comprising 330,400 hectares of irrigable land of which 201,200 hectares were effectively irrigated, or about 13 percent of the settler-owned land. Of these irrigation communities, 86 were dependent on diversion dams with which they could irrigate more than 500 hectares each.[198] Settler *syndicats* had to come to terms with existing users and hence often conflicted with native communities reliant on the same watercourse.[199] Brunhes noted that several communities in Kabylia resorted to armed resistance when *colons* had attempted to regulate the distribution of irrigation water that had hitherto been exclusively used by the

Figure 4.3. *Barrage du Sig, pris en amont* (The dam at Sig, viewed from upstream). Published in *L'Illustration,* March 1, 1845, 132.

Kabylians.[200] The fact that Algeria's waterways had become part of the public domain empowered the colonial state to distribute irrigation water as it saw fit, and dams were a means to centralise decision-making. When, for example, in 1858 the settlement of Relizane was founded, the water of the nearby Ottoman dam which had been restored by the French, was reserved exclusively for the irrigation

[198] *Ibid.*, 122-129.

[199] Brunhes, *L'irrigation,* 211.

[200] *Ibid*., 165.

purposes of the town's European population.[201] To secure the developing hydraulic infrastructure against sabotage, the state instituted so-called *ayguadiers*, usually European civil servants charged with policing the irrigation canals.[202]

Exploiting vertical riches: drilling wells in the desert

The importance of the establishment of artesian wells throughout Algeria was recognised in the 1840s and 1850s by the mining engineers Fournel, Dubocq and Berbrugger. Fournel's first attempts at Biskra and in the province of Oran, however, failed to bring to the surface any aquifer water.[203] Soon after the conquest of the Oued Rir', plans were devised at the order of governor-general Randon to develop the region's subterranean hydrological riches and transform the population's "miserable state".[204] The rationale was to revive existing oases while opening up this part of the Sahara to trade and ensuring easy access for French *colons* by creating regular water sources between Biskra and Ouargla.[205] A custom-made drilling rig by the company of the engineer-geologists Degousée and Laurent, who were experts in drilling and surveying artesian wells in France and had previously drilled artesian wells in the oases of Upper Egypt, was imported from the metropole.[206] The first successful drilling in Algeria was initiated on 17 May 1856 in the oasis of Tamerna in the Oued Rir', led by the engineer Henri Jus – the 'new Moses' in the words of Georges Rolland.[207] This well brought forth a "real river of 4,010 litres of water per minute [rushing] from the bowels of the earth," comparable, according to Georges Rolland, to the best artesian wells in Paris.[208] General Desvaux recalled the immense joy of the oasis inhabitants: "the news of this drilling spread throughout the South with incredible speed. People came from very far to

[201] Robert Tinthoin, "Une plaine oranaise transformée par l'irrigation: la Mina," *Revue de géographie alpine* 42, no. 2 (1954), 232.

[202] Brunhes, *L'irrigation*, 176.

[203] Ludovic Ville, *Notices sur les puits artésiens des provinces d'Alger, d'Oran et de Constantine* (Algiers: V. Aillaud et Cie, 1876), 57.

[204] Achille Fillias, *Géographie physique et politique de l'Algérie* (Algiers: Imprimerie V. Aillaud et Cie, 1875), 76: "Les habitants, réduits à la misère."

[205] Justin Savornin, *Essai sur l'hydrologie du Hodna* (Algiers: Adolphe Jourdan, 1908), 8.

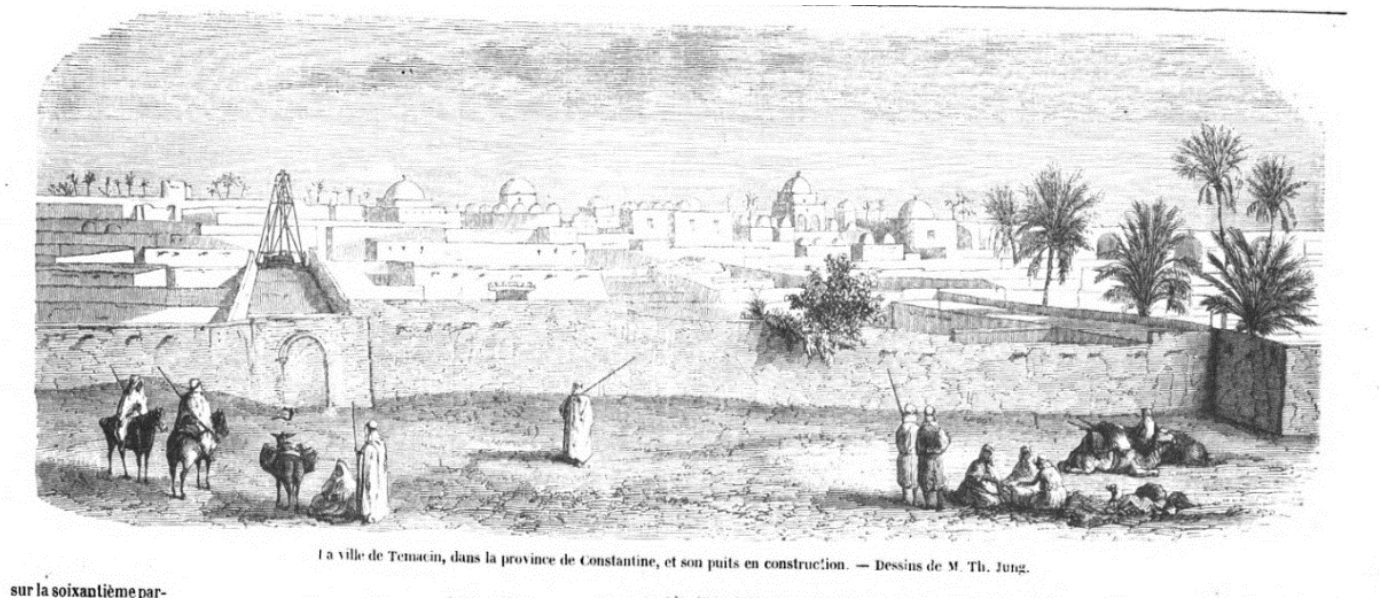
[206] Henri Jus, *Les Forages artésiens de la province de Constantine (Algérie). Résumé des travaux exécutés de 1856 à 1878* (Paris: Imprimerie Nationale, 1878), 11-12.

[207] Georges Rolland, *La Conquête du désert. Biskra, Tougourt, L'Oued Rir'* (Paris: Challamel, 1889), 44.

[208] Louis Piesse, *Itinéraire historique et descriptif de l'Algérie, comprenant le Tell et le Sahara* (Paris: L. Hachette, 1862), 453: "une véritable rivière de 4010 litres d'eau par minute, s'élançant des entrailles de la terre." Georges Rolland, *La Conquête du désert. Biskra, Tougourt, L'Oued Rir'* (Paris: Challamel, 1889), 40.

see this marvel."[209] The well was allegedly baptised the *Fontaine de la Paix* (Fountain of Peace) by local leaders.[210]

Soon after, new wells were inaugurated in several other oases in the Oued Rir' and the military extended its operations to the Hodna region (Fig. 4.4 and 4.5).[211] According to Desvaux, in the first five years these drilling operations had delivered fifty functioning artesian wells in the Oued-Rir', the Eastern Sahara and the Hodna, totalling nearly 37,000 liters of water per minute to revive "ruined oases" and facilitate the planting of 31,000 palm trees, 1,000 fruit trees and more than 1,000 vegetable plots. The general further proclaimed that the Hodna's fertile lands, "watered by gushing fountains, will one day be the diamond of European colonisation."[212] Ludovic Ville reported in 1875 on the progress of well construction across the provinces of Constantine, Algiers and Oran. The endeavours of the drilling workshops in Constantine had established 169 wells by 1875, with a total debit of 1,028 litres per second, of which 85 percent was located in the Sahara.[213] The vast majority of these had been dug in the Oued



La ville de Temacin, dans la province de Constantine, et son puits en construction. — Dessins de M. Th. Jung.

sur la soixantième par-

Figure 4.4. Th. Jung. *La ville de Temacin, dans la province de Constantine, et son puits en construction* (The town of Temacin, in the province of Constantine, and its well under construction). Published in *L'Illustration* 30 (1857), 284.

[209] As quoted in Louis Piesse, *Itinéraire historique*, 453: "la nouvelle de ce forage se répandit dans le Sahara avec une rapidité inouïe. On vint de très-loin pour voir cette merveille."

[210] *Ibid.*, 12.

[211] Justin Savornin, *L'hydrologie du Hodna*, 9-10.

[212] Nicolas Gilles Toussaint Desvaux, *Rapport à M. le maréchal gouverneur général de l'Algérie sur les forages artésiens exécutés dans la division de Constantine en 1859-1860* (Constantine: Ve Guende, 1861), 35-36: "Les terres fertiles du Hodna, arrosées par les fontaines jaillissantes, seront un jour le diamant de la colonisation européenne."

[213] *Ibid.*, 90-91.

Rir', a region rich in date palms where private French *sociétés* had established several new agricultural oases (Fig. 4.6).[214] Rolland noted that by 1889, the agricultural value of the Oued Rir' had quintupled and its population doubled as a result of the extension of artesian wells.[215] It must be noted that, according to Ville, the original debit of the wells in Constantine was over 2,100 litres per second, but had more than halved several decades later as a result of siltation and technical failures. Nevertheless, the operation of the drilling workshops in the province of Constantine continued steadily in the following decades, totalling more than 360 wells by 1902 with a debit of over 4,400 litres per second.[216] Outside of Constantine and its desert hinterlands, drilling operations were equally extended, although their results were more moderate. Ville noted that between 1836 and 1875, 113 drillings had been executed in the province of Algiers, furnishing 416 litres of water per second.[217] In the province of Oran, the results were even more feeble, as merely 15 wells had been drilled by 1875, with a total debit of 126 litres per second.[218]

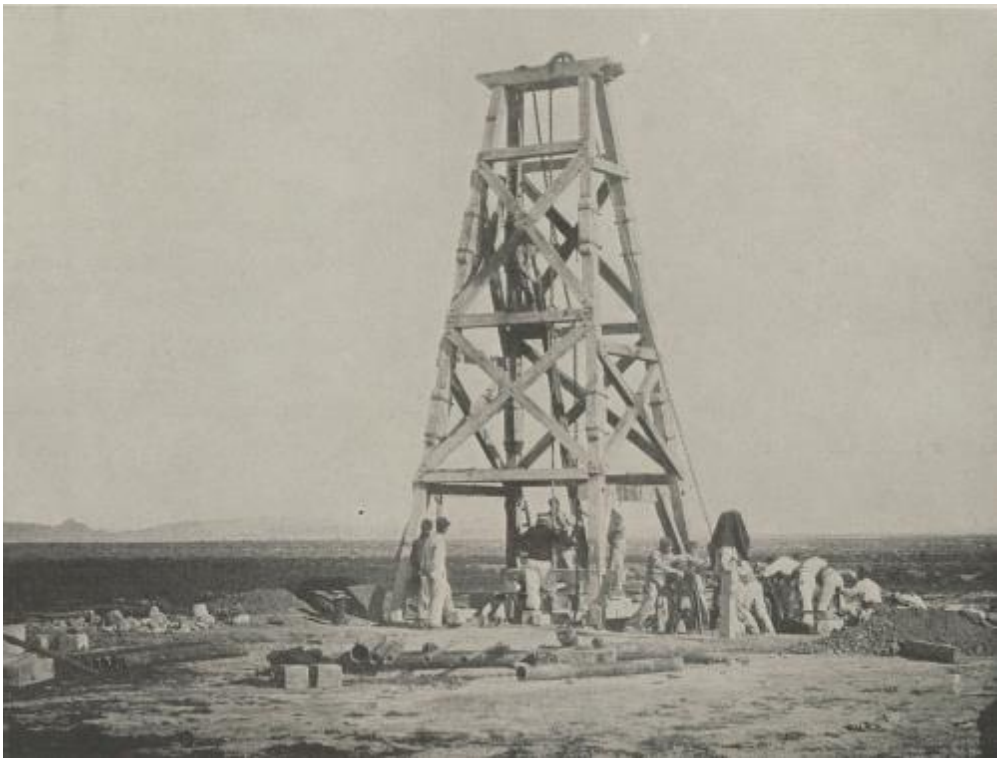


Figure 4.5. French drilling workshop at Tolga. Published in Paul Paris, "Les Puits artésiens sur les territoires du Sud en Algérie," *La Dépêche Coloniale Illustrée*, March 15, 1909.

[214] Brunhes, *L'irrigation*, 269-270.

[215] Rolland, *La Conquête*, 48.

[216] Paul Paris, Les Puits artésiens sur les territoires du Sud en Algérie, *La Dépêche Coloniale Illustrée*, March 15, 1909, 74.

[217] Ville, *Notices sur les puits artésiens*, 18-19.

[218] *Ibid*., 49-50.

French interventions in the hydrology of the desert oases affected existing social and cultural relations around water. The indigenous organisations of well drillers (*m'eallem*) and 'divers' (*r'tassin*), who for centuries had been responsible for the excavation of wells. These indigenous workshops were hired in the oases both to manually dig new wells and to clear out existing wells that had been congested with sand. As described with fascination by Adrien Berbrugger, the *r'tassin* would descend into the wells after performing extensive prayers and musical rituals.[219] But the manual work of the *r'tassin*, who were organised in associations and operated by descending into deep well, was earmarked as too dangerous and unhealthy and technically inferior in comparison to the more automated French technical equipment and expertise of the engineers brought from France. Subsequently, the *r'tassin* were prohibited by General Desvaux, who argued that "far from ruining their industry, we wanted to make it less dangerous."[220] Now that their local prestige had faded, Desvaux argued, the *r'tassin* attempted to denigrate European technology instead of participating in the wave of progress, but "fortunately our triumph was so brilliant […] that they could not mislead public opinion."[221] The institution of the *m'eallem* and *r'tassin* was superseded by the French workshops led by the military or the *Service des Mines*, rendering oasis communities more dependent on the colonial authorities for their water provision. After the French had commenced their drilling campaigns in the Oued Rir', some of the 'divers' were employed by these French workshops.

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As I have outlined in the previous chapter, dominant hydrological discourses in Algeria prescribed that its hydrological system was defunct and inefficient and therefore demanded to be regularised and modernised along French scientific and 'rational' lines. The growing apparatus of hydrological scholarship in Algeria was instrumental in identifying inefficiencies and wasteful uses in the existing water system and informed political and economic centres of calculation in the metropole and the colony. The *politique hydraulique* pursued by the French government in Algeria from around the middle of the nineteenth century envisioned a prestigious system of *barrages-réservoirs.* These emblematic infrastructures were aimed at rationalising and regularising Algeria's rivers for agricultural purposes and ensuring that irrigation water was available throughout the seasons. Even when the results of the initial series of *barrages-réservoirs* constructed before the end of the century were meagre and did not correspond to the French discourse of technological superiority, these first decades of hydropolitics

[219] Adrien Berbrugger, *Les puits artésiens des oasis méridionales de l'Algérie (2e édition)* (Algiers: Bastide, 1862), 68.

[220] Georges Rolland, *Hydrologie du Sahara algérien* (Paris: Imprimerie Nationale, 1894), 55; Piesse, *Itinéraire historique*, 461: "loin de ruiner leur industrie, nous voulions la rendre moins dangereuse."

[221] Piesse, *Itinéraire historique*, 461: "Heureusement notre triomphe a été si éclatant, si considérable, qu'ils n'ont pu égarer l'opinion publique."

nevertheless constituted a first breakthrough in the reorganisation and regulation of water-society relations in Algeria. In accordance with the discourse dissected in the previous chapter, which stipulated that the desert could be revived if only its underground reserves were exploited, the French also laid out an expansive patchwork of wells throughout Algeria's desert regions, particularly in the province of Constantine. This resulted in the disappearance of traditional well drilling techniques and institutions and the establishment of new oases. By bringing the extension of hydraulic engineering and the provision of water to the oases under the command of the colonial authorities, these first attempts at a hydraulic politics also encompassed a first attempt at increasing the colonial state's ability to govern and regulate the relations between colonial subjects and water. Analogous to the expropriation of farmland and the regulation of forests, the increased legal and infrastructural regulation of water-society relations was necessary to forge rational subjects who could advance the development of a settler colony with an agricultural economy along European lines. The logic behind the first French hydraulic infrastructures in Algeria, even if they broke down or underperformed, nevertheless remained rooted in the conviction that European science and technology could forge the idea of modernity, and was pivotal in achieving control over nature and enhancing political sway over colonised subjects.

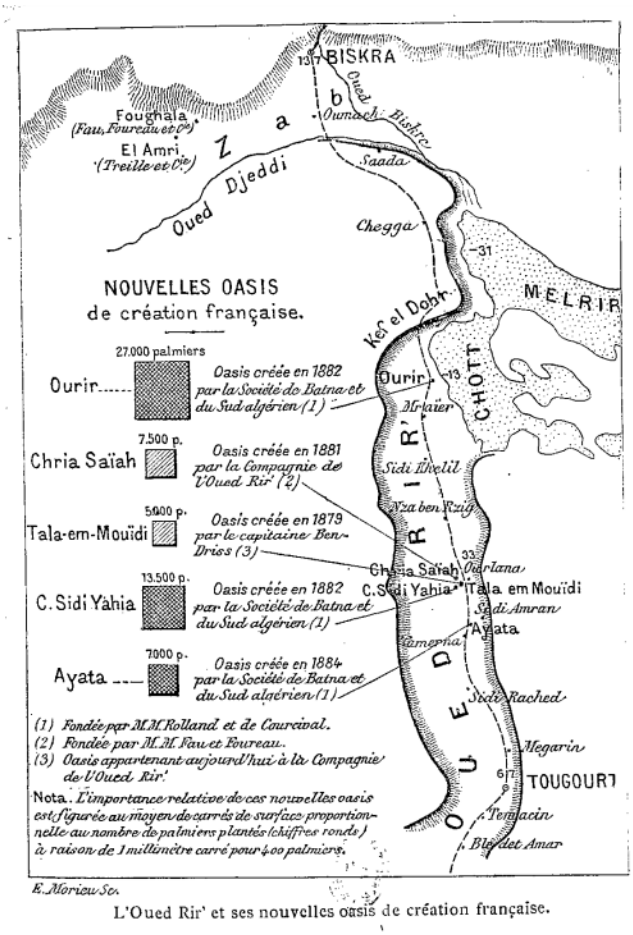

Fig. 4.6. E. Morieuse, *L'Oued Rir' et ses nouvelles oasis de création française* (The Oued Rir' and its new French oases). Published in Georges Rolland, *La Conquête du désert* (Paris: Challamel, 1889), 21.

CONCLUSION

Let us return to the quotation in the introduction of this study, in which Georges Rolland likened the extension of French hydraulic infrastructure in Algeria to 'colonisation efforts of an entirely new kind.' Throughout the four preceding chapters, my aim has been to demonstrate in what ways water indeed came to be viewed as an instrument of the French colonisation of Algeria begun in 1830. In the first chapter, I have outlined how existing analyses of environmental discourses and their material repercussions in French Algeria can be theorised from a colonial environmental governmentality perspective. Environmental governmentality offers a lens to elucidate how socio-environmental relations become part of the political rationality of the state, while introducing new forms of knowing and representing nature which in a colonial context often displaced existing environmental epistemologies. As I discussed, modern imaginations of water, introduced by colonial hydrology, informed hydraulic interventions aimed at shaping native populations into modern and 'civilised' colonial subjects.

In the second chapter, I outlined how the introduction of such new 'regimes of truths' about water was facilitated in French Algeria, emphasising the linkages between hydrological knowledge production and the political and economic interests of the colonial military government and the metropole. Knowledge of the colony's water resources became a major concern for the development of an agricultural settler colony, and water was embedded in the colonial state's political rationality through state-sponsored science and hydrological surveys. As growing numbers of engineer-scholars and other scientists settled in Algeria, many of them reproduced and built upon the results of the first scientific mission of the 1840s, while collectively shaping novel understandings of water largely rooted in metropolitan epistemologies. These scientific conventions moulded water into a measurable and mechanical resource that could be made legible for the colonial state through extensive surveys of quantified data. Importantly, therefore, new ways of seeing and knowing water emerged that facilitated the calculation and regulation of water and water-society relations.

Given that water is charged with cultural, political and social meaning, parallel ontologies and discourses of water exist, such as Worster's 'imperial water'. In the third chapter, my objective has been to empirically inquire how a specifically French colonial imagination of water emerged in the nineteenth century, facilitated by newly introduced structures of knowledge production. The French vision of Algeria's water, and of Algerians' relations with water, was cast in a language of 'hydrological Orientalism'. Existing water management was classified as defunct and inefficient, both in the more water abundant Tell region and in the relatively arid desert regions. I demonstrated that by identifying themselves with the Roman history of the region, the French positioned themselves as the rightful heirs of a rich and abundant land, consistent with Davis' 'declensionist' environmental narrative. The Roman imagination of water was supposedly reminiscent of a modern French hydrological imagination that centred around voluminous and regular flows of surface water. At the same time, French scientific and

technical superiority was deemed capable of achieving an even greater abundance than the Romans had ever attained. The techno-scientific mastery of nature was progressively linked to society's advancement, and hydraulic engineering became an intricate aspect of the French civilising mission, anticipating the regularisation and 'rationalisation' of Algeria's rivers and streams and exploitation of aquifers. As I demonstrated, there also existed an explicit recognition in nineteenth-century France that interventions in Algeria's hydrology served as a political instrument by facilitating colonial expansion and increasing the legitimacy of French rule among the indigenous population. The assumption that technology could instil political legitimacy was rooted in broader discourses portending European technological superiority, which could not but leave Algeria's desert populations in awe by supposedly transforming the Sahara into a fertile Eden. Water management was deemed particularly useful in transforming social relations, especially as French hydraulic technology could mould pastoral desert populations into sedentary and therefore manageable communities. Hydrology was thought to contribute to the broader objectives of colonial state-building in French Algeria, as it aided the transformation of socio-environmental relations that were equally pursued through forest management and related legal measures, as Davis, Ford and Sivak have so convincingly argued.

As the existing scholarship on forest management in Algeria reflects, the state can resort to an assortment of instruments and tactics to regulate the relations between the population and the territory in accordance with dominant environmental discourse. In the final chapter, it became clear that the French colonial authorities and *colons* nurtured ambitious visions of a *politique hydraulique* that entailed a rearrangement of existing water-society relations. Initial endeavours to regularise Algeria's rivers in the form of large-scale storage dams, which replaced or complemented existing indigenous infrastructure deemed ineffective, stumbled upon instances of 'environmental resistance' that delineated the limits of transferring French scientific and technical expertise to a new socio-environmental context. Nevertheless, these policies were aimed at preparing the territory for the settlement of growing numbers of French and European settlers and the irrigation demands of expropriated agricultural lands. Parallel to the hydraulic engineering in the Tell region, the French authorities devised plans to extend wells into the desert regions as a means of consolidating political power in more remote parts of the colony and increasing the agricultural production of the oases. This project was particularly successful in Constantine and its desert hinterlands, even though French technology did to a certain extent encounter similar environmental resistance there. I argued that despite the disappointing results of some of the earliest hydraulic infrastructures in Algeria, nineteenth-century technological endeavours were rooted in a 'modern' and mechanical imagination of water that viewed European hydraulic engineering as a superior means to increase control over Algeria's hydrology and regulate the relations between water and colonial subjects. This newly introduced vision at times conflicted with existing social relations around water in Algeria.

This study contributes to an understanding of previously studied environmental narratives in French Algeria by detailing an underexposed 'resource' through which the French were convinced they

could restore an underdeveloped and barren land. The belief that a modern European state can revive the hydrology of its colonised lands through its scientific superiority is of course not novel and has been extensively studied especially in the case of British India. But what sets French hydrological discourses of Algeria apart is the notion that this technical superiority was grounded in the belief that the French inherited the superb hydrological project of the Romans. Furthermore, this thesis contributes to a blossoming scholarship on the 'power and politics of water', as it deepens our understanding of how environmental knowledge production, as a practice that is historically and culturally contingent, relates to colonial environmental discourses and their material corollaries. As such, the concept of environmental governmentality helps to explain how the French colonial state depended on the introduction of new hydrological imaginations or regimes of truth in order to be able to reimagine and reorganise the relations between water, colonisers and colonial subjects. With this in mind, I do not advocate an essentialist or romanticised understanding of 'indigenous knowledge' about water and the environment, nor that indigenous relations with the environment are always synonym with socio-economic equality. As argued by John Briggs et al., it is important to acknowledge that 'local knowledges' tend to have a multiplicity of sources, are dynamic and are grounded economically and socio-culturally.[222] Nevertheless, with the introduction of French science and technology to Algeria, new Orientalist imaginations of water were introduced that tended to dismiss existing hydro-social relations and informed material policies predicated on social and racial hierarchies.

Important questions remain, for example with regards to the multidirectional dissemination of hydrological knowledge within the confines of the French empire and beyond. Acknowledging empires as transnational spaces that facilitate the complex circulation of people, cultural products, knowledge and political ideas, this study would equally be a good starting point to inquire how the experiences of *ingénieurs savants* with water in Algeria subsequently shaped knowledge production and water infrastructure in other parts of the French empire. David Gilmartin points out that British colonial irrigation engineers at the College of Civil Engineering at Roorkee in the middle of the nineteenth century were educated closely along the lines of the Parisian *École Polytechnique* where French colonial engineers generally were trained. This suggests that the experiences of French hydraulic engineers in Algeria may arguably also have affected hydrological policy in other parts of overseas Europe.[223] Recent ventures in the field of critical digital humanities have demonstrated the value of combining such digital methodologies as Geographic Information System (GIS) to concretely entrench historical, socio-economic and spatial data and render these connections visible. Since the scope of this thesis did not allow an additional analysis of that calibre, I am convinced that such an approach in future research

[222] John Briggs et al., "The nature of indigenous environmental knowledge production: evidence from Bedouin communities in southern Egypt," *Journal of International Development* 19, no. 2 (2006), 239-251.

[223] David Gilmartin, "Water and Waste: Nature, Productivity and Colonialism in the Indus Basin," *Economic and Political Weekly* 38, no. 48 (2003), 5058.

could produce a more thorough image of the extent of French hydrological engineering in Algeria and the socio-environmental inequalities resulting from French water policies. This touches upon another important avenue for future inquiry, namely to draw a more comprehensive picture of the subjectivities involved in the reorganisation of hydro-social relations. Brunhes described briefly the resistance against redistributions of irrigation water by communities in Kabylia, and it would be valuable to see if the *Archives Nationales d'Outre-Mer* hold material that can further our understanding of how, why and by whom French hydrological interventions were contested.

The relevance of this study is underscored by pointing to visions of water and hydraulic policies in post-colonial North-Africa. As Diana Davis points out as well, the historically inaccurate environmental narrative construed in colonial North Africa, has to a certain extent persisted in post-colonial states, particularly with regards to desertification.[224] As these states were incorporated into the global economy, large-scale hydraulic interventions became common-place both as instruments for economic development and as symbols of modern state power. Large-scale hydraulic infrastructure has been increasingly scrutinised for its severe social and environmental costs and for embodying a technocratic and mechanical imagination of water that is often inconsistent with alternative socio-cultural understandings of water.[225] This study has demonstrated that the construction of modern, colonial visions of water has a longer history and that in Algeria, French colonisation and its 'civilising mission' contributed to this sweeping ontological and socio-environmental transformation. Reconsidering the origins and evolution of these hydrological discourses and their ties to modern state power is relevant for present-day socio-ecological crises. As Orazio Irrera notes, recognising the emergence and contingency of environmental discourses and governmental technologies in nineteenth-century colonial empires helps to better understand our postcolonial present.[226] Significant areas in Algeria today suffer from overexploitation of renewable and non-renewable groundwater reserves. While climate change serves as an exacerbating factor, shortages of irrigation water are intimately tied to the Algerian government's ceaseless policy to promote the expansion of irrigated agriculture at an industrial scale.[227] Together with the construction of large-scale storage dams, the continuous exploitation of groundwater is part of a modern hydrological paradigm premised upon the view that the hydrology of more arid regions can be fixed and regularised through techno-political instruments. This

[224] Diana Davis, "Desert 'wastes' of the Maghreb: desertification narratives in French colonial environmental history of North Africa," *Cultural Geographies* 11, no. 4 (2004), 379-380.

[225] See, for example, Beatriz Rodríguez-Labajos and Joan Martínez-Alier, "Political ecology of water conflicts," *WIREs Water* 2, no. 5 (2015), 537-558. For a review of the socio-environmental impacts of

[226] Orazio Irrera, "*Environmentality* and Colonial Biopolitics: Towards a Postcolonial Genealogy of Environmental Subjectivities," in *Foucault and the History of our Presence*, ed. Sophie Fuggle, Yari Lanci and Martina Tazzioli, 179-194 (Basingstoke: Palgrave MacMillan, 2015), 192.

[227] Nabil Kherbache and François Molle, "Causes and consequences of the Macta basin closure, Algeria," *International Journal of Water Resources Development* 39, no. 3 (2023), 382-403.

thesis demonstrates that such narratives, grounded in the belief that the modern state can achieve absolute control over nature, clearly had colonial antecedents if not roots.

In a much more generic sense, I believe that this study contributes to a growing intellectual endeavour to rethink and reimagine dominant nature-society relations in the Anthropocene which in the past decades have proved to be so detrimental to our climate and ecosystems. It does so by historicising what water is and how it can be known, as well as contextualising how society's relations with water are contingent and grounded in political-economic and socio-cultural realities. By starting from the conviction that water and society are dialectically intertwined and acknowledging the parallel existence of alternative hydrological imaginations, I hope this study adds to a much-needed reconsideration of widely held perceptions of water-society relations.

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