Marshland of Cities:

Deltaic Landscapes and the Evolution of Civilization

by

Jennifer R. Pournelle

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ABSTRACT OF THE BOOK

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Prevailing theories of the evolution of early complex societies in southern Mesopotamia presume a uniform, arid landscape transited by Tigris and Euphrates distributaries. These theories hold that it was the seventh millennium BCE introduction of irrigation technologies from the northern alluvium to the south that began the punctuated evolution of Mesopotamian irrigation schemes. In this view, irrigation-dependent agro-pastoral production was the primary stimulus to urbanization and, millennia later, the emergence of city-states.

In this book, I cast serious doubt on the landscape characterization underlying this model. I argue that much of the archaic alluvial landscape of southern Iraq consisted in large part, not of desert or steppe, but of wetlands, and that this finding requires a comprehensive reassessment of southern Mesopotamian resource management strategies and their role in emergent complex polities. Chapter One examines a Western Enlightenment tradition hostile to uncultivated wetlands. In Chapter Two, I discuss the role of imagery in archaeological research design,

distinguish physical *terrain* from ideological *landscape* as objects of investigation, and address tendencies to conflate *visibility* of archaeological data with *visualizations* of the past. In Chapter Three, using satellite imagery to integrate geomorphologic and paleoclimatic evidence, I examine the Tigris-Euphrates delta, identify courses of the Tigris and Euphrates rivers, locate the Persian Gulf head, and reconstruct terrain surfaces as they may have appeared five—six thousand years ago.

In Chapter Four, I review assumptions about Mesopotamian cultural ecology, present material indications for settlements, waterways and associated terrain features, and discuss archaeological and ethnographic evidence for interactions between human and natural processes. I argue that a significant component of the resource basis for precocious, large deltaic towns was probably that derived from surrounding marshland; and conclude that only following specialization and integration of, not two, but three, productive economies: agricultural, pastoral, and wetland, could and did Mesopotamian urban civilization flourish.

In Chapter Five, I consider how the landscape vision at the dawn of the twentieth century blinkered the view of colonial administrators, in ways that had a lasting impact on reconstructions of life in the lower alluvium. I contrast this with ways that wetlands may have been seen by proto-urban elites five millennia earlier, as they undertook their urbanizing projects that eventually converted socially unranked, undifferentiated wetlands, into alienated, ranked, extra-urban hinterlands.

They which collect truth out of fables, say, that Hercules…restrained the exorbitant overflowings of this river, with banks and trenches; and drained a great part of the adjacent country; and that this was the Cornucopia, which the poets made to be the emblem of plenty.

———Sir William Dugdale. *The History of Imbanking and Draining of Divers Fens and Marshes, Both in Foreign Parts and in this Kingdom, and of the Improvements Thereby*. London, 1772.

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CHAPTER ONE: WASTELAND VISIONS

> I loved better [than Bombay] Egypt…where the clear desert air breathes health, not septic soddenness…And to Mesopotamia I turned, as to another Egypt.
>
> ———H. R. Hall, 1930: 7

In a 2002 issue of the New York Times, a one-third page advertisement confronted the reader with a sinister montage. Eyes obscured by the glare on his goggles, a weathered, straw-hatted man clutched a pitchfork, its tines thrust upward outside the frame. His image was under- and over-laid with blurred fragments: a tractor with climate-controlled cab, dragging an unidentifiable implement; generically Asian ideograms with what appeared to be a male Asian face in vaguely ethnic headdress; a chick with eggs; an unopened ear of feed corn surrounded by sprays of ripe wheat; the word "Yes"; scraps of maps so placed that the word "Ethiopia" scrawled up his forearm like a badly-faded tattoo. Superimposed upon this collage was a globe portraying the Americas, circled and pierced by four arrows. Across it, in type so comparatively fine that the reader had to peer to make out the text, was set the chilling question: "What if we looked at the world as one giant farm field?"

No doubt, the advertiser did not intend and did not see this composite as being in the least sinister. But its net effect was to obliterate an undifferentiated, chaotic background (and the fragmentary Asian farmer contained therein) with a clear, aggressive stance: pitchfork to the fore, North American farmers united with heavy equipment, engineered seeds, and battery incubators stand tall against disorder. One did not need to look far for confirmation of this reading: in twelve-point type below the picture, the advertiser declared: "In tomorrow's global food economy, every crop will grow where it grows best. And ADM can link farmers to almost any market in the world. It's a natural way to improve agricultural efficiency, make food more affordable, and feed a hungry world. Nature has answers. Is anyone listening? Yes. ADM. The Nature of What's to Come™."

The drive for farming efficiency expressed in ADM's advertisement was hardly new. Nor was it merely a recent iteration of "Green Revolution" agricultural development schemes that introduced high-yield, pest-resistant crops to wide swaths of Asia in the 1960s–1970s (although it was that, too). It reflects a much older classificatory sentiment, deeply rooted in Western thought, that distinguishes "wasteful" from "useful" land usage practices, and "wasteful" from "useful" land. Most particularly, without the transformative hand of human engineering, that classificatory dichotomy has historically placed wetlands in the former category[1]—a schema that has shaped profoundly the way that archaeologists have examined social complexity in the prehistoric Middle East.

The eye casts back to the spindled globe. Clear to see above and below the text are Canada, the United States, and Brazil—three nations where, over the past three centuries, public planners indeed did and do look at the better part of two continents "as one giant farm field." In *Ecological Imperialism*: *The Biological Expansion of Europe, 900–1900* (1986), geographer and historian Alfred Crosby elegantly and

[1] Witness Dawson's 1930 report on Iraqi land tenure (p. 7): "About four-fifths of the country consists of unproductive or slightly productive desert, steppe, *marsh*, and hill masses" (emphasis added).

originally described the march of European crops, livestock, diseases, and barnyard pests across the Americas, Australia, and New Zealand—accompanied by a concomitant obliteration of life ways, species, and ecosystems.[2] While most are aware that crop and grazing land was won at the expense of former forests, fewer are acquainted with the impact of this expansion in coastal and deltaic settings. Unlike their early seventeenth-century counterparts, who highly valued salt meadows for thatch, forage and (indirectly as it was cycled through ruminant digestive tracts), upland fertilizer, by the end of that century English colonists had already hacked and drained their way through several thousand hectares of North American marshes and mudflats. Around thriving towns like Boston and New York; Charleston and Savannah they felled trees, diked estuaries, dammed coves, and shifted tons of gravel landfill to make way for wharves, warehouses, millponds, and larger harbors. "Because the marshes seemed inexhaustible, colonists took them for granted," until by the mid-eighteenth century, forced to import salt hay from distant sources, livestock keepers found themselves in dire straights. Nevertheless, landowners near cities banded together in drainage projects that converted remaining wetlands from hay meadows to higher-profit garden crops—even as farmers further away from the burgeoning cities furiously resisted the practice (Vileisis 1997: 31–33).

[2] Physician Jared Diamond received much attention—and a Pulitzer Prize—for *Guns Germs and Steel: The Fates of Human Societies* (1997). However, the central tenets, structure, and even illustrative figures in Diamond's treatment were laid out a full decade earlier in Crosby's authoritative, Ralph Waldo Emerson Prize-winning paperback—and in the subsequent collection of Crosby's public lectures, entitled: *Germs, Seeds, and Animals: Studies in Ecological History* (1994).

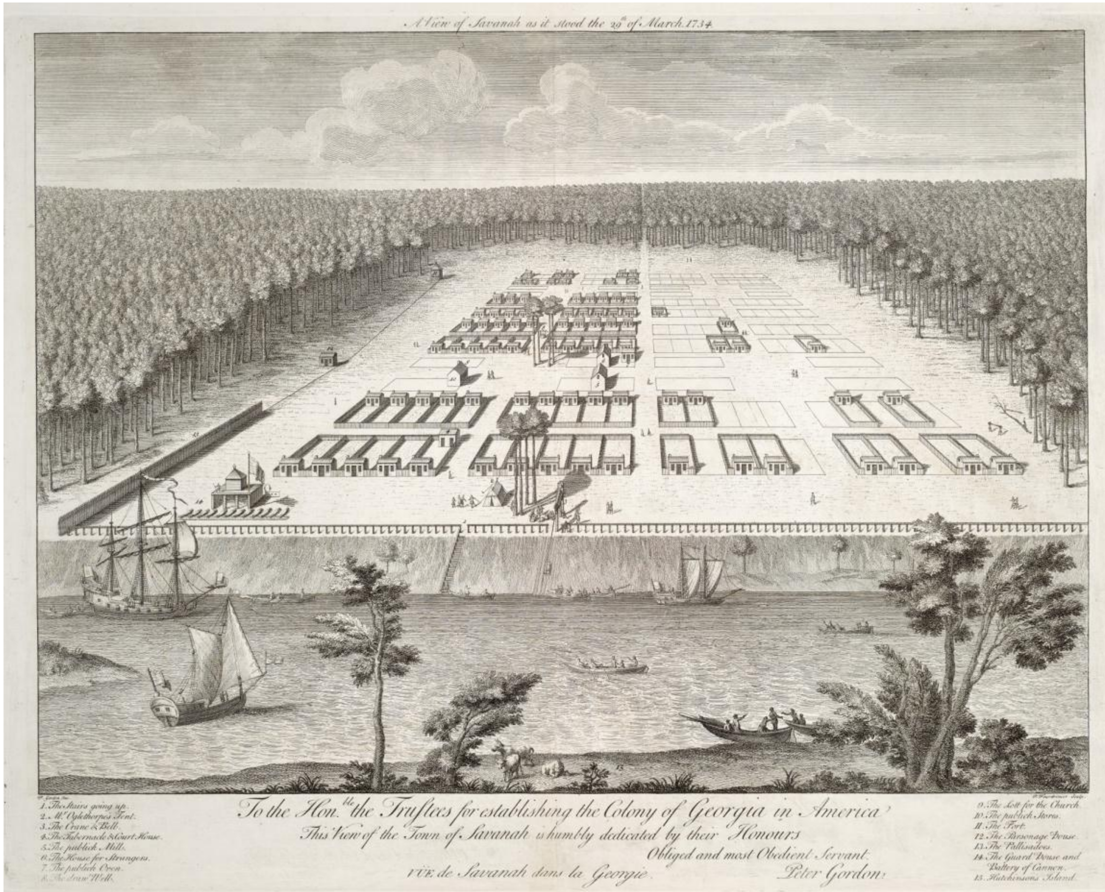

Figure: A view of Savannah as it stood the 29th of March 1734. Source: Toronto Public Library.

The tension between the aims of emergent urban mercantile capitalists, and those who raised and managed the livestock on which they depended for farm traction, land transport, and well-dressed tables, were not unique to the American colonies. Indeed, some of the colonists themselves were as much economic as religious refugees, driven from the broad Lincolnshire fenlands surrounding the English Wash by massive land reclamation schemes begun in the sixteenth century, aimed at bringing flood meadows under tillage (Harvey 2002). Both John Smith's and Ann Hutchinson's colonial expeditions originated in the market town of Alford, where religious dissention went hand-in-hand with unsuccessful resistance to the progressive subjugation of the landscape by absentee aristocrats. In 1662, English antiquarian and early modern historian Sir William Dugdale felt it necessary to defend the legitimacy of the reclamation practices, in a *History of imbanking and draining of divers Fens and Marshes, both in foreign Parts and in this Kingdom, and of the Improvements thereby, extracted from Records, Manuscripts, and other authentic Testimonies.*[3] The work was revised and corrected a century later by Charles Nalson Cole, and a second edition published in 1772. In it, Dugdale/Cole explicitly appealed to a series of proofs that equated embanking and drainage with great rulership. They argued that all the great biblical civilizations—Egypt, Babylon, Greece, and Rome—owed their wealth and prosperity to drainage works, and that the great English families had emulated this good work in the riparians of Britain.

The Dugdale/Cole apology demarcates an Enlightenment turn that would dominate Western thinking regarding wetlands for the coming two centuries. [4]

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[3] For a discussion of Dugdale's role in defining English antiquarian practice, see Lancaster 1999.

[4] A full exploration of these attitudes would require several volumes. Glacken treats at length eighteenth century attitudes toward wetlands (Glacken 1967: 654–705). Buffon's early eighteenth century conviction that "thickets, dense forests, accumulated organic debris, [and] poisonous swamps…were inimical to nature and to civilization," and that the vast marshlands remaining in America were "proof of the newness of the country, of the small number of inhabitants, and still more, their lack of industry" underpinned budding scientific authority (Glacken 1967: 670, 680). That during the following century cultural bias against marshes, swamps, and lowlands still held wide currency is perhaps exemplified by the preoccupations of influential British art historian John Ruskin. In his review of Tim Hilton's *Ruskin: The Later Years,* Valentine Cunningham notes "Ruskin's unquenchable enthusiasm for irrigation and drainage systems" (2000: 8). In his now-classic exploration of early twentieth century

Wedding the concepts of Biblical morality, urban civilization, technological innovation, and landscape transformation to productive increase (as defined by the urban landholder) (Glacken 1967), coastal wetlands, perceived little more than a century earlier as a source of productive ease, became redefined as waste land awaiting the firm hand of good governance.

During the nineteenth century, this transformative vision extended inland along vast river basins with their brush-choked, wooded, swampy backwaters. In the United States, bottom lands became timber lands, then crop lands. Technological innovation in logging rigs, ceramic tile manufacture for underdrainage, and trenching machinery steadily accelerated the conversion of millions of hectares by the turn of the twentieth century (Vileisis 1997: 116–127). Contemporaneously, half way around the world, in the 1875 *Statistical Account of Bengal*, Indian Civil Servant Sir William Hunter portrayed the Sundarbans, "densely forested wetlands that cover the sea-face delta of the rivers Ganges and Bramaputra as they empty into the Bay of Bengal," (Greenough: 237) as a tiger-infested, sodden wasteland. He warned: "So great is the evil fertility of the soil, that reclaimed land neglected for a single year will present to next year's cultivator a forest of reeds…The soil, too must be cultivated for ten or twelve years before it loses this tendency to at once cover itself with jungle weed" (Greenough

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German masculinist ideologies, Klaus Theweleit (1974) dedicated an entire chapter to German biases against swamps. That these had deep cultural roots is evident in the now seldom-read second volume of Goethe's *Faust*, in which the protagonist, having been unfulfilled by all other offerings, finally finds surcease as he contemplates draining his land.

1998: 249). By 1890, once a vast commons, “most of the Sundarbans had been declared ‘reserved and protected’ under the supervision of a Deputy Conservator of Forests,” with authority to charge user fees, assess tolls, issue licenses, and grant leases (Greenough 1998: 261, 271 n. 83).

In the Middle East, by the later nineteenth century, British explorer-merchants in Egypt had slogged their way from Cairo upriver through the seasonally inundated Sudanese floodplains. In the same year that the Sundarban mangroves passed to the control of the Imperial Raj, convinced that the security of Britain in Egypt depended upon rejuvenating downstream triannual crop irrigation systems, Sir Colin Scott-Moncrieff recruited hydrologists and engineers from the Indian irrigation service. These included Sir William Garstin, who proposed, Sir William Willcocks, who designed, and Sir Murdoch MacDonald, who built the first Aswan Dam, completed in 1902 (Collins 1990: 107–108). Garstin was not enamored of the vast, wet heart of the Shilluk, Dinka, and Nuer cattle lands, although he and Willcocks both understood well their natural role as flow regulators (Collins 1990: 92, 99). “No-one who has not seen this country can have any real idea of its supreme dreariness and its utter desolation,” he wrote. “To my mind, the most barren desert I have ever crossed is a bright and cheerful locality compared with the White Nile marshland.” (Garstin 1909, in Collins 1990: 66). The successive dams at Aswan have since come to symbolize modernist, technocratic schemes to fully control entire river basins, from their headwaters to the sea. No sooner was the first complete, than Garstin proposed that a new channel—the lineal ancestor of the Jonglei Canal—be cut to divert White Nile flow directly to

Egypt, without “wastage” from evaporation in the swamps (Collins 1990: 101). Proponents would later argue that the bypassed regions would benefit from the water diversion, as they were “better suited” to rain-fed agriculture. The project—often fiercely resisted by upstream users dependent upon seasonal pasturage rejuvenated by wetlands ebb and flow—was finally abandoned in 1988.

Having established his hydrologic expertise in Egypt, at the invitation of the Ottoman government Willcocks carried his totalizing hydrologic ambitions to Mesopotamia—“the land between the rivers” that slices through present-day southeastern Turkey, Syria, and Iraq (see Figure 1, Figure 2)—where he envisioned a complete re-engineering of the Tigris–Euphrates delta. He designated vast reaches of the alluvial plain as amenable to early development, proposed a series of flow diversions, drainage trenches, regulators, and reservoirs, and built an ill-fated flood control barrier at Hindiyah. Drainage efforts were to be enhanced by cutting new channels to discharge outflows directly into the Arab-Persian Gulf. These engineering works would systematically empty marshes, lower the saline water table, rationalize irrigation systems, and thereby reclaim “waste” land for high-profit agricultural production (Willcocks 1917).[5]

Interrupted by wars, coups, revolutions, and remapped political boundaries, under a succession of governments in four nations (Turkey, Syria, Iran, and Iraq), the transformative vision of Willcocks and his successors has proceeded along the twin

[5] Initially, the Hindiyah barrage diverted water to the Shatt al Daggarah, initiating a renaissance of settlement around Fara (Shurrupak), but it was overwhelmed by a great flood in 1918. See Adams and Nissen 1972.

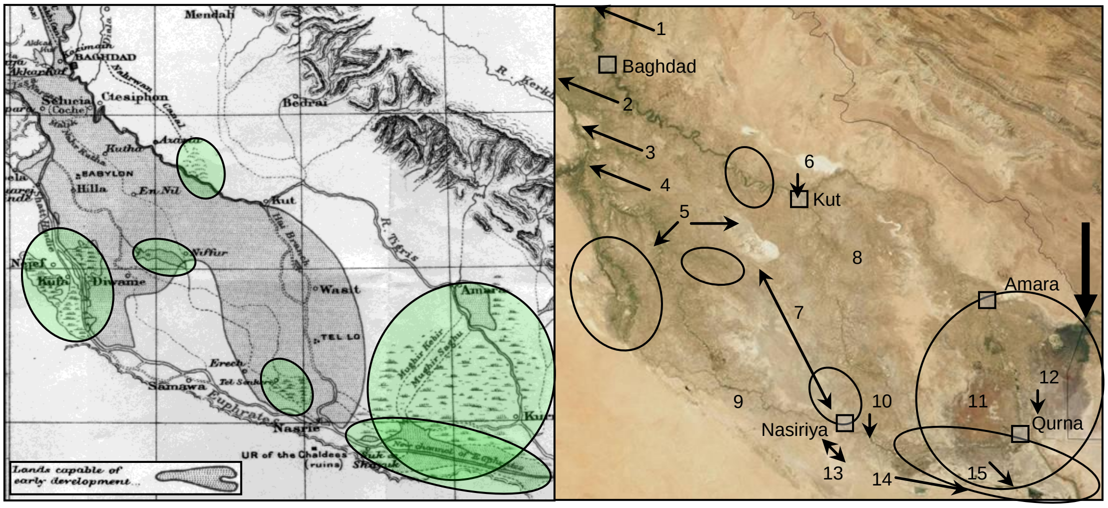

Figure 1: Marshes of the Mesopotamian alluvium (circles), 1908 (L) vs. 2000 (R). Willcocks's map shows approximately 20,000 km^2 of primary (year-round) and secondary (seasonal) wetlands. Flood control and drainage projects have reduced that area to less than 1000 km^2 of rapidly-diminishing marshlands (black, arrow) east of Amara. Most of that reduction has occurred since 1990. (1) Samarra–Tharthar Dam and canal, 1954. (2) Ramadi–Habbaniya dams and canals, 1956. (3) Felluja Dam, 1985. (4) Al Hindiyah Dam, al-Hilla Canal, 1918, 1989. (5) Greater Mussayib reclamation, 1956–99. (6) al-Kut dam, 1939; Dujailia reclamation, 1953–7. (7) Main Outfall Drain–Third River 1953; 1972; 1990–92. (8) East Gharraf reclamation 1952–68. (9) Al-Qadissiyah River, 1993. (10) Suq el-Shuyoukh regulators, 1956. (11) Polder dykes and canals, 1993–94. (12) Military causeway, 1980–88. East–West canal, 1992. Prosperity River, 1993. (13) Mother of Battles River, 1994. (14) Fidelity canal, 1997. (15) Shatt al-Basrah canal. Sources: Willcocks 1917, Iraq 1956, Partow 2001, NASA 2001a, Brasington 2003. Image: MODIS April 1999.

rivers for the past century. In a United Nations report, based on National Aeronautics and Space Administration (NASA) analyses of LANDSAT satellite images, Hassan Partow documents the outcome of the systematic state efforts. The flood control, damming, and drainage aimed at asserting centralized political authority and expanding agricultural export production instead resulted in the demise of the vast marshlands of southeastern Iraq. (MacFayden 1938; Iraq 1956; Cotha Consulting Engineers 1959; Koucher 1999; Partow 2001; NASA 2000, 2001a, Brasington 2003). The LANDSAT multispectral system, released to public access in the early 1970s, was itself produced in response to demands for an accessible aid to landform analysis, to be used in part in service to regional development schemes. Within the public arena, LANDSAT launched hopes that satellite imagery would both expand coverage and lower costs over those of traditional aerial photography. But imagery of this kind was barely imaginable to archaeologists and public planners when, in the 1950s, the Iraqi government contracted for a series of engineering studies aimed at harnessing the water and power of the Tigris and Euphrates rivers. Among its aims, the Iraqi monarchy then reigning intended to implement the ambitious schemes first proposed by Willcocks a half-century earlier.

Thus, the documentation of the marshlands, their demise, and the documentation of that demise are all in a sense a terminal outcome of those nineteenth century beliefs that marshes are inherently diseased, sodden wastelands, and that the appropriate effort of good government was to transform them into cultivated agricultural land. For the purposes of this study, it is important to note that the Enlightenment, Victorian, and Modern emphases on transforming "waste" wetlands for "useful" agricultural endeavor were especially operative during the formative period of Mesopotamian archaeology and Assyriology. As is revealed in the epigraph that begins this chapter, engineers and archaeologists alike viewed marshes as worse than deserts—a notion confirmed to them by the desertic locale of long-abandoned Egyptian and Mesopotamian cities. A prime example of this linkage is Ragozin's *The Story of Chaldea. From the Earliest Times to the Rise of Assyria*, first published in 1886 as a volume in Hutchinson's school text *Story of the Nations*. Widely read for decades in multiple editions as a general introduction to the study of ancient history, Ragozin summarized for the young, educated reader exciting discoveries in biblical Shinar. Still in print,[6] her colorful illustration of pre-literate, pre-civilized Sumerians anchoring, behind reed-and-earth dams, baskets of muck dredged from a waste-deep mire remained imbedded in research paradigms through the mid-twentieth century that viewed the birth of Mesopotamian civilization as a process of "reclaiming" primordial lands for irrigated plow agriculture (e.g. Sousa 1983).

In examining the precursors of social complexity in the Middle East, consideration of wetland[7] resource exploitation has been subordinated for the most part to close examination of agro-pastoral economic components characterized by grain cultivation and ungulate husbandry (Pollack 1992, Kouchoukos 1998, Zarins 1990). Naomi Miller has succinctly summarized this overarching view: "By about 6000 BCE, domesticated animals, notably sheep, goat, and cattle, had joined the familiar crop complex of Near Eastern cereals and pulses, forming the economic basis of later Neolithic society and the first civilizations" (Miller 1991: 144–45). Underlying prevailing models of the Mesopotamian path to complexity (such as Jacobsen 1957: 97–98, Wittfogel 1955, Diakonoff 1974, Adams 1981, Charvát 2002: 59) is the primary assumption that extension of sedentary agriculture made possible the hydrologic engineering used to intensively exploit arid settings wherein, as compared to equal hectarage in rain-fed agro-pastoral economies, exponential agronomic return

[6] Long Beach, CA: LAME Publishing.

[7] Including riparian/riverine, palustrine/lacustrine, estuarine, and marine littoral.

was possible per unit labor input. Following Frankfort (Frankfort 1932: 18) and Perkins (Perkins 1949: 73), despite hints offered by remains of burnt fish excavated at Eridu, Ur, Uruk, Tello, and Tell Asmar (van Buren 1948: 103–4; Potts 1997: 34), the southern Mesopotamian wetlands were tacitly viewed as an impediment to expanded irrigated grain production, and hence expanded urbanity, until the region became sufficiently "dry" during the late-fourth millennium BCE Uruk period (Nissen 1988). "The South," meaning either all of the alluvium below Baghdad, or only that most southerly portion encompassed by ancient Sumer, was recognized as a locus of presumptive colonization by irrigation technologies from "the North," meaning variously Syro-Anatolia, Assyria, the Zagros piedmont, or the northern margins of the alluvium (Samarra).

These views have proven remarkably persistent, despite the obvious wetland setting of many of the world's early complex societies in the Nile (Egyptian), Indus (Harappan), Yellow (Shang), Tabascan (Olmec), and other deltas. Early on, New World archaeology should have posed serious challenges to the implicit drain-and-civilize model: raised field agriculture clearly depended upon *maintaining* highland wetlands in Mexico (Brumfiel 1976; Steponaitas 1981) and the Altiplano (Kolata 1993).

Evidence also mounted from around the Pacific Rim of mollusk and anadromous fish exploitation as a basis for early sedentism and territorial consolidation (Aikens 1981; Moseley 1975; Akazawa 1981; Pearson and Underhill 1987), and Murdock noted as early as 1969 the high correlation between specialized fishing economies and early sedentism in non-maritime contexts. Moseley's revolutionary work in South America specifically linked ENSO oscillations to marine bioproductivity and urban origins (Moseley 1975). [8]

That the role of wetland exploitation in early Near Eastern sedentism and social evolution has received insufficient attention is perhaps unsurprising on purely methodological grounds—most excavations in the region were conducted decades before the invention and introduction of systematic fine-mesh screening, floatation, and deflocculation for small and organic find recovery.[9] However, an antiquarian emphasis on hallmarks of "civilization" such as massive architecture and collectible *objets d'art* conspired with later searches for hallmarks of state governance, such as

[8] Relevant literature is becoming unwieldy, but with no good synthesis. Nicholas (1998) reviews hunter-gatherer studies in wetland settings. Hoffman (1969) documents the displacement of sizeable Native American mid-Atlantic coastal wetland settlements by early colonial encroachment. For other recent work in North America, see (Mississippi Valley): Bernick 1998 Part III and Saunders et al. 1997 on Poverty Point; Emerson and McElrath 1983 on Cahokia; Goldstein 1997 on Azatlan. See Marquardt 1988 and Walker and Marquardt 2001 on the south Florida Everglades Calusa; Rountree and Turner on the mid-Atlantic Powhatan. For Europe, see Bernick 1998 Part I; Baldia 1993–2001, Chapter 4.2; Wallace 2000; Whittle 2000; and Gheorghiu 2003. For south Asia, see Belcher 1998 on the Indus Valley. For China, see overviews at Pearson and Underhill 1987 and Song 1998. See Lin, Wright, and Miller-Rosen 2002; and Miller-Rosen 2002 on the Yi-Lao river valley in western Hunan. See Jing, Rapp, and Gao 1997 and Underhill, Feinman, Nicholas, Bennet, Cai, Yu, Luan, and Fang 1998 on the Huang (Yellow) river floodplains in southeastern Shandong. See Miyatsuka, Uno, and Sakamoto 2002 for visualizations on the Yangtze. For Southeast Asia, see Stargardt 1998 on South Thailand, and Stark 2002 on the Lower Mekong. For Australia, see Petersen 1973; Dortch 1997; and Builth 2002. Egypt is discussed below.

[9] Fish bones are in any event poorly preserved, but these methods result in an up to a hundred-fold increase in their recognition and, in the case of otoliths, MNI identification (Ross and Duffy 2000; Payne 1972). Microscopic analysis of recovered scales further allows identification of additional species present (Desse 1983).

urban craft specialization and top-down irrigation schemes, to consign to the spoil heap or render invisible the ephemeral evidence of reliance on former wetlands even when it lay in plain sight.

Robert McC. Adams was among the first to seriously challenge this paradigm. In support of the Iraqi crown studies, KLM Dutch Airlines had been contracted to conduct systematic aerial photographic mapping of alluvial Iraq, and the Mesopotamian plain was rendered in a series of high-quality photographic mosaics intended to aid geomorphological studies. Adams, insisting that any characterization of Mesopotamian civil complexity must include due consideration of not just cities but their hinterlands, used these as an interpretive tool in contextualizing the results of decades of ground survey. He described a flexible social adaptation to an unpredictable and uncertain environment, comprising grain agriculture, livestock husbandry, and marshland exploitation. He examined not just the deep past, but its continuous transformation to the onset of modern age and its drainage efforts, beginning with construction of a massive flood-control barrage at al-Hindiyah in 1918 (Adams and Nissen 1972; Adams 1981).

But access to the KLM photos was never guaranteed, dependant as it was on the vicissitudes of geopolitics and the variable good will of Iraqi officials. And during the subsequent decades, it became apparent that LANDSAT could and would not reveal the fine detail of small site locations and associated ground features that had made possible his ambitious study. By the early 1990s, even as the final drainage installations were emptying Lake Hammar of water, understanding that a lasting impact of the first Gulf War would likely be to constrain further photographic access for decades, Adams and others successfully lobbied for declassification of, preservation of, and public access to a hoped-for replacement from the United States military sector: satellite photographs, code-named CORONA. In 1997, near-world-wide CORONA coverage was made publicly available at low cost through the United States Geological Survey's web-based order system. Over the next several years, the United States National Imagery Management Authority released to the public domain, at no cost in downloadable digital form, two more near-world-wide imagery datasets: SPOT, and imagery-derived digital terrain models (DTED). Complementing the monochrome SPOT, at higher resolution than the old LANDSAT workhorse, NASA also released ASTER. From an archaeological perspective, the timing of these releases could not have been better. They arrived on the heels of mounting evidence that a systematic examination of newer geomorphologic, archaeological, glyptic, and textual data from fifth–fourth millennium BCE Mesopotamia was overdue.

Collating available evidence requires a coherent methodology for addressing problems on a regional scale, using data collected under widely variant conditions and degrees of exactitude. In the next chapter, I propose a critical role for satellite imagery and, where available, ground and air photography in this process. In Chapter Three, results of recent geomorphological investigations that relate mid-Holocene Nile delta paleogeology to fifth millennium BCE site locations provide a point of departure for interpreting the recently-declassified CORONA photography and newer imagery of the southern Mesopotamian alluvium—a dataset especially useful in that the region so considered will remain closed to regional coring operations for the near future.[10]

In the Nile delta, Neolithic and early Chalcolithic sites, instead of being aligned along archaic watercourses discharging into the Mediterranean, followed chains of Pleistocene "turtlebacks" extending across the alluvium, suggesting wet-season boat traffic (Van den Brink 1993; Butzer 2001). [11] In the fourth chapter I argue that, similarly, in alluvial Iraq roughly south of the thirty-second parallel archaeologically visible early villages were concentrated on high ground at locations bordering swamps and marshes during the ʻUbaid 0–3 periods (6500–4900 BCE). Further, half of the sites extant in the Warka and Eridu survey areas dating to ʻUbaid 4 (4900–4350 BCE) were newly founded during that time. Of these newly founded sites, as in the Nile delta, all but one were founded on exposed surfaces of turtlebacks that once overlooked anastomosing distributaries subject to seasonal flooding.

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[10] This is not meant in any way to diminish the findings of site-specific geomorphological investigations upon which this study depends for ground truth of photographic analyses. However, political and security restrictions limit the areal extent of present and planned landscape investigations, and for now preclude replicating the Nile delta research design in lower Mesopotamia. That such research is warranted in many deltas is shown by Stanley and Warne 1994, 1997.

[11] The term turtleback is often conflated with the Arabic *gezira,* broadly meaning sand island, which is misleading for two reasons. Firstly, *gezira* (with many transliteration variants) is used to designate any island, plateau, or upland, including vast tracts of upper Mesopotamia. Secondly, turtlebacks are not necessarily sand, nor are they necessarily islands. Turtlebacks, in the sense used herein, are formed during pluvial periods (such as the Pleistocene), when meandering rivers down-cut through (relatively) uniform alluvial surfaces, leaving former surfaces exposed above the newly formed floodplain. The channels between these exposures infill during subsequent conditions of alluvial aggradation, leaving weathered humps of the older surface protruding slightly above the newer alluvial plain—like a floating turtle's back, protruding above calm water.

As in Egypt, between these turtlebacks the Mesopotamian plains are for the most part buried under meters of alluvial accumulation, and we cannot know what sites are buried with them. Nonetheless, larger sites situated on the once-elevated turtlebacks *are* visible, and to date have been accepted as archaeologically (proto-) typical. These ‘Ubaid-period towns presaged an explosion of new (or newly visible) sites founded during the Early Uruk period, when virtually all identifiable turtlebacks became inhabited.

It is probably true that during historical periods of four thousand years ago the climatic regime of the southern Mesopotamian alluvium had dried to something approximating its present state, with urban pearls strung along riparian filaments. It is therefore unsurprising that early reliance on historical texts dating from that later time, plus eighteenth- through-twentieth-century travel experience, lent to most interrogations of that alluvial past the persistent presumption of a largely flat, uniform, desertic-steppic plain, devoid of the meanest resource save silt and shrub, transited by its two great rivers (such as Nissen 1988: 2).[12] But mounting climatic and geomorphological evidence requires a reconsideration of that terrain during the fifth–fourth millennia BCE, and thus of the social developments arising within it. During the

[12] Innumerable overviews of the broader geologic and geographic settings comprising greater Mesopotamia have been published over the past several decades (e.g. Redman 1978, Adams 1981, Nissen 1988). More recently, these have been reconsidered in light of new evidence regarding rising sea levels commencing in the mid-Holocene (Sanlaville 1989, 1996, and 2003; Postgate 1992; Lambeck 1996; Geyer and Sanlaville 1996; Potts 1997; Aqrawi 1997, 2001; Kouchoukos 1998; Verhoeven 1998; Pollock 1999; and especially Wilkinson 2003). See Chapter Three.

thousand years of the Uruk-period expansion, a rivers-through-the-desert image[13] simply does not adequately characterize conditions on the ground as we now understand them. We cannot wrest the origins of alluvial Mesopotamian cities from an irrigated version of the modern landscape, because they grew instead on the borders and in the heart of vast deltaic wetlands. These were in part derived from Euphrates floods, supplemented by rainfall, but the greatest portion of their annual recharge was the result of Tigris outflows. These wetlands served as a massive sponge, absorbing water during flood seasons, and releasing it to soil moisture and ground water during the remainder of the year.

Guillermo Algaze (2001) was among the first to consider significant consequences of a fundamental reconception of the ecology of the southern alluvium during the Uruk period urbanization. He hypothesizes that:

> "geography, environment, and trade can be seen as the most important factors helping shape the initial nature of social complexity in the Mesopotamian alluvium," (199) in that "the unique ecology and geography of the alluvial lowlands...gave Mesopotamian societies important advantages in agricultural productivity and subsistence resilience not possessed by contemporary polities on their periphery," (204–205) spurring a "synergistic cauldron" (207) that created "high levels of social and economic differentiation, promoted unprecedented population agglomerations and selected for the creation of new forms of social organization and technologies of social control." (208)

Taking as his point of departure findings presented in Chapters Three and Four of this study, his model laudably reassigned marshes from the "wasteful" to the "useful" side

[13] E.g., Jacobsen 1957: "Settled human occupation, accordingly, is closely tied to rivers and canals and only occurs along them" (96); "These cities with their surrounding villages were limited essentially to points along two separate lines…Between the two lines, effectively separating them, lay open desert…" (98).

of the land classification equation, focusing in particular on transportational advantages and subsistence resilience.

We can now reconstruct with greater precision than was available to mid-twentieth century theorists the paleogeography of the lower Mesopotamian alluvium during the formative Chalcolithic and Early Bronze periods, and offer a view at a regional scale inaccessible through single-site excavation. I also hypothesize the essential nature, not merely of *water,* but of *wetlands*, in supporting and shaping the complex social institutions that underlay urbanization in southern Mesopotamia, arguing that, as for fifth–fourth millennia BCE Egypt (Hassan 1997; Hellier 2000),[14] broad processes can be discerned that require a third pillar to be added to the agro-pastoral subsistence dyad so vigorously investigated during the twentieth century.

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[14] Faunal analyses at deltaic (Maadi, Buto, and Merimde) and lacustrine (Fayum) sites challenge earlier exclusion of a role for the lower delta in the rise of social complexity in Egypt. During the sixth and fourth millennium BCE, pluvial conditions prevailed, and the Fayum Depression/Lake (Birket) Qarun was connected to and received Nile flood overflow. Thickly vegetated shallows were interspersed with thick reed beds and tree-lined shores. Nile catfish (*Clarias* sp.) were the most common fauna represented in both Fayum B (6170–5670 BCE) and Fayum A (4341–3020 BCE) remains. At Fayum B these also included significant proportions of migratory waterfowl (Brewer 1989: 28). The Nile Neolithic/Predynastic transition can be broadly characterized by an accumulation of fishing technologies, from opportunistic clubbing of catfish stranded in seasonal pools, to shore netting of *Tilapia*, to deep-water angling/harpooning of Nile perch, especially in Upper Egypt. In the delta, while the later Fayum A saw the introduction of ovicaprids, in only one case did this constitute a significant proportion of remains—and then only *after* a full complement of fishing technologies had been developed elsewhere (Eiwanger 1984; Boessneck, von den Dreisch, and Ziegler 1989).

However, I wish to stress the role of littoral propinquity,[15] not in originating (or improving) agriculture, but in establishing the territorial precursors to later governing institutions. In the concluding chapter, I attempt to understand what "new forms of social organization and technologies of social control" across that now visible wetland might be, in an era when an urbanized elite, with the will to redefine productivity toward its own ends, was first emergent. That is, I interrogate the origins of the wasteful/useful dichotomy itself, arguing that it *expresses* principles of rank, authority, privilege and landscape organization that define social complexity, and therefore cannot precede them.

In this chapter, I have briefly reviewed an intellectual tradition that, over the past century, has limited the ways that early civilizations of Mesopotamia were investigated and understood.

In Chapter Two, I discuss the role of imagery in archaeological research design, and address tendencies to conflate *visibility* of archaeological data with *visualizations* of the past. I distinguish physical *terrain* from ideological *landscape* as objects of investigation, and discuss means for relating changes in both through time.

In Chapter Three, using satellite imagery to integrate geomorphologic and paleoclimatic evidence, I examine the Tigris-Euphrates delta, identify courses of the Tigris and Euphrates rivers, locate the Persian Gulf head, and reconstruct terrain

[15] In the broad sense including all borderlands between land/water, freshwater/saltwater, and steppe land/marsh.

surfaces as they may have appeared between five and six thousand years ago. I argue that much of the archaic alluvial landscape of southern Iraq consisted in large part, not of desert or steppe, but of wetlands, and that this finding requires a comprehensive reassessment of southern Mesopotamian resource management strategies and their role in emergent complex polities.

In Chapter Four, I review assumptions about Mesopotamian cultural ecology, present material indications for settlements, waterways and associated terrain features, and discuss archaeological and ethnographic evidence for interactions between human and natural processes. In the light of excavation data,[16] I argue that a significant component of the resource basis for precocious, large deltaic towns was probably that derived from surrounding marshland; and conclude that only following specialization and integration of, not two, but three, productive economies: agricultural/horticultural, pastoral/husbanding, and wetland, could and did Mesopotamian urban civilization flourish.

In Chapter Five, I consider how the landscape vision at the dawn of the twentieth century blinkered the view of colonial administrators, in ways that had a lasting impact on reconstructions of early urban life in the lower alluvium—and contrast this with ways that wetlands may have been seen by proto-urban elites five millennia earlier, as they undertook their urbanizing projects that eventually converted socially unranked, undifferentiated wetlands, into alienated, ranked, extra-urban

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[16] From Uruk, ‘Oueili, Eridu, ‘Ubaid, Ur, and others, discussed below.

hinterlands.

MAP: THE MESOPOTAMIAN ALLUVIUM

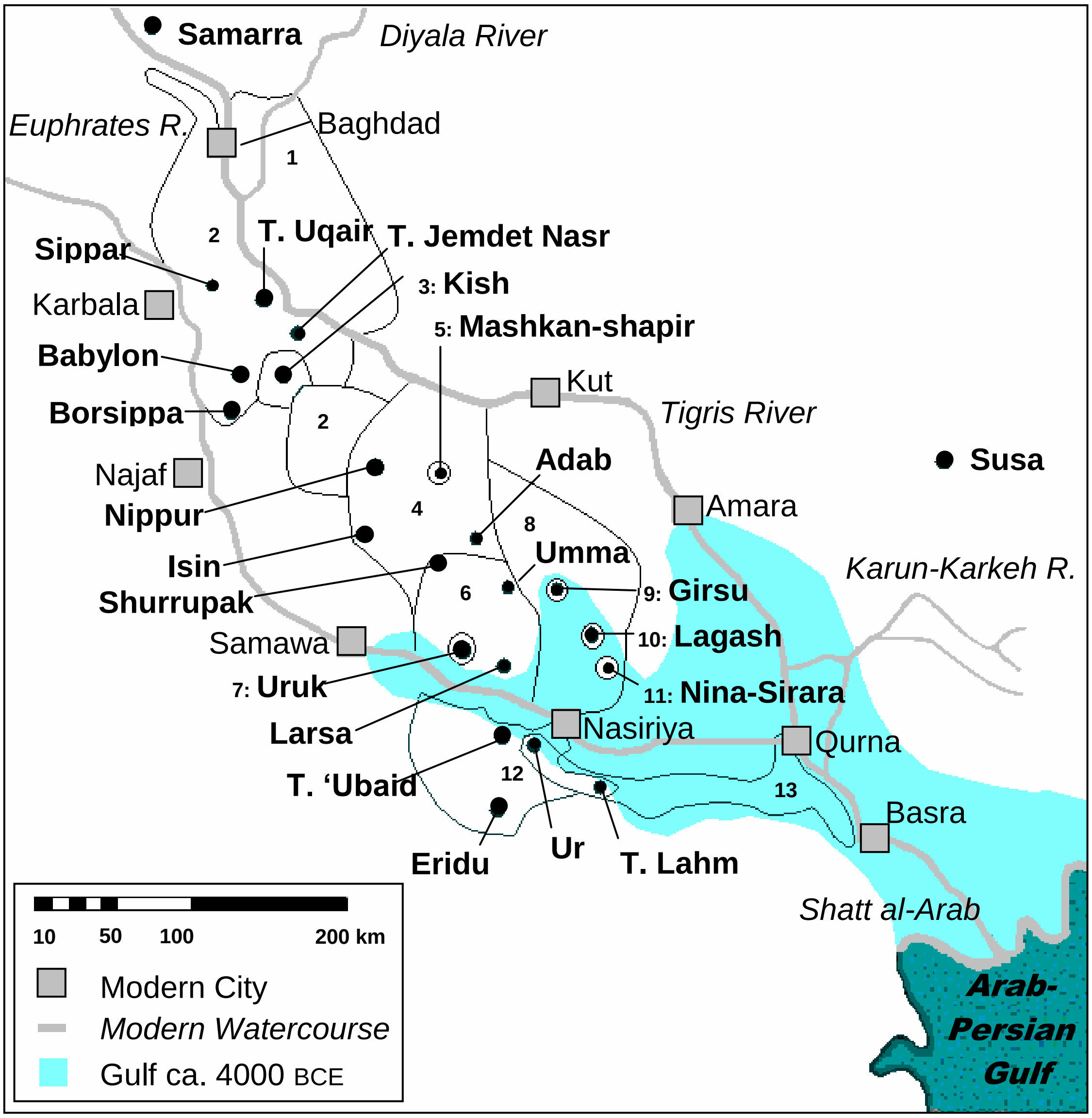

Figure 2: Major archaeological sites of alluvial Mesopotamia, with surveyed areas and hypothetical extent of the Persian Gulf ca. 4000 BCE. **1.** Diyala Survey. **2.** Akkad Survey. **3.** Kish Survey. **4.** Nippur Survey. **5.** Mashkan-Shapir. **6.** Warka (Uruk) Survey. **7.** Uruk. **8.** East Gharraf area, with: **9.** Tello Region, **10.** Lagash, **11.** Zurghal (Nina-Sirara). **12.** Ur-Eridu Survey. **13.** Hammar Lake Survey. See **Error! Reference source not found.**; **Error! Reference source not found.**.

CHRONOLOGY OF PERIODS MENTIONED IN TEXT

PERIOD (=Egypt)	PROMINENT SITES/*ANCIENT NAME (LEVEL)*	BCE (CE)	NOTED PERSONAGES
LATE NEOLITHIC–EARLY CHALCOLITHIC			
Ubaid 0	Oueili (Awayli)	6500–5900	
Ubaid 1	Abu Shahrain/*Eridu*	5900–5200	
Ubaid 2	Haji Muhammad	5200–5100	
CHALCOLITHIC			
Ubaid 3	Tell Al-Ubaid	5100–4900	
Ubaid 4	Tell Al-Ubaid	4900–4350	
Terminal ‘Ubaid	Warka/*Uruk/Erech (Eanna XVI–XIV)*	4350–4200	
Early Uruk (Naqada I)	*Uruk (Eanna XIV–XIII)*	4200–3800	
Middle Uruk (Naqada II a–b)	Abu Salabikh; *Uruk (Eanna XII–VII)*	3800–3400	
(Protohistoric Periods)			
Late Uruk (Naqada II b–c)	*Uruk (Eanna VI–IVa);* Niffer/*Nippur (Inanna XVI–XV)*	3400–3200	Enmerkar
Jemdet Nasr (Naqada II d–IIIb1)	Jemdet Nasr*; Uruk (Eanna VI–I/7); Nippur (Inanna XIV–XII)*	3200–3000	
EARLY BRONZE (Historical Periods)			
Early Dynastic I (Naqada III)	*Uruk (Eanna I/6–I/1); Nippur (Inanna XI–IX a);* Sakheri Sughir	3000–2750	Gilgamesh, Enmebaragesi?
Early Dynastic II	Bismaya/*Adab; Khafaja;* T. Asmar	2750–2600	Ziusudra, Meselim; Lugalshagengur?
Early Dynastic III	Muquayyar/*Ur;* Fara/*Shurrupak; Adab;* Abu Salabikh, Tello/*Lagash*, *Nippur*	2600–2350	Pu-abi, Mesannepada; Ur-Nanshe, Eanatum, Enanatum I & II, Enmetena, Enentarzi, Lugalanda, Urukagina; Lugalzugezi
Akkadian	*Nippur*; Al Hiba/*Girsu;* T. Brak	2350–2150	Sargon, Rimush, Manishtushu, Naram-Sin, Sharkalisharri, Gudea
Ur III	*Nippur, Ur, Umma*	2150–2000	Ur-Nammu, Shulgi, Amar-Suen, Shu-Sin, Ibbi-Sin
*MIDDLE–LATE BRONZE			
Isin-Larsa	*Nippur, Ur, Isin,* Senkereh/*Larsa, Mashkan-shapir,* Babylon	2000–1763	Ishme-Dagan, Enlil-bani, Damiq-ilishu; Rim-Sin
Old Babylonian	*Sippar*, Babylon*/Babil, Mashkan-shapir*	1763–1600	Hammurapi
(*omitted: Old Assyrian, Cassite, Neo-Assyrian—Nebuchadnezzar I, Tiglathpileser I, Ashurnasirpal II, Shalmaneser III, Sargon II, Sennacherib, Esarhaddon, Ashurbanipal)			
CLASSICAL			
Neo-Babylonian		626–539	Nebuchadnezzer II, Nabonidus
Achaemenid–Hellenistic		539–331	Cyrus (Persia), Alexander, Seleucus (Greece)
Parthian		126–(227)	Artabanus II
Sassanian		(224–642)	
ISLAMIC			
Abbasid		(750–1258)	
Ottoman		(1516–1914)	
Modern		(1914–89)	

Sources: Bertman 2003: 341, Rothman 2001: 7, Wilkinson 2000a: 225, Kouchoukos 1998: 190–97, Zettler and Horne 1998: xiii, Postgate 1994: 39, Walters 1970: xviii

GLOSSARY

ANADROMOUS: ascending rivers from the sea for breeding, e.g. salmon, shad

ANTICLINE: An upward flexure of the Earth's crust, such as a mountain range formed where one tectonic plate slides over another.

ASTER: Advanced Spaceborne Thermal Emission and Reflection Radiometer, an imaging instrument mounted on Terra, a satellite launched in December 1999. As part of NASA's Earth Observing System (EOS), ASTER obtains detailed maps of land surface temperature, emissivity, reflectance and elevation as part of NASA's Earth Science Enterprise, which studies interactions between the biosphere, hydrosphere, lithosphere and atmosphere.

AWHAR: The freshwater wetland zone of southeastern Iraq, characterized by permanent fresh-to-brackish lakes, permanent reed marshes, and seasonally inundated tracts of mixed grasses, bulrushes, and sedges, distinct from the salt marshes of the outer delta.

BOG: A peat-accumulating wetland with little in- or out-flow that supports acid-loving mosses such as *Sphagnum.*

BOOSA/QUSAH/GUSAB: fodder, especially reeds, sedges, and grasses cut seasonally in wetland margins.

BULRUSH: an edible sedge, requiring continuously wet shallow standing water, of the genera *Scirpus*, commonly used for fodder and in basketry and twine-making.

CATADROMOUS: descending rivers to the sea for breeding, e.g. eel, mullet

COASTAL: pertaining to land near the shore of an ocean, or inland sea, e.g. Mediterranean, Red Sea, Persian Gulf

CORONA: the program name for the first operational space photo reconnaissance satellite. Colloquially, the photographs produced by several sattelites and camera systems operated under that program.that program 1958–72.

DELTAIC: pertaining to the alluvial deposit at the mouth of a river, generally encompassing lacustrine/lakeshore; riverine/riparian, lagoon/marsh, estuarine/swamp, and maritime/coastal pelagic/littoral/ zones.

DOLOMITE: a mineral consisting of a calcium-magnesium carbonate $(CaMg(CO_3)_2$ found in crystals and in extensive beds as a compact limestone.

ECOTONE: the transition area between two ecological communities.

ESTUARY/ESTUARINE: pertaining to a water passage where the tide meets a river current, especially an arm of the sea at the lower end of a river, e.g. Basra inlet.

FEN: A peat-accumulating wetland with sufficient drainage from surrounding mineral soils to support marsh vegetation.

FORAMINIFER: an order of marine protozoa and component of plankton or benthos. On death, through compaction calcareous shells form the bulk of chalk and some limestones.

GASTROPOD: a large class of mollusks, usually with a univalve shell, such as limpets, cones, and conches. Those without shells are not preserved in the archaeological record.

GRAMINAE MARSH: See reed swamp.

HAUR: a seasonal lake or permanent fresh or brackish marsh of the Mesopotamian delta, to include the surrounding seasonal grasslands and central playa remaining after water evaporation. *Haur* boundaries vary seasonally and interannually with water recharge rates. See also *hor*.

HOR (KHOR): a permanent lake or open tract of fresh-to-brackish water within a reed swamp of the Mesopotamian delta; the most deeply inundated portion of a *haur*.

LACUSTRINE: of, relating to, formed in, living in, or growing in (freshwater) lakes.

LAGOONAL: pertaining to a shallow sound, channel, or pond near or communicating with a larger body of (especially salt) water.

LAKE (L.): as labeled in figures, a *hor* or *haur*.

LAMELLIBRANCHIA: an order of bilaterally symmetrical hinged bivalve mollusk, such as clams, oysters, and mussels.

LANDSAT: A family of satellites, first orbited 26 July, 1972, carrying multispectral scanners that digitally record discrete bands of visible and invisible light reflected from the earth's surface. Colloquially, the images produced from those digital recordings using computer processing. During image processing, individual wavelengths are manipulated and assigned to visible colors in order to produce "false color" enhancements of vegetation, land use, geology, hydrology, and other environmental characteristics. Processed images may then be printed photographically, but such prints reflect only a subset of data produced for a particular purpose, not a conventional photographic recording.

LITTORAL: specifically, pertaining to a coastal shore zone lying between high and low tide marks. More generally, pertaining to aquarian ecotones, e.g. the border between land/water, freshwater/saltwater, grassland/marsh.

MANGROVE, MANGROVE SWAMP: coastal wetland dominated by trees and shrubs growing in brackish-to-saline tidal waters. Also, a common name for the many species of trees and shrubs therein.

MARINE: of or relating to the sea.

MARITIME: of, relating to, or bordering on the sea.

MARSH: (American usage) a frequently or continually inundated tract of soft, wet land usually characterized by monocotyledons such as reeds, grasses, sedges, and cattails. (European usage) As above, but specifically with a mineral soil base that does not accumulate peat. See also Reed Swamp.

MODIS: Moderate Resolution Imaging Spectroradiometer. A multispectral imaging sensor aboard NASA's Terra Earth Observation satellite.

MONOCLINE: A level trend in the Earth's crust.

OSTRACOD: an order of crustaceans with body parts enclosed in a hinged bivalve carapace. Because the legs are hidden they may at first be confused with small bivalve mollusks. Ostracods are often overlooked because they are so small but can be very common, and geologists rely on the fossilized carapaces of ostracods to date sediments. Also known as seed shrimp.

PALYGORSKITE: a white or gray pale lavender mineral, often classified as a clay mineral because it is present in some soils, consisting of hydrated magnesium aluminum silicate hydroxide $(Mg, Al)_2Si_4O_{10}(OH)\text{-}4H_2O$). Found in hydrothermal deposits, soils, and along faults often lining the slicken sides of fault lines, it also forms matted felted masses that closely resemble woven cloth. Also known as attapulgite or, in its felted form, "Mountain Leather," it appears with attached calcite crystals that look like interwoven glass beads.

PELAGIC: of, relating to, or living or occurring in the open sea

POCOSIN: Peat-accumulating, non-riparian freshwater wetland, generally dominated by evergreen shrubs and trees and found on the southeastern coastal plain of the United States. From the Algonquin for "swamp on a hill." (Mitch and Goss link 2000: 41).

PHYTOLITHS: minute silicate particles formed within living plant cells, in shapes and structures characteristic of genera and species. More durable than pollen grains, phytoliths are often the only paleobotanical evidence remaining in slty, gypsiferous Mesopotamian soils.

REED SWAMP, SWAMP: (U.K. usage) A *Phragmites*-dominated marsh.

REED: an herbaceous grass standing up to six meters in height, requiring continuously wet shallow standing water, commonly used for fodder, construction, boat-building, thatching, and woven mat-making. *Phragmites* australis (communis), also known as reed grass, is the dominant species carpeting fresh water marshes of southern Iraq.

REEDMACE, REEDMACE SWAMP: (U.K. usage) Cattail, cattail marsh.

RIPARIAN: pertaining to the bank of a natural watercourse (as a river), surrounding land characterized by a high water table, and associated water-seeking woody vegetation such as palm, willow, and poplar. Also called bottomland hardwood forest, floodplain forest, Bosque, riparian buffer, and streamside vegetation strip.

RIVERINE: of, relating to, formed in, living in, or growing in rivers

SABKHA: An environment of coastal sedimentation characterized by arid or semiarid conditions above the level of high tide and by the absence of vegetation. Evaporites, aeolian deposits and tidal-flood deposits are common in sabkha, especially the thick gypsum crust left after the evaporation of standing water from shallow basins.

SALT GRASS: *Spartina* patens, a halophytic grass, requiring continuously waterlogged soil and tolerant of shallow standing salt water, commonly used for grazing, fodder and in twine-making. Also known as cord grass.

SALT MARSH: a halophytic vascular plant community on alluvial sediments bordering saline water bodies with fluctuating water levels.

SEDGE: A thick-rooted grass-like hydrophytic monocotyledon with triangular stem cross-section, notably, *Carex* sp.

SWAMP: (U.S. usage) a wetland often partially or intermittently inundated with water and dominated by hydrophytic woody vegetation such as cypress, mangrove, palm, willow. In U.K./Europe, known as Wooded Swamp. See also Reed Swamp.

SYNCLINE: A downward flexure of the Earth’s crust, as is formed where one tectonic plate slides beneath another.

TELL (T.): a mound (Arabic: *Tell*, Persian: *Tepe*, Turkish: *Höyük*) resulting from repeated occupation, leveling, and rebuilding with mud brick on the same locale. In the Mesopotamian delta, tells are generally the only feature of any significant elevation above plain level.

TERMINUS ANTI QUEM: date before which an event must have occurred. For example, a datable settlement situated on the crest of a meander scroll dates that scroll to some period prior to establishment of the settlement. Care must be taken, however, to determine that the *base* of the settlement in fact lies above the dated feature. It is possible for a high point of an earlier sediment to protrude through subsequent sediments, and this can be difficult to discern on imagery.

TERMINUS POST QUEM: date after which an event must have occurred. For example, datable archaeological materials sealed within a sediment dates material deposited above that sediment to some later period. However, care must be taken to determine that adjacent earlier material has not been folded over the later sediment—often a problem in deltaic contexts.

WETLANDS: various (often interconnected) ecotones distinguished by the permanent or seasonal presence of water either at ground surface or within the root zone, characterized by high bioproductivity, and often exhibiting unique soil conditions that support hydrophytes and discourage flood-intolerant species. These include (among others) seagrass beds, marine littorals, mangroves, salt marshes and brackish estuaries; freshwater wooded swamps, reed swamps (graminae marshes), riparian floodplains, lacustrine basins, fens, and bogs.

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