

Water and Power:
Reintegrating the State into the Study of Egyptian Irrigation

Brendan Haug

Assistant Professor of Classical Studies and Archivist of the Papyrology Collection
University of Michigan, Ann Arbor
435 S. State St.
2160 Angell Hall
Ann Arbor, Michigan 48109-1033
United States

bjhaug@umich.edu

Author Manuscript

This is the author manuscript accepted for publication and has undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the [Version of Record](#). Please cite this article as doi: [10.1111/hic3.12394](https://doi.org/10.1111/hic3.12394)

Water and Power:
Reintegrating the State into the Study of Egyptian Irrigation

Abstract:

The study of irrigation in ancient Egypt has swung between two poles. Early environmental-determinist scholarship stressed the imperative of state control while the most recent work denies the state any significant role and instead emphasizes the agency of local communities. This article briefly explores the historiography of Egyptian irrigation, critiquing both its colonialist roots and the extreme reaction against colonialist preconceptions that marks current scholarship. A case study of Roman state coordination is then presented as an argument for reintegrating the state into the history of Egyptian water management.

In a wide-ranging 2010 survey of water use in human civilization, journalist Steven Solomon describes the construction of Egypt's Aswan High Dam as "heralding a renewal of Egyptian control over the Nile like that exerted by the Pharaohs of its bygone ancient civilization" (2010, p.249). The assertion jars the ears of the contemporary Egyptologist, reeking as it does of the environmentally-determinist theory of "hydraulic despotism" advanced in Karl Wittfogel's controversial monograph *Oriental Despotism: A Study in Total Power* (1957). Indeed, Wittfogel's fixation on state power has been so thoroughly rejected in Anglophone Egyptology that assertions of the predominant role of the state in ancient Egyptian irrigation are now decidedly *passé*. In their place is an emphasis on local control and the agency of village communities, a welcome and long-overdue turn toward an agricultural history of ancient Egypt whose protagonists are Egypt's farmers themselves, not their political masters.¹

In papyrological circles a revisionist take on Roman Egypt has similarly established itself as the conventional wisdom. Earlier orthodoxy held that after reducing it to a Roman province, the emperor Augustus conferred upon Egypt a unique status. It was to be the private property of the emperor and governed by his own hand-picked equestrian deputy rather than a senatorial proconsul; senators, furthermore, were prohibited from setting foot upon Egyptian soil without the emperor's explicit permission. Both decisions were pragmatic moves to deny potential

challengers an effective power base (as Egypt had been for Augustus' former rival Mark Antony). But these atypical administrative arrangements were also rooted in Egypt's new function as the granary of Rome, its renowned productivity having been yoked to the service of the *cura annonae*, the grain dole in the imperial capital. Egypt's agricultural wealth and its recent role in Roman international politics thus combined to create a province that occupied a "special place" (*Sonderstellung*) in the constellation of Rome's overseas possessions.

Like the notion of pharaonic Nile mastery, the *Sonderstellung*-thesis has been relegated to the historiographical dustbin. It is now broadly accepted that Egypt was no more unusual than any other region of the Roman Empire, chiefly because there was no such thing as a "typical" imperial province (Bowman & Rathbone 1992; Rathbone 1993; Keenan 2009). It has also been convincingly demonstrated that Roman exploitation of Egypt was less intensive than previously believed and far from an crushing burden on the backs of an enslaved peasantry (Rathbone 1989, Monson 2012, p. 159-248; Haug forthcoming). On the whole, this has been yet another salutary shift in scholarly perceptions. With the numerous similarities between the provincial and municipal administrations of Egypt and those of the rest of the eastern Mediterranean now established beyond doubt, Roman historians are no longer able to justify the neglect of papyrological sources in larger historical narratives (e.g., Potter 2014). After languishing on the sidelines for more than a century, papyrology is quickly becoming an integral component in the Roman historian's toolkit.

Perhaps perversely, this paper takes a step back from these revisionist narratives and asks whether we have too hastily banished both the notion of a state role in ancient Egyptian irrigation and the idea of Roman-Egyptian exceptionalism. To be sure, this is neither a wholesale criticism of these recent interpretive turns nor is it a call to return either to environmental determinism or to some variant of the *Sonderstellung*. Rather, it is simply suggested here that these earlier scholarly paradigms may yet have something to contribute to the study of Egyptian irrigation, one of the most confounding and controversial subjects in history of Egyptology.

To salvage something of value from the wreckage of hydraulic despotism we must first move beyond Wittfogel and explore the role of environmentally-determinist *étatisme* in the development of modern Egyptology itself. The early historiography of Egyptian irrigation reveals that the politicized environmental determinism of colonial writers—scientists, scholars, and statesmen alike—made a foundational contribution to the understanding of water and state power during Egyptology’s nineteenth-century *naissance*, a legacy that has been obscured by the flurry of anathemas directed solely at Wittfogel and his specific errors. The unwillingness within the most recent scholarship to grant the state any significant role in Egyptian irrigation thus simultaneously serves as a principled rejection of the colonialist paradigms that underpinned early Egyptology, an atonement for the original sin inherent in the discipline’s colonial-era conception. Yet only by acknowledging the political context of early research into water and the state in ancient Egypt can we clear the way for more sophisticated inquiries into the role of the central government in managing premodern Egypt’s natural resources.

Reestablishing a convincing role for the state in Egyptian irrigation further requires a greater respect for the administrative limitations of premodern bureaucracies than either Wittfogel or his intellectual predecessors possessed. Still more essential, however, is an emphasis on state particularity, i.e. an acknowledgment that there was not a singular premodern “Egyptian state” but rather a series of state formations whose character and ambitions changed over time (Manning 2010). Consequently, there was a spectrum of potential relationships between nature, state, and society throughout Egyptian history, none of which ever amounted to governmental control over the waters of the Nile.

The basic outlines of Egyptian irrigation have long been familiar in the west. Farmers practiced a unique method of flood-recession (often dubbed “basin”) irrigation throughout the Nile Valley and Delta. Through a complex network of embankments, dykes, canals, and inundation basins, the predictable and usually gentle yearly rise of the Nile was harnessed and directed toward productive ends. Once the flood reached its zenith and local basins were filled and sealed, the

water was left to stand for as long as two months. During this time it saturated parched soils and dissolved the salts and other deleterious minerals that had built up over the preceding year. After the basins were breached for sowing, whatever waters remained within them were drained, carrying dissolved pollutants and back to the river.² A flood sufficient to irrigate all or most of Egypt's agricultural land promised a bountiful harvest with substantial surplus.³ By contrast, low and high floods disrupted the sowing schedule and produced short-term food shortages; high floods also caused significant property damage and loss of life as they tore violently across the floodplain. Although not uncommon, these were minority events, occurring only once every four or five years on average (Said 1993, p. 96-7).

This highly productive form of agricultural irrigation was distinct from the rainfed agriculture of the northern Mediterranean, the *wadi* irrigation of arid North Africa, and the less reliable basin irrigation practiced along the banks of the Tigris and Euphrates, whose floods were unpredictable and often violent. Emerging in prehistory and fully superseded only in the first decade of the twentieth century, flood-recession irrigation has long epitomized Egypt as the "hydraulic civilization" *par excellence* in the western historical imagination. Yet observers of Egyptian antiquity have simultaneously tended to perceive an unfortunate but inevitable corollary to the country's dependence upon artificial irrigation, namely the despotic central government essential—allegedly—to the coordinated exploitation of the flood and the management of the so-called "irrigation system."

Although the twinned theories of environmental determinism and eastern authoritarianism have their roots in Classical Greek thought, the specific relationship between irrigation, state formation, and the development of despotic centralization is most often associated with Wittfogel's *Oriental Despotism* (1957). Although the book remains a touchstone of determinist political theory, it nonetheless represents only the fullest elaboration of an idea that already underpinned the modern western encounter with Egypt in the late eighteenth and early nineteenth centuries (Manning 2010, p.39). Indeed, Napoleon Bonaparte, whose brief

conquest of Egypt sparked its scholarly and popular rediscovery in the west, was already convinced that nature demanded a strong central state in Egypt. In his memoirs he argued:

The [French] government has no influence on the rain or snow that falls on Beauce or Brie, but in Egypt the government has a direct influence on the extent of the inundation that takes their place. This is what makes the difference between the Egypt administered by the Ptolemies and the Egypt already in decline under the Romans and ruined by the Turks.

Like blood coursing through veins, the movement of water throughout the canals of the countryside reflects the strength of the central government, Egypt's beating heart. A vigorous administration produces a swift and unimpeded flow. By contrast, Napoleon claimed, under weak and flabby leadership:

[T]he canals are choked with mud, the dykes badly maintained, the rules of irrigation transgressed, and the principles of the system of inundation contravened by sedition and the private interests of persons and localities (*Correspondence de Napoleon I^{er}*, Vol. 29, 463).

French scholars and scientists continued to disseminate this deterministic view of Egyptian governance throughout the first half of the nineteenth century, crying in vain that "Egypt's life is the Nile; the desert is death; the Nile created it...Therefore Egypt is the land that most demands to be governed" (Baring, *Modern Egypt*. II.457-8, from Colla 2007, p.113-4). But as French influence in Egypt waned in the latter half of the nineteenth century, British writers took the lead in time with their own empire's increasing entanglement in Egyptian politics (Kalin 2006). Scarcely a year after Britain's brutal 1882 Bombardment of Alexandria and its subsequent takeover of the Egyptian government, the determinist narrative was already a fixture of British

popular discussions of the “Egyptian Question.” As the *Times*’ special correspondent for Egypt would write in 1883:

The quantity and quality of the crops depend on the way in which the fields are watered, and the way in which the fields are watered depends upon the administration, so that in Egypt the Government plays the part which in most other countries is assigned to weather-controlling Providence. (Wallace 1883, p.477)

Firmly ensconced in the popular and intellectual imagination, the determinist narrative finds its finest summation in a wide-ranging monograph by botanist and cotton specialist Lawrence Balls entitled *Egypt of the Egyptians* (1920):

When glancing through the History of Egypt we have seen how repeatedly the country has gone to ruin because the irrigation system was allowed to deteriorate, and how quickly the country again became prosperous when a strong ruler took the irrigation system in hand...The history of the Egyptians themselves, as apart from the history of their governors, is largely a history of the water supply.”⁴

Nowhere is the dehumanization produced by the determinist narrative more obvious. By effacing any human agency apart from the firm hand of the state, determinism reified irrigation practices in Egypt as a single, unified “irrigation system” whose behavior remained static over time. Thus conceived, rational albeit necessarily authoritarian state management of the country’s water resources becomes the only viable option. Without such control, irrigation would lapse into chaos and, for want of water, Egypt would desiccate and starve. Tendentious and unproven, this constant refrain helped to justify first French and later British colonialism as the liberation of Egypt from Ottoman misrule and the restoration of its “irrigation system” to the heights it had reached under the pharaohs.⁵

Developed and disseminated by scientists, politicians, and journalists, this propagandistic narrative became a piece of common wisdom amongst educated classes in France and Britain in the later nineteenth century. As a result, its influence was felt even in early Egyptology, a field whose disciplinary boundaries were at the time highly porous. *Fin de siècle* Egyptology's membership was diverse, comprising both credentialed academics and amateur enthusiasts with varied backgrounds and interests (Gange 2013). Among its most high-profile and well-respected early satellite members were a handful of British hydraulic engineers who had been involved in massive, publicly-celebrated irrigation modernization projects in colonized India and Egypt (Andersen 2011). Since academic Egyptologists were trained primarily in philology and archaeology, they supposedly lacked the necessary expertise to expound upon so technical a subject as irrigation. As a result, the first histories of Egypt's eternal "irrigation system" were written not by scholars but by practitioners with vast experience in the field of hydraulic engineering.

This disciplinary cross-fertilization is most evident in the career of the polymathic William Willcocks, Victorian Britain's most celebrated hydraulic scientist.⁶ In the preface to Willcocks' *From the Garden of Eden to the Crossing of the Jordan* (1919)—an attempt to locate the Garden of Eden by identifying rivers and waterways mentioned in the Bible—Oxford scholar Archibald Sayce accepted Willcocks as a colleague "in the same field of archaeological research".

In numerous public lectures, interviews, monographs, and even U.S. Congressional testimony, Willcocks and others brought their unique expertise and interests to bear upon the task of explaining the political and cultural achievements of pharaonic Egypt. Predictably, they located the source of its greatness in the pharaohs' genius for water control. In one engineer's telling, the legendary first pharaoh Menes himself was the technocratic mastermind of Egypt's canal system:

We may suppose that [Menes] came into Egypt...and found the Nile in a very untrained state...The first thing he would do would be to construct a series of banks reaching from the desert on the one hand to the high deltaic ridge on the other. The conditions under which he would work must have been much the same as now.⁷

In this fanciful scenario, the founder's engineering skill inspired a long tradition: "when we read of such and such a king restoring public works in a long and glorious reign, there must have existed a continuous supply of good engineering talent which had *carte blanche* from the ruler of the day."⁸ Such talents were found even in foreigners integrated into to the kingdom. The patriarch Joseph, eventually promoted to the position of pharaoh's vizier after his enslavement in Egypt, is transformed by another engineer-scholar into an ancient analogue of the peripatetic and micromanaging colonial British Inspector of Irrigation, who would "travel all over Egypt and make himself personally acquainted with the conditions of the problem with which he had to deal" (Brown 1899, p.22).

In this self-regarding variant of the determinist narrative, Egypt's earliest rulers were compelled by the harsh demands of their environment to become "masters of engineering, mathematics, agriculture, civil government, and organisation of masses of men" (Ross 1893, p.178-79). As Willcocks would incessantly argue, their achievements held profound lessons for the present, particularly the need for greater political power and autonomy for contemporary engineers like himself: "the lessons to be learned from the river regulation and control of the ancients are writ large over all their undertakings—thoroughness, combination, and continuity. The farther we go back in the world's history the more thorough was the work." (Willcocks 1903, p.61).

These fictions provided the model for the few notices of Egyptian irrigation that appear in near-contemporary academic Egyptology. Basing himself upon the rough outlines of the determinist narrative, Gaston Maspero alleged that self-interested, localized irrigation projects resulted in chaos and intercommunal conflict in Egypt until water control was centralized by the

kings of the nascent Egyptian state: “It was necessary...to coordinate the system of distribution in order for the country to obtain at least a start on the social organization analogous to that which it had later: the Nile determined the political makeup as well as the physical makeup of Egypt” (1899, vol I p.70). By comparison, the technocratic language of American Egyptologist James Henry Breasted reveals his dependence upon the more developed version of the narrative popularized by Anglophone engineer-scholars: “Public works, like the opening of irrigation canals...show [the pharaohs’] solicitude for the economic resources of the kingdom, as well as a skill in engineering and a high conception of government” (1905, p.48). Breasted’s Old Kingdom also displayed “uniform government, with centralized control of the inundation, in the vast system of dykes and irrigation canals,” as well as a ruler who bore more than a passing resemblance to British colonial Consul-General Lord Cromer in consultation with the Egyptian Ministry of Public Works: “[The pharaoh] was thus an educated and enlightened monarch...[and] constantly received his ministers and engineers to discuss the needs of the country, especially in the conservation of the water supply and the development of the system of irrigation” (1905, pp. 92, 77).

Specialists in Graeco-Roman Egypt did not lag far behind, similarly claiming that “the system of irrigation, by canals from the river and by control of the annual flood, should be organised as a whole throughout the country” (Milne 1927, p.6). Accordingly, the late antique decline of a number of villages in the Fayyum was taken to represent the collapse of “competent engineering and an effective system of irrigation” throughout the whole of the country (Westermann 1919, p.164; cf. Milne 1898; Boak 1926). Even in some contemporary scholarship it remains axiomatic that “control of the Nile flood, with the irrigation and drainage works this necessitates, has always been of crucial importance for whoever controls the land of Egypt” (Thompson 1999, p.107).

In the midst of the long and vigorous debate surrounding Karl Wittfogel’s *Oriental Despotism*, an archaeologist noted approvingly that “Wittfogel’s work has attracted relatively little notice

among Egyptologists.”⁹ True, as far as it goes. But Egyptology had little need for Wittfogel, having already developed its own version of his “hydraulic hypothesis.” Its most enduring creation, Egypt’s singular “irrigation system,” dies hard.

Contemporary approaches to water management in ancient Egypt, at least the most recent Anglophone scholarship, attempt to avoid even the suggestion of *étatisme*. Today the state is pushed into the background and ancient texts attesting government officials involved in irrigation are construed as idealizing rhetoric (Cook 2011, p.31). Egypt possessed a “centralizing principal” in the figure of the pharaoh but it simultaneously lacked the administrative capacity to manage water at the national level (Manning 2010, p.81). The king, whether native pharaoh or Greek Ptolemy, is accordingly reduced to the role of “director” while “local elites and the growing bureaucracy” take center stage (Manning 2010, p.44). The recent landmark compendium *Ancient Egyptian Administration* (Willems 2013) encapsulates the contemporary mood, relegating in-depth discussion of water management to a chapter on local government in the Middle Kingdom.

There is much to be grateful for in this new history. But in rejecting not only Wittfogel but also the obsession with state power intrinsic to colonial Egyptology, contemporary scholarship on water management unduly ignores the state. While it is true that no Egyptian government ever exercised the mastery of the Nile envisioned in the romantic fantasies of modern hydraulic engineers, the evidence for central state involvement in irrigation in all periods of Egyptian history cannot be dismissed (Cook 2011, pp.30-51).¹⁰

Evidence from the Roman period showcases the ambitions, capacities, and limitations of premodern state governance of Egyptian water. Although the *annona* depended in part upon exported Egyptian grain, Rome did not create a central bureaucracy to regulate the water supply (Bonneau 1981). Instead, Rome incorporated traditional Egyptian irrigation practices into its provincial administrative apparatus by reconfiguring certain informal, customary activities as liturgical obligations or other state appointments. This manipulation of Egypt’s socio-natural allowed Rome to coordinate, though not ultimately control, the flow of water throughout the

Egyptian countryside (cf. Mikhail 2011). The complex administrative structure that resulted from Roman intervention cannot be described in full here; a brief glimpse will nonetheless suffice to illustrate its key features.

Rome's primary interest was the maintenance of Egypt's irrigation infrastructure, i.e. the public dykes and canals that harnessed and channeled the flood. In this, the Alexandrian *dioiketes* (Egypt's chief of finances), an official renamed the *katholikos* in late antiquity, took the lead. Dioiketai commanded local administrators to appoint "overseers" (*epimeletai*) from local magistrates or private persons to supervise the work in each village and ensure the integrity of irrigation infrastructure. They similarly appointed "inspectors of dykes" (*chomatepimeletai*) who were in charge of the maintenance of public dykes and canals in a single toparchy (district within a nome) (Sijpesteijn 1964; Bonneau 1993b, pp.158-61).

But these "inspectors of dykes" were simply one member of a complex network of officialdom that stretched from Alexandria to Egypt's country villages. In the rural hinterland, where the life and prosperity of all farmers depended upon timely access to floodwaters, village officials could be burdened with critical logistical responsibilities such as the provision of supplies necessary to repair local infrastructure. If they failed to do so, villagers could appeal to higher levels of the provincial administration for assistance (Youtie 1974). Far from being simply reactive, however, state officials encouraged village irrigators to inform nome (county) *stratego*i of local needs prior to the commencement of the annual dyke-work project.

The administration of canal- and dyke-work (*chomatika kai diorychika erga*) produced a blizzard of paperwork each year that extended from the highest levels down even to illiterate villagers, who were required to complete five days of labor each year on public canals and dykes—the so-called *penthemeros* system. Every able-bodied male, in turn, was presented with a dated receipt certifying his completion of this obligation (Sijpesteijn 1964).

Although vast amounts of detail are necessarily elided here, even this brief survey gives the impression of a rigid hierarchy originating in Alexandria and terminating on the bowed back of a laborer in some remote village, struggling to move his assigned quantum of heavy, black

Egyptian earth under the watchful eye of state appointees. This is hardly unwarranted. Yet it would be a mistake to get lost in the often perplexing administrative details and come to regard the Roman administration of dyke- and canal-work as the *sine qua non* of Egyptian water management. Rather, we must remember that the system was founded upon the willing efforts of the Egyptian peasantry.

Comparative evidence helps to illuminate aspects of spontaneous self-organization in rural Egypt. In the thirteenth-century Fayyum, for instance, the yearly opening and closing of the dam that admitted water into the canal system was performed and directed entirely by villagers themselves. The only “officials” involved in the process were the handful of local men informally dubbed “engineers” (*muhandis*) by virtue of their long experience with the dam (Rapoport & Shahar 2012). The beneficiaries of this infrastructure, in other words, simultaneously comprised the labor force responsible for its upkeep. Even in contemporary Egypt where water control has been largely centralized, the task of monitoring irrigation at the village level—the state function of *hydrophylakia* in the Roman period—is collectively performed by irrigators themselves. Since each cultivator has a stake in the fair apportionment of the water supply, mutual surveillance is a fact of life and water thieves are informally treated by their neighbors to a broken nose or a sharp blade (Mehanna 1984; Price 1995; Luyendijk 2009, pp.55-56).

Roman management of Egyptian irrigation is thus best characterized not as the imposition of radical new forms of rural organization but as the institutionalization of extant communal behavior. But if it is a mistake to overlook the independent agency of Egypt’s peasantry, it is equally unwise to forget that Roman coordination of local labor was backed at all times by the threat of state violence. Indeed, by incorporating the irrigation practices of independent communities into an administrative hierarchy in which each liturgist was accountable to his superiors and undertook considerable personal risk in the execution of his responsibilities, Rome incentivized a heavy-handed approach to labor coordination. In the end, villagers who wished for whatever reason not to participate in the annual *chomatika kai*

diorychika erga had little room for maneuver under Roman rule. In small, independently-governed irrigation communities, stubbornness and personal enmities can be enough to get a farmer out of work (Sheridan 1996). In Roman Egypt, apart from an ignominious flight from one's land, close-fisted belligerence was perhaps the only other viable option for healthy adult males.

Although the independent agency of the peasantry was ignored and the power of the ancient state exalted in the earliest studies of Egyptian irrigation, their fantastical depictions of the relationship between state and society do not justify the equally extreme rejection of state agency that characterizes the most recent work. Indeed, it has been argued here that we ignore the influence of the state in Egyptian irrigation at our peril. During the Roman period at least, Egypt's government engaged in a wholesale coordination of the spontaneous rituals of dyke- and canal-work, an attribute of Egyptian socio-nature that was as integral a part of the rhythms of the agricultural year as the flood itself. Under Rome, these local labor traditions were restructured as a tax, albeit one measured in days of work and volumes of earth to be moved rather than in cash or kind.¹¹ The local oversight of this tax-labor was further systematized by extending liturgies, a common form of municipal governance in the eastern half of the empire, deep into Egypt's rural hinterlands. Rome thus produced a singularly intense form of state oversight that linked rural Egyptians and the earth they shifted each year to the heights of the Alexandrian administration and ultimately to public granaries and dole recipients in Rome and Constantinople.¹² It was an altogether exceptional administration, albeit one that helped to make an unusual environment legible to and tractable by its Roman imperial masters.

This administrative apparatus was nonetheless founded upon the willing participation of the Egyptian peasantry, the labor force of Egyptian irrigation.¹³ Rome could coerce and compel but not indefinitely, as we see in an incident in late fourth-century A.D. Theadelphia, a dying village in the western Fayyum. Formerly a large and prosperous settlement (Sharp 1999), Theadelphia had lately suffered from chronic water shortages and its population had

consequently declined to a mere handful (Bagnall 1982). In what was surely an extraordinary encounter between the highest levels of provincial administration and the environmental concerns of a tiny village, Valerius Tziper, the governor (*praeses*) of the late antique province of Aegyptus Herculia, adjudicated a dispute between the remaining Theadelphians and the residents of the village of Andromachis to the south, whom the Theadelphians accused of stealing water. In his Latin verdict, Tziper adhered to the Roman legal principle that public water should be divided according to the needs of its dependents and he accordingly ordered the Andromachians to take only what they required and allow the remainder to flow downstream to Theadelphia.¹⁴ Tragically for the Theadelphians, the decision failed to solve their problems and the village was soon thereafter abandoned completely. In spite of his power over life and death, no provincial governor could conjure water out of thin air or force Egypt's peasants to remain bound to empty canals and the desiccated fields they no longer watered.

WORKS CITED

Bibliography

Alleaume, Ghislaine. (1992). Les systèmes hydrauliques de l'Égypte pré-moderne: Essai d'histoire du paysage. In Christian Décobert (ed.), *Mélanges offerts au père Maurice Martin s.j.*, (pp.301-22). Cairo: Institut français d'archéologie orientale.

Andersen, Casper (2011). *British Engineers and Africa, 1875-1914*. London and New York: Routledge.

Bagnall, Roger S. (1982). The Population of Theadelphia in the Fourth Century. *Bulletin de la Société d'Archéologie Copte* 24, 35-57.

--- (1993). *Egypt in Late Antiquity*. Princeton: Princeton University Press.

Balls, W. Lawrence (1920). *Egypt of the Egyptians*. New York: Charles Scribner's Sons.

Baring, Evelyn. (1907). *Modern Egypt*. London & New York: The Macmillan Company.

Blouin, Katherine (2014). *Triangular Landscapes: Environment, Society, and the State in the Nile Delta under Roman Rule*. Oxford: Oxford University Press.

Boak, Arthur E. R. (1926). Irrigation and Population in the Faiyûm, the Garden of Egypt. *The Geographical Review* 16/3, 353–364.

Bonaparte, Napoleon (1870). *Correspondence de Napoléon I^{er}, Tome 29: Oeuvres de Napoléon I^{er} a Sainte-Hélène*. Paris: Henri Plon.

Bonneau, Danielle (1971). *Le fisc et le Nil*. Paris: Éditions Cujas.

--- (1981). La haute administration des eaux en Egypte, d'après la documentation papyrologique aux époques grecque, romaine et byzantine. In Roger S. Bagnall et al. (eds.) *Proceedings of the XVI International Congress of Papyrology, New-York, 23-31 July 1980* (pp.321-328). Chico, CA: Scholars Press.

--- (1993a). Une survivance indigène: les 'Anciens du village' et l'irrigation en Égypte. In Marie Madeleine Mactoux and Evelyne Geny (eds.) *Mélanges Pierre Lévêque* 7 (pp.21-31), *Annales littéraires de l'Université de Besançon* 491.1.

---(1993b). *Le régime administratif de l'eau du Nil*. Leiden: Brill.

Bowman, Alan K. and Rathbone, Dominic (1992). Cities and Administration in Roman Egypt. *Journal of Roman Studies* 82, 107-27.

Brown, Robert Hanbury (1899). *The Land of Goshen and the Exodus*. London Edward Stanford.

Breasted, James Henry (1905). *A History of Egypt from the Earliest Times to the Persian Conquest*. New York: Charles Scribner's Sons..

Clot, Antonine Barthelemy (1840). *Aperçu général sur l'Égypte*. Paris: Fortin Masson.

Colla, Elliott (2007). *Conflicted Antiquities: Egyptology, Egyptomania, Egyptian Modernity*. Durham N.C.: Duke University Press.

Cook, Ronald James (2011). *Landscapes of Irrigation in the Ptolemaic and Roman Fayum: Interdisciplinary Archaeological Survey and Excavation Near Kom Aushim (Ancient Karanis), Egypt*. Dissertation, University of Michigan.

Esmeir, Samera (2012). *Juridical Humanity: A Colonial History*. Stanford: Stanford University Press.

Gange, David (2013). *Dialogues with the Dead: Egyptology in British Culture and Religion, 1822-1922*. Oxford: Oxford University Press.

Gilmartin, David (2006). Imperial Rivers: Irrigation and British Visions of Empire. In D. Ghosh and D. Kennedy (eds.) *Decentering Empire: Britian, India and the Transcolonial World* (pp.76-103). New Dehli: Orient Longman.

Haug, Brendan (forthcoming). Roman Egypt. In T. Howe and D. Hollander (eds.) *The Blackwell Companion to Ancient Agriculture*. Malden, MA: Wiley.

Kalin, Michael (2006). *Hidden Pharaohs: Egypt, Engineers and the Modern Hydraulic*. M.Phil.Thesis, Oxford.

Keenan, James G. (2009). Egypt's "Special Place." In E.P. Cueva, S.N. Byrne, and F. Benda (eds.), *Jesuit Education and the Classics* (pp.177-92). Newcastle upon Tyne: Cambridge Scholars Publishing.

Luyendijk, Joris (2009). *People Like Us: Misrepresenting the Middle East*. Berkeley, CA: Soft Skull Press.

Manning, Joseph G. (2010). *The Last Pharaohs: Egypt Under the Ptolemies, 305-30 BC*. Princeton: Princeton University Press.

Maspero, Gaston (1899). *Histoire des Peuples de l'Orient Classique*. Paris: Librairie Hachette.

Mehanna, S., R. Huntington and R. Antonius (1984). *Irrigation and Society in Rural Egypt*. Cairo papers in social science Vol. 7, Monograph 4. Cairo: American University in Cairo Press.

Mikhail, Alan (2011). *Nature and Empire in Ottoman Egypt: An Environmental History*. Cambridge: Cambridge University Press.

Milne, J. Grafton (1898). *A History of Egypt under Roman Rule*. London: Methuen and Company.

Milne, J. Grafton (1927). The Ruin of Egypt by Roman Mismanagement. *Journal of Roman Studies* 17, 1-13.

Monson, Andrew (2012). *From the Ptolemies to the Romans: Political and Economic Change in Egypt*. Cambridge: Cambridge University Press.

Ostrom, Elinor and Gardner, Roy (1993). Coping with Asymmetries in the Commons: Self-Governing Irrigation Systems Can Work. *The Journal of Economic Perspectives* 7/4, 93-112.

Ozden, Canay (2013). The Pontifex Minimus: William Willcocks and Engineering British Colonialism. *Annals of Science* 71/2, 183-205.

Parsons, Peter (2007). *City of the Sharp-Nosed Fish: Greek Lives in Roman Egypt*. London: Weidenfeld and Nicolson.

Pearl, Orsamus M. (1951). ΕΞΑΘΥΡΟΣ: Irrigation Works and Canals in the Arsinoite Nome. *Aegyptus* 31, 223-30.

Potter, David (2014²). *The Roman Empire at Bay*. London: Routledge.

Price, David (1995). Water Theft in Egypt's Fayoum Oasis: Emics, Etics, and the Illegal. In M.F. Murphy and M. Margolis (eds.) *Science, Materialism and the Study of Culture* (pp.96-110). Gainesville, FL: University Press of Florida.

Rapoport, Yossi and Shahar, Ido (2012). Irrigation in the Medieval Islamic Fayyum: Local Control in a Large-Scale Hydraulic System. *Journal of the Economic and Social History of the Orient* 55, 1-31.

Rathbone, Dominic (1989). The Ancient Economy and Graeco-Roman Egypt. In L. Criscuolo and G. Geraci (eds.), *Egitto e storia antica dall'ellenismo all'età araba* (pp.159-176). Bologna: CLUEB.

Rathbone, Dominic (1993). Egypt, Augustus and Roman Taxation. *Cahiers du Centre Gustave Glotz* 4/1, 81-112.

Römer, Cornelia (2013). Why did the villages in the Themistou Meris die in the 4th century AD? New ideas about an old problem. In C. Arlt, M.A. Stadler (eds.), *Das Fayyûm in Hellenismus und Kaiserzeit: Fallstudien zu multikulturellem Leben in der Antike* (pp.169-80). Wiesbaden: Harrassowitz Verlag.

Ross, Justin C. (1893). Irrigation and Agriculture in Egypt. *Scottish Geographical Magazine* 9/4, 169-93.

Said, Rushdi (1993). *The River Nile: Geology, Hydrology and Utilization*. Oxford: Pergamon Press.

Sijpesteijn, Pieter J. (1964). Zum Bewässerungswesen in Römischen Ägypten. *Aegyptus* 44/1-2, 9-19.

Sijpesteijn, Pieter J. (1964). *Penthemeros-Certificates in Graeco-Roman Egypt*. Leiden: Brill.

Sharp, Michael (1999). The Village of Theadelphia in the Fayyum: Land and Population in the Second Century. In A. Bowman and E. Rogan (eds.), *Agriculture in Egypt from Pharaonic to Modern Times* (pp.159-92). Oxford: Oxford University Press.

Sheridan, Thomas E (1996). La Gente Es Muy Perra: Conflict and Cooperation over Irrigation Water in Cucurpe, Sonora, Mexico. In J.B. Mabry (ed.), *Canals and Communities: Small-Scale Irrigation Systems* (pp.33-52). Tuscon, AZ: University of Arizona Press.

Solomon, Steven (2010). *Water: The Epic Struggle for Wealth, Power, and Civilization* (New York: Harper Collins).

Thompson, Dorothy (1999). Irrigation and Drainage in the Early Ptolemaic Fayyum. In A. Bowman and E. Rogan (eds.), *Agriculture in Egypt from Pharaonic to Modern Times* (107-22). Oxford: Oxford University Press.

Trigger, Bruce (1970). Egypt and the Comparative Study of Early Civilizations. In K. Weeks (ed.) *Egyptology and the Social Sciences*. Cairo: American University in Cairo Press.

Wallace, Donald Mackenzie (1883). *Egypt and the Egyptian Question*. London: Macmillan and Company.

Westermann, William L.(1917). Aelius Gallus and the Reorganization of the Irrigation System of Egypt under Augustus. *Classical Philology* 12/3, 237-43.

Westermann, William L. (1919). The Development of the Irrigation System of Egypt. *Classical Philology* 14/2, 158-64.

Willcocks, William (1899). *Egyptian Irrigation*. London: E. & F.N. Spon, Ltd.

Willcocks, William (1903). Egypt, Fifty Years Hence. In W. Willcocks, *The Restoration of the Ancient Irrigation Works on the Tigris or the Re-creation of Chaldea* (pp.43-71). Cairo: National Printing Department.

Willcocks, William (1910). Mesopotamia: Past, Present, and Future. *The Geographical Journal* 35/1, 1-18.

Willcocks, William (1914). "River Regulation and Control in Antiquity," 63rd Congress, 2nd Session, Committee on Rivers and Harbors, House of Representatives, U.S., Document No. 18.

Willcocks, William (1918). *From the Garden of Eden to the Crossing of Jordan*. Cairo: IFAO.

Willems, Harco (2013). Nomarchs and Local Potentates: the Provincial Administration in the Middle Kingdom. In J.C.M. Garcia (ed.), *Ancient Egyptian Administration* (pp.341-92). Leiden: Brill.

Wittfogel, Karl A. (1957). *Oriental Despotism: A Study in Total Power* (New Haven: Yale University Press).

Youtie, Herbert (1974). P.Mich.Inv. 2920 = Sammelbuch IV 7361. *Zeitschrift für Papyrologie und Epigraphik* 15, 149-152.

¹ In contrast to the turn in Anglophone scholarship described here, demonstrated most clearly in the work of Joseph Manning (see references below), irrigation continues to be studied as a branch of administrative history in certain European circles. The late French papyrologist Danielle Bonneau's work on the flood, particularly irregular floods, and taxation (Bonneau 1971) and her later studies of the administration of irrigation in the Graeco-Roman period are well-known (Bonneau 1981; 1993b). Her late-life turn toward localism in Egyptian irrigation was sadly not developed beyond a single article (Bonneau 1993a) thanks to her death in 1992. In her massive administrative study of the *praefectus Aegypti*, Andrea Jördens (2009, pp. 399-439; esp. 399-414) offers a more subtle reading of Roman state involvement in Egyptian water management, one that recognizes the paucity of evidence for the regular involvement of high officialdom. The monograph's focus on the upper levels of Roman Egyptian state administration nonetheless precludes advancing a new theory of state-society cooperation in the field of water management.

² Thanks to the profound changes to the Egyptian landscape over the millennia and the dearth of ancient evidence for rural phenomena so banal as irrigation, the technicalities of ancient flood-recession irrigation are impossible to reconstruct in precise detail. It is nonetheless clear that the 19th-century Egyptian countryside, a product of a massive late Ottoman reorganization of Egyptian irrigation, can no longer be read as a proxy for the ancient irrigated landscape (Alleaume, 1992). The comparative work of Ottomanist Nicolas Michel (2005) on ancient and 18th-century and irrigation suggests that a tangled network of dykes and tiny localized basins, rather than feeder canals and massive basins, characterized Egyptian basin irrigation throughout premodernity, prior to the 19th century.

³ Usually estimated as a tenfold return seed for grain though a countrywide return of 13:1 or even 15:1 is possible. See Haug (forthcoming)

⁴ Balls (1920, p.128). Cited with similar analysis in Esmeir (2012, p.167).

⁵ E.g. Baring, *Modern Egypt*. II.457-8. Cited with analysis in Colla (2007, p.113-4).

⁶ On Willcocks see Gilmartin (2006) and Ozden (2013).

⁷ Ross (1893). What Col. Ross describes is in fact the layout of the nineteenth-century Nile Valley, not that of the ancient past.

⁸ Ross (1893), Willcocks (1899, p.vi-vii).

⁹ Trigger (1970, p.27).

¹⁰ Cook (2011, 30-51).

¹¹ Certain categories of landholder could commute their labor into a cash payment, the so-called *naubion* tax. Blouin (2014, p.133).

¹² My debt here to Mikhail (2011) is obvious.

¹³ Bonneau (1993a) explores the place of village elders (*presbyteroi*) in Egyptian irrigation, a subject that does not figure prominently in her unfinished and posthumously published monograph Bonneau (1993b). Bonneau draws a sharp line between “the state” (i.e. titled officials representing the government) and “*indigènes*” like the *presbyteroi*, representatives of an older pre-Greek and pre-Roman stratum of village self-organization that is merely tolerated by the state and permitted to act only in unusual circumstances or on marginal lands sporadically cultivated. In contrast, this argument has sought to blur such a stark state-society distinction.

¹⁴ *P.Sakaon* 33 (ca. 320 A.D.), the principle here expressed as *aqua iuxta terram quam possident* (“water equal to the land that they possess”). Cf. *Dig.* 8.3.17