

Frode F. Jacobsen & John McNeish



**From where life flows:
The local knowledge and politics
of water in the Andes**

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Whilst a large number of foreign and state initiated water management systems have failed for various reasons, locally developed water harvesting systems have proven their viability by surviving for hundreds of years. Whilst there has to be some recognition of the geographical limits and some questions asked about the quality of these water supplies, even with these detractors accounted for these systems often remain superior to those imposed by political and private interests, not only in terms of their reliability, but also in terms of their flexibility and more equitable control.

This book aims to offer a closer look at local flexible strategies for securing water resources under demanding climatic conditions and during environmental changes. The research dealt with here aims to identify a range of initiatives that have been created by and for members of indigenous communities to address such challenges, such as traditional structures for collecting run-off and rainwater. It poses the questions: How have these strategies been formed and made to operate? What positive and negative lessons can be learned from the interplay between local knowledge, subsistence strategies, and the influx of knowledge and initiatives from the outside?

As well as describing the function and social significance of water harvesting systems, a further aim of this book is to highlight the wider political and economic context of local knowledge about water harvesting and its uses, and the impact of contrasting management strategies on social development in the local communities involved. Water harvesting and irrigation systems form an important part of the vast knowledge that indigenous and local populations have of their natural environment. Such knowledge is embedded within complex social organisations, and forms the basis of both formal and important non-formal social networks. Indeed, together with the management of land, the management of water resources frequently provides the basis of social institutions and relationships to which ideas of belonging and community membership are tied. Indeed, water resources, along with other natural resources, comprise not only a vital element of subsistence, but also a vital field of social and political inter-action and practice.

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Tel.: + 47 73 59 32 10

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- Ruf, Thierry and Apollin, Frédéric (1994) *Community based water management in irrigated Andean agriculture: From research to diagnosis, from negotiation to renovation of the irrigation system of the town of Urcuqui, Ecuador*. <http://srdis.ciesin.columbia.edu/cases/ecuador-002-en.html> accessed on 28.02.05.
- Shiva, Vandana. 1991. *The Violence of the Green Revolution. Third World Agriculture, Ecology and Politics*. Third World Network, Malaysia.
- Tuijelaars, C., M. E. Pozo, R. M. Antezana y R. Saavedra. 1996. *Mujer y riego en Puna-ta. Aspectos de género*. Programa de Enseñanza e Investigación en Riego Andino y de los Valles. Cochabamba, PEIRAV-UMSS-UAW.
- World Bank (1991) *Bolivia Agricultural Sector Review*. Report n° 9882-BO, Latin American and the Caribbean Regional Office.
- (2001) *World Development Report 2000*. Washington.
- Zimmerer, Karl. 1995. The Origins of Andean Irrigation. *Nature*, vol 378, pp 481–483.

Part III

Local Level Water Management and the Progress of Civilizations in the Ancient Near East: A comparative case

Oystein La Bianca

Abstract

The Ancient Near East (ANE) is frequently referred to as the «cradle of civilizations.» In this paper I highlight ways in which local level water management—as opposed to centralized control of water—has played a role in the development of various pristine and secondary civilizations in the region. To this end I begin by offering a brief overview of theoretical issues pertinent to the study of water and civilizations in the ANE. Next I survey the contribution of local level water management to the progress of various civilizations, including those of ancient Mesopotamia, Egypt and the Levant. I conclude by discussing ways in which lessons learned from the past might inform planning for future supply of freshwater in the region.

Introduction

Much of what has been written and said about the history of water and civilization in the Ancient Near East (henceforth ANE) has focused on engineering and organizational achievements related to advances in state-level control and management of fresh water. A well known example is Wittfogel's (1957) hypothesis linking the rise of powerful despotic rulers in Mesopotamia and Egypt to the managerial requirements of canal based irrigation and agriculture. Another is Reifenberg's (1955) effort to connect

advances in agriculture in Palestine to state sponsored construction of large scale water distribution projects—such as the miles of aqueducts built by the Romans. No doubt a major reason for this tendency among scholars to focus on instances of centralized control of freshwater in antiquity is the abundance of archival sources available from places where state level control at times was very strong (esp. Egypt and Mesopotamia). This situation is all the more reason to be cautious about the sort of essentialism that renders marginal all other forms of water control than that involving state-level administration.

The point of the present essay is to argue that the progress of various civilizations in the ANE has depended as much, and perhaps even more, on local level control of water as it has on state level control. This argument proceeds from a fundamental tendency with regard to the state-level politics that normally drive the forward thrust of civilizations—namely their tendency to be transient.¹⁰² The long-term progress of civilizations is therefore normally not a linear process, but an undulating journey of ups and downs. It is for this reason that local level practices are so important, for being more resilient and thus less vulnerable to exhaustion and collapse, they have far greater staying-power. They thus provide civilizations with a solid sub stratum on top of which successive dynasties and associated state level projects can rise and fall.

I begin this paper by offering a brief overview of theoretical issues pertaining to the study of water and civilizations in the ANE. Next I survey the contribution of local level water management to the progress of various civilizations, including those of ancient Mesopotamia, Egypt, and the Levant. I conclude by discussing ways in which lessons learned from the past might inform planning for future supply of freshwater in the region.

Theoretical issues

As already indicated, Wittfogel's hydraulic civilization hypothesis—as presented in *Oriental Despotism: A comparative Study of Total Power* (1957)—remains the single most influential treatise on water and civilization in the ANE. As grand theory it remains without rival. Although dismissed by many as a distortion of the facts on the ground, its great merit is that—because of its scope and parsimony—it initiated and continues to foster cumulative thinking and research about water and civilization in the ANE and beyond (c.f. Hole 1995:2716). As a result we know today that river basin irrigation agriculture need not depend on complex administration (Fernea 1970; Adams 1981). We also know, however, that where such agriculture exists, it is a most convenient and attractive target of elite domination. And once captured and harnessed by an ambitious elite, it offers enormous potential as a means to power, wealth and influence—indeed, to the rise and development of civilizations!¹⁰³

Anthropological research on civilizations has emphasized the difference between 'great' and 'little traditions' (Redfield 1955; 1962; Marriott 1955; Bodley 2000). It is a distinction that has great relevance to our task here. A civilization's great traditions are normative principles and behaviors propagated by its literate elites who are the primary custodians of the canonical texts. Its little traditions, on the other hand, are the con-

102. For an excellent discussion of the vulnerability of state-level politics, see Robert McC. Adams 1965.

glomerate of vernacular or local knowledge¹⁰⁴ and practices considered normative by the largely non-literate masses not derived from a canonical text.

'Great traditions' are disseminated by means of universalizing agents (Marriot 1955).¹⁰⁵ Such agents include empires, dynasties, and sometimes religious movements. Agents disseminate 'great traditions' by means of projects – concrete undertakings of various kinds that expand the reach of a 'great tradition.' Modalities are transmission vehicles associated with particular projects and links are places along a chain of geographical points linking a particular 'great tradition' with a particular region or site. Whereas little traditions can persist and change without reliance on the process of universalization, great traditions depend on a network of transmission centers in order to persist and change.

For the purposes of this study, we will define great traditions simply as *universalized collective heritage and knowledge*; and little traditions as *localized indigenous heritage and knowledge*. Defined thus, the concepts are sufficiently broad to accommodate research not only on the ideological aspects (literate vs illiterate) of civilizations, but also on their material aspects (for example, water management systems).

Below these distinctions will be used as a basis for analyzing the management of fresh water resources in various ANE civilizations. Specifically our project here is to identify the little traditions upon which specific civilizations were founded and upon which they relied during times of exhaustion and collapse. How certain of these little traditions were turned into elite-controlled great traditions will also be noted.

Elsewhere (LaBianca 2004) I have discussed how Great and Little Traditions cooperate to produce long-term cycles of intensification and abatement in local food systems which, in turn, are reflected in changes over time and space in historical landscapes and in region-wide and local policies and practices for controlling fresh water resources. In this paper I compare the history of freshwater management in three ANE

103. Elsewhere (LaBianca 2004) I have defined 'civilization' as the luminous constellation of radiant attitudes, beliefs, behaviors, values, elite cultural traditions, institutions and works of art, artisanry and architecture that emanate from a particular center such as ancient Sumer, Thebes, Athens or Rome. In this definition three terms—luminous, radiant and constellation—have been drawn from astronomy for the sake of facilitating systematic thinking about the role of civilizations throughout the ANE. Civilizations are luminous when they emit «light» that advances the development of human societies and cultures. Such light might be contributions to the development of writing and language or innovations in such varied fields as religion, technology, commerce, science or the arts.

104. Redfield's framework has been famously applied to the study of Middle Eastern society by Gustave von Grunebaum (1955). In *Unity and Variety in Muslim Civilization* he uses it to examine the interaction between *dar al-Islam*, the «genuine» great tradition, and local culture patterns (1955:27-29). Even though this particular application has been widely criticized (Lukens-Bull 1999), the framework continues to be used and adapted by anthropologists as a means to study interactions between elite cultural traditions and the cultural patterns of commoners (Odner 2000; Bodley 2004).

105. According to McKim Marriott (1955), a student of Redfield, a great tradition owes its existence to two processes. The primary process is *universalization*, by which Marriot meant «the carrying forward of the material which is already present in the little traditions in the villages to a body which «universalized» the knowledge into a great tradition... The second process is *parochialization* or the «downward spread» to the villages of the great tradition. Both *universalization* and *parochialization* are characterized by transformations, and there are gaps in communication which the communities fill at their own discretion» (Marriott 1955 as cited in Odner 2000:34).

regions, namely Mesopotamia, Egypt and the Levant as a means to learn more about the respective contributions of Great versus Little Traditions.

Southern Mesopotamia

Other than the less than 200mm of rain that falls each year between October and May — an amount significantly below that needed to carry on sedentary agriculture—the main source of fresh water in Southern Mesopotamia is water from melting snow drained into headwaters in the Central Anatolian Plateau and transported to the Mesopotamian lowland by the Euphrates and Tigris rivers in two parallel channels (Charles 1988: 6). While the Euphrates follows a meandering channel which runs relatively high with respect to the surrounding flood plain, the Tigris has a much deeper channel and follows a much less meandering path, a fact which makes its late spring floods more violent and its waters more difficult to tap for irrigation (Charles 1988: 6). Over the past five thousand years, flood trends for the two rivers have oscillated between long periods of higher than average floods and long periods with lower than average floods (Butzer 1995: 133).

The earliest experiments with irrigation agriculture in Southern Mesopotamia were undertaken already during Late Neolithic times or about 6000 – 5000 B.C. by early farmers at Samarra. These incipient efforts at irrigation took place along tributary streams of the two great rivers where natural contours and small man-made ditches were combined to create primitive canal systems (Saggs 1988: 8). The development of these systems coincide with expansion of cattle breeding and village life as well as with the appearance of a distinctive type of pottery known as Samarran—which is why this whole culture is sometimes referred to as «Samarran culture» (Hansen 1997: 473; Hole 1997: 135).

The first to successfully tap the waters of the main channels of the Tigris and Euphrates for irrigation were the Ubaid people, who lived ca 5000–3500 B.C. in southernmost Mesopotamia (Adams 1981: 52–60). This was no minor achievement given the very real danger of massive flooding by either river just as crops would be ready for harvesting. A key component of their system was timely organization of labour to keep the natural levees along the river banks from leaking (c.f. Gasche 1988:41–43). Another was successful transfer of water from the main river channels to man-made canals for transporting water to adjacent agricultural fields. The Ubaid people were the first to employ canal inspectors to look after the expanding local networks of fortified levees and abutting canals (Saggs 1988:8; Steinkeller 1988:87). Significantly, these achievements were all made by village level farmers—there were no cities or urban-based elites yet in existence.

The first instance of irrigation associated with urban centers occurs during Uruk times, ca. 3500 to 3000 B.C. According to Adams (1981: 60), what is especially notable during this period is the «mass appearance of sedentary cultivators around regionally differentiated hierarchies of urban centers.» In other words, the huge expansion in village-based canal irrigation that occurred during this period appears to have produced a distinctive settlement pattern involving urban centers surrounded by market towns which, in turn, were encircled by clusters of smaller villages. Each of these villages had

their own local network of canals on which they depended for irrigation. Significantly this hierarchical rural settlement pattern coincides with the first instances of monumental buildings and use of cylinder seals and writing. This has led many scholars to conclude that some sort centralized administration exerted influence over the affairs of these village farmers during this period (Saggs 1988: 9).

According to Adams (1981: 75), urban dominance of rural hinterlands during Uruk times was by no means linear in the direction of ever increasing centralization of power. Instead his survey data points to unabated and often ruinous competition between various city-states for control over rural hinterlands. A consequence of this situation was that most urban centers tended to be fledgling and transient depending on the success or failure of their competition for dominance over rural hinterlands. By contrast, village settlements tended to be more resilient, more likely to go on existing despite the predation of urban elites. Thus «little traditions» appear already in Uruk times to provide the baseline wherewithal those incipient civilizations needed in order to succeed in establishing themselves in particular localities.

This pattern of on-again off again control of rural hinterlands by urban centers continues throughout the entire history of ancient Southern Mesopotamia. Eventually a «great tradition» establishes itself that has the following features: 1) elite domination of agricultural labour and canals by means of an agro-managerial bureaucracy centered in city-states; 2) application of various social technologies—for example, priestly regulation of the agricultural calendar—as a means to ensure elite control of agricultural production (Eyre 1955); 3) use of cylinder seals as a means to empower officials and delegate authority within an elite-controlled agro-managerial bureaucracy.

The place where this great tradition first became fully established was Ancient Sumer (Kramer 1963; Woolley 1965). Crucial to the progress of this great tradition was the Sumerian language and script—cuneiform—which not only facilitated routine administrative activities of the Mesopotamian city-states, it also served as an important medium for dissemination of sacred temple literature, epic poetry, and royal decrees. Like its Egyptian counter part, the Sumerian Great Tradition shaped the elite cultural traditions of a succession of dynasties and empires in the Mesopotamian heartland and beyond, starting ca 3500 B.C. and ending ca 500 B.C.

Egypt

Apart from its reliance on water from a great river—the Nile—there is relatively little that ancient Egypt otherwise had in common with ancient Mesopotamia. To begin with, rainfall along the Nile Valley is even scarcer than in the Tigris-Euphrates Valley—way below the minimum for rain fed agriculture. Second, thanks to the evening-out effect of numerous tributaries at its source in Ethiopia, the annual flooding cycle of the Nile is less violent and more predictable by the time it reaches Upper Egypt when compared to that of the two great rivers to the north. And third, water for agriculture along the Nile was much less dependent on networks of canals. Instead, during the flooding season water would spill over at low points along the Nile's natural levees thus inundating adjacent flood basins.¹⁰⁶ These basins, in turn, would be submerged in water for about two months during August and September until the river level dropped below

the elevation of the basin floor. The clayey make-up of the soils assured that they retained their moisture for months, allowing the traditional farmer to broadcast his seed during October and November and harvest its produce in February and March before the hot winds of spring (Butzer 1997: 249–250). Herodotus (as cited in Bowman 1986:13) summarized the process well: «they merely wait for the river of its own accord to flood their fields; then when the water has receded, each farmer sows his plot, turns the pigs into it to tread in the seed and then waits for the harvest.»

To a much greater extent than in Mesopotamia, irrigation during the dynastic period in Egypt was, therefore, «essentially a local matter» (Baer 1971)—the stuff of little traditions. Not surprisingly there are no pictures showing the irrigation of fields, no accounts of the methods, no administrative records about the construction, maintenance, or operation of irrigation systems...it is taken for granted, just as houses are never shown in tombs from the Old Kingdom» (Baer 1971).¹⁰⁷

What is known about the beginnings and history of irrigation in Egypt is the result primarily of archaeological and geoarchaeological investigations in the three main parts of the country, namely the Nile Valley, the Fayyum Depression and the Delta. They have revealed that wheat, barley, pulse and flax have been the staple crops of Egyptian agriculture since prehistoric times (Butzer 1976; Wetterstrom and Murry 2001);

According to Butzer (2001), the history of irrigation agriculture in the Nile Valley has proceeded over three stages. The earliest and therefore the longest lasting—as it was begun during prehistoric times and practiced right up till the mid-twentieth century—is called recessional or *eotechnic* agriculture. It requires no manipulation of the water whatsoever—merely planting of seeds, such as cereals and flax, in the moist alluvial soils as the water in natural flood basins recedes following inundation. To this very basic technique a second, somewhat more sophisticated one was added during dynastic times. Called *paleotechnic* or pharonic irrigation, it involved cultivators compensating for «lower-than average floods by cutting sluices into the levees, or attempt to limit the incursion of unusually high floods by reinforcing levees or plugging up breaks in them» (Butzer 2001: 184). The third, and last, is artificial or *neotechnic* irrigation which the construction of irrigation ditches and canals and techniques for mechanically lifting the water, such as the *shaduf*, or sweep (Butzer 2001: 185). Both *paleotechnic* and *neotechnic* are attested already during late Predynastic times, but it was not till the Ptolomies, that *neotechnic* or artificial irrigation really took off. Concludes Butzer (2001: 187) «the transition from eotechnic, recessional agriculture to paleotechnic irrigated farming was incremental and took place primarily at the grass-roots level.» He adds «irrigation was never maintained or regulated by an administrative bureaucracy; instead, it functioned at the local level, beyond the purview of the pharaoh.»

It is thus clear that in Egypt, even more so than in Mesopotamia, irrigation agriculture belonged to sphere of little traditions (Iliffe 1995: 20). To the extent that it became

106. According to Butzer (1976) the Nile floodplain was «subdivided into shallow basins, as a result of the intersection of various active and older levees.»

107. This is perhaps a bit overstated. Butzer (2001: 187) writes with regard to pharonic Egypt that «Basin irrigation was the norm and therefore elicited few directives and no explanatory comment. Estate irrigation and commercial crops, representing only a tiny fraction of the arable land, attracted most of the explicit attention.»

enmeshed within the great tradition, it was at the ceremonial level of centralized regulation of the agricultural calendar by religious elite with the pharaoh at the top (Robins 1995: 1811–1812). During flooding season, Pharonic intervention may also have impacted local agriculture through diversion of agricultural labour to build pyramids (Mendelssohn; 1974; Iliffe 1995: 20).

The Levant

The Levant is made up of the fertile highlands of coastal Syria, Lebanon, Israel, Palestine and Jordan (Tubb 1998:13). Along the coast and in the highlands to the west of the Jordan Valley rainfall can exceed 800 mm annually. The central and northern highlands to the east of the Jordan River can receive in excess of 600 mm annually. As one moves eastward and southward beyond the Syrian and Transjordanian highland rainfall tapers off to less than 200mm annually. The western frontier of the Arabian desert follows a meandering line running north to south through Syria and Jordan. In a normal year rain falls from October to March—in a wet year from September to May and in a dry year from November to February.

Unlike either Mesopotamia or Egypt, much of the Levant is made up of mountainous highlands intersected by wide valleys and steep canyons. This topography interacts in important ways with local rainfall conditions to produce a range of different natural sources of freshwater. To begin with is the varied pattern of rainfall, which in part is attributable to elevation differences in the landscape. Thus the Dead Sea gets very little rain, while the mountainous highlands and their piedmonts receive the most.

Second is the down slope drainage, which presents opportunities for harvesting run-off water by means of terracing, diversion dams, reservoirs and cisterns. Such run-off collection installations are ubiquitous throughout the highland regions of the Levant, and have even been adapted to harvest rainfall in regions receiving minimal rainfall, such as the Negev and Southern Jordan. There is a great description of how this system worked at the beginning of the 20th century, over 100 years ago, in Libbey and Hoskins (1905):

«Two hours north of Hesban, while traversing the line of the old Roman road, we noticed the curious way in which miles of gently sloping lands had been divided into great terraces by lines of black rock built with cement into dikes that ran all over the country. At places, the level terraces resembled great tennis courts. As we neared Hesban and the Hill about the ancient city, these walls or dikes increased in number and in many cases ran like rulers straight up and down the hillsides. When near Hesban itself, we notices that nearly every terrace or slope had a cistern at its lowest corner, and it at once became clear that this was an ancient device for dividing and securing the rainwater which fell on each man's land. On the more rocky slopes the rain was, of course, the only «crop», and each owner guarded his rainfall as carefully as modern ploughmen do their portion of the running streams. Recalling what we had seen in the Ajlun district, and noting the similar diking about Madeba, Diban, and a dozen other sites, the whole system became clear. There is not a tree or a fountain for miles on that Mishar plateau, and it is very plain that the ancient inhabitants depended almost wholly upon cisterns, of which there are thousands in and about the larger ancient sites. As

an addition to the cisterns, they also constructed open pools, which caught the rainfall of larger areas than any one individual could control. At Hesban are the remains of a tank one hundred and thirty-nine feet by one hundred and thirty-nine feet, having a depth of at least ten feet. Another and much larger one will be noticed at Madeba.»

Third is seepage of rain water below ground into natural subterranean reservoirs and aquifers. These, in turn, replenish the underground headwaters of natural springs and streams that appear in various locations throughout the landscape and provide fresh water for parts or all of the year for local residents and visitors alike. Such springs and streams are especially plentiful along the wadies and slopes draining into the Jordan valley and the Dead Sea.

Fourth are the *wadies* or dry river beds that during the rainy season transport runoff and flood waters to lowlands below. While most remain dry all year except following heavy rains, a few are so well endowed with springs and small tributary streams that they have water running in them for most or all of the year. Some, such as the Yarmouk, Zerka, and Moujib in Transjordan are rivers that run all year. The degree to which wadies contain moisture all year can be estimated in part from the quantity of oleander and other water loving plants that inhabit their banks.

Fifth is the dew water that condenses naturally on plants and stone surfaces during night time. The greater the variance in temperatures between night-time and day-time—which depends in part on topographic factors—the greater the amount of dew water produced. Throughout the Levant dew water, supplemented at times by water harvest by means of terraces, has been the main source of irrigation for crops produced by «dry farming» methods. Not only cereals, but also vegetables and tree crops can be produced by this means. Often small stones are piled in a circle around trees or small vegetable gardens to increase the amount of irrigation from dew water. This is sometimes called «stone mulching.»

To these largely local-level water management techniques transient state-level projects were added during certain time periods. In particular the Roman Great Tradition is notable for its heavy emphasis on maximization of agricultural production and yield, including maximization of water supply through addition of aqueducts for channelling water from distant streams and springs; waterwheels and pumps for raising water to nearby fields; large underground cisterns and reservoirs for storing water, and drainage systems for managing runoff (Hughes 1975); maximization of land area available for agricultural production through removal of forests and draining of swamps (White 1970:146–172); maximization of yield through application of green manure, fertilizers, and rotation of crops (White 1970: 86–172); maximization of crop and stock yields through breeding and improved husbandry practices (White 1970: 173–331); and maximization of farm labour through increased use of slaves and hired personnel (White 1970: 332–383).

These efforts to maximize food system outputs were intimately linked to the growth and spread of cities throughout the Roman world. Modelled to a great extent on urban designs developed by the Greeks, and linked by paved highways, cities became the political centres of the Roman economy, exerting a powerful influence on their agricultural hinterlands (Foss 2002).

To these changes in rural and urban landscapes introduced by the Romans must be added their devotion to law, order and discipline—their «unwavering adherence to the

idea of a controlled life, subject not to this or that individual, but to a system embodying the principle of justice and fair dealing» (Hamilton 1993: 129–130). In the end, this ideal ended up favouring the settled farmer over the nomad; the strong over the weak; and the landowner over the farm hand.

As a part of their Great Tradition the Byzantines continued to a significant extent the emphasis on maximization introduced as part of the Roman Great Tradition, but with modifications attributable in great measure to the rise of Byzantine Christianity, centred in Constantinople. Core components of their food system included continuation, and in certain locations, expansion of Roman system for maximizing water supply (Evenari, Shanan and Tadmor 1971; Patrich 1995: 483; Reifenberg 1955); addition of monasteries and estate farms as centres of agricultural production and distribution (Foss 2002: 95); intensification of cash crop production of olives and grapes (Foss 2002:92); and increased hierarchical organization of production due to increased concentration of political power in the hands of bishops at the expense of city endowments and private citizens (Foss 2002:71).

As in the case of the Roman Great Tradition, that of the Byzantines was essential to life in towns and cities. And every town, every city had its own church, or churches—often constructed of reused remains of destroyed Roman temples. Even the rural landscape took on a new character as monasteries and shrines were inserted in the midst of olive groves and along highways and paths linking cities and towns (Foss 2002:74).

Lessons for Today

In the foregoing pages I have attempted to highlight ways in which local level water management—as opposed to centralized control of water—has played a role in the development of various pristine (Mesopotamia and Egypt) and secondary (Levant) civilizations in the Ancient Near East. I have sought to show that the progress of various civilizations in the ANE has depended as much, and perhaps even more, on local level control of water as it has on state level control. This is because local level systems are far more resilient and thus less vulnerable to exhaustion and collapse—thus providing civilizations with a solid sub stratum on top of which successive dynasties and associated state level projects can rise and fall.

There are several important lessons for today that can be drawn from this study. The first is that local level water management strategies more often than not are so ordinary, so commonplace, that they tend to be ignored—taken for granted—by both ancient and modern observers. By contrast, large-scale water works, such as aqueducts and canals, are imposing—grand to see and behold as they criss-cross the rural landscapes of antiquity. No wonder, then, that scholarly research on ancient water management practices has tended to emphasize large-scale systems.

Elsewhere (2005) I have argued that in order to adequately analyze the rural landscapes of antiquity a three-pronged approach is needed that includes three interrelated perspectives—food systems, political economy and civilizations. Research on food systems investigates how the inhabitants of a given region or site interact with their local environment in order to obtain food, water, shelter and protection. This is the perspective that is most likely to bring little traditions—small-scale solutions—into view. The

political economy perspective studies the ways in which local economic activities are connected to larger systems represented by market dominant elites in nearby towns or cities and by bureaucracies under the control of empires far beyond the local region. This perspective brings to light the role of the state in orchestrating local practices. The civilizational perspective expands the inquiry to examine underlying connections between various civilizations and the cultural and political projects of states and empires as they manifest themselves archaeologically in local regions. All three perspectives are needed in order to adequately study both small and large-scale water management systems in antiquity as well as today.

A second lesson—one that follows from this first—is that local level solutions more often than not tend to be undervalued and at times are deliberately discouraged by state-level bureaucracies. Being local—they can and usually do operate without the state—thus in a sense undermining the central project of all states—to create allegiance among constituent populations through rendering services that foster dependence. No wonder little is recorded about the little traditions for managing water in Egypt, for there was not much that the state could take credit for in this domain. To the extent that records pertaining to water management practices do exist in Mesopotamia, it is usually from places and periods when the state succeeded in capturing some degree of control over these systems. In the case of the Levant, practically nothing is preserved in written records of little traditions for managing rain water—archaeological excavations and surveys are the main—and almost exclusive—means of knowledge about such systems in the past in this region.

A third lesson has to do with the interplay of expert versus indigenous knowledge. To the extent that small-scale water systems are locally controlled, they are sustained by little traditions or indigenous knowledge. I define *indigenous knowledge* as «a bundle of intangible assets—including beliefs, sentiments, practical information and know-how—accumulated through centuries of experience and passed on from generation to generation within local communities as a means to cope with present and future challenges. Such knowledge stands in contrast to *expert knowledge*, by which I mean universalized systems of understanding and practice to which individuals gain access and proficiency through formal education or apprenticeship with an acknowledged master.

Since expert knowledge is normally required by states to build and maintain large-scale infra-structure systems such as paved roads, aqueducts and huge dams, a presumption tends to take hold within state bureaucracies that expert knowledge is automatically to be preferred over local or indigenous knowledge. This presumption, and associated sentiments about the inferiority of local knowledge, can and often does lead to policies and practices on the part of the state that ultimately undermine traditional practices. An example of this is the introduction of deep drilling, mechanical pumping stations, and water pipes throughout Jordan during the seventies and eighties in Jordan. This state-sponsored infrastructure initiative had the very likely unintended consequence of directly undermining centuries and millennia of local level—household—reliance on cisterns and related rainwater capture and storage technologies. I have reported on this situation elsewhere and have recently become active in seeking to restore such little traditions in Jordan (see www.rainkeep.org).

At this writing I remain uncertain as to whether grass-roots efforts at restoring local level water control—such as Project Rainkeep—can truly succeed. What has been ex-

tinguished by the modern capitalist great tradition—and attendant consumer attitudes and expert knowledge—is not only an ancient technology, but a bundle of conservation-friendly attitudes and sentiments without which the restored technology alone will not be sufficient. The question is: what will it take to restore the *complex whole* of attitudes, sentiments, skills and practices that it takes for little traditions to live again.

Bibliography

- Adams, Robert. Mc C. *Heartland of Cities: Surveys of Ancient Settlement and Land Use on the Central Floodplain of the Euphrates*. Chicago: University of Chicago Press, 1981.
- _____. *Land Behind Baghdad: A History of Settlement on the Diyala Plains*. Chicago: University of Chicago Press, 1965.
- Baer, Klaus. «Land and Water In Ancient Egypt.» Paper presented at the 28th International Congress of Orientalists, January 1971.
- Bodley, John. *Cultural Anthropology: Tribes, States, and the Global System*. 3rd ed. Mountain View, CA: Mayfield Publishing Co., 2000.
- Bowman, Alan K. *Egypt After the Pharaohs: 332 BC-AD 642 from Alexander to the Arab Conquest*. London: British Museum Publications, 1986.
- Butzer, Karl. *Early Hydraulic Civilization in Egypt: A Study of Cultural Ecology*. Chicago: University of Chicago Press, 1976.
- _____. «Environmental Archaeology.» In *The Oxford Encyclopedia of Archaeology in the Near East*. vol. 2. Ed. Eric M. Meyers. New York: Oxford University Press, 1997: 244–252.
- _____. «Irrigation.» In *The Oxford Encyclopedia of Ancient Egypt*. vol. 2. Ed. Donald B. Redford. Oxford: Oxford University Press, 2001: 183–188.
- _____. «Environmental Change in the Near East and Human Impact on the Land.» In *Civilizations of the Ancient Near East*. vols. 1 and 2. Eds. Jack Sasson, John Baines, Gary Beckman, and Karen Robinson. Peabody, MA: Hendrickson Publishers, Inc., 1995. 123–151.
- Charles, M.P. «Irrigation in Lowland Mesopotamia.» In *Irrigation and Cultivation in Mesopotamia*. part 1 vol. 4. Cambridge: Sumerian Agriculture Group, 1988.
- Evenari, Michael, Leslie Shanan, and Naphtali Tadmor. *The Negev: The Challenge of Desert*. Cambridge, Massachusetts: Harvard University Press, 1971.
- Eyre, Christopher J. «The Agricultural Cycle, Farming, and Water Management in the Ancient Near East.» In *Civilizations of the Ancient Near East*. vols. 3 and 4. Eds. Jack Sasson, John Baines, Gary Beckman, and Karen Robinson. Peabody, MA: Hendrickson Publishers, Inc., 1995. 175–189.
- Fernea, Robert A. *Shayhk and Effendi: Changing Patterns of Authority Among the El Shabana of Southern Iraq*. Cambridge, MA: Harvard University Press, 1970.
- Foss, Clive. «Life in City and Country.» In *The Oxford History of Byzantium*. Oxford: Oxford University Press, 2002. 71–95.
- Gasche, H. «Le Systeme Paleo-Fluviale Au Sud-Ouest De Baghdad.» In *Irrigation and Cultivation in Mesopotamia*. Bulletin on Sumerian Agriculture. vol. 4. Cambridge: Aris & Phillips Ltd., 1988: 41–48.
- Hamilton, Edith. *The Greek Way*. New York: W.W. Norton & Company, 1993.
- Hansen, Donald P. «Samarra.» In *The Oxford Encyclopedia of Archaeology in the Near East*. vol. 4. Eds. Eric M. Meyers. New York: Oxford University Press, 1997. 472–473.
- Hole, Arnold Frank. «Assessing the Past Through Anthropological Archaeology.» In *Civilizations of the Ancient Near East*. vols. 3 and 4. Eds. Jack Sasson, John Baines, Gary Beckman, and Karen Robinson. Peabody, MA: Hendrickson Publishers, Inc., 1995. 2715–2727.
- _____. «Deh Luran.» In *The Oxford Encyclopedia of Archaeology in the Near East*. vol. 4. Eds. Eric M. Meyers. New York: Oxford University Press, 1997. 134–137.
- Hughes, J. Donald. *Ecology in Ancient Civilizations*. Albuquerque, NM: University of New Mexico Press, 1975.
- Iliffe, John. *Africans: The History of a continent*. Cambridge: Cambridge University Press, 1995.
- LaBianca, Øystein. «Food Systems, Political Economy and Civilizations: A Framework for Investigating Historical Landscapes and Archaeological Tells in the Ancient Near East.» Paper presented at BASOR (Nov. 2004). Andrews University Institute of Archaeology.
- _____. «Project Rainkeep.» On the web at <http://www.rainkeep.org>, 2004.
- Libbey, William and Hoskins, Franklin E. *The Jordan Valley and Petra*. New York: G.P. Putnam's Sons, 1905.
- Lukens-Bull, Ronald A. «Between Text and Practice: Considerations in the Anthropological Study of Islam.» In *Marburg Journal of Religion* Dec. 1999, 4:2.
- Kramer, Samuel Noah. *The Sumerians: Their History, Culture, and Character*. Chicago: University of Chicago, 1963.
- Marriott, McKim. «Little Communities in an Indigenous Civilization.» In *Village India: Studies in the Little Community*. Eds. McKim Marriott and Alan Beals. Chicago: University of Chicago Press, 1955.
- Mendelssohn, K. *The Riddle of the Pyramids*. New York: Praeger, 1974.
- Odner, Knut. *Tradition and Transmission: Bantu, Indo-European, and Circumpolar Great Traditions*. Bergen, Norway: Norse Publications. Bergen Studies in Social Anthropology No. 54, 2000.
- Patrich, Joseph. «Church, State and the Transformation of Palestine – The Byzantine Period (324–640 CE).» In *The Archaeology of Society in the Holy Land*. London: Leicester University Press, 1995: 470–487.
- Redfield, Robert. «Social Organization of Tradition.» In *Social Organization of Tradition* Nov. 1955 15:1: 13–21.
- _____. *Human Nature and the Study of Society*. Chicago: University of Chicago Press, 1962.
- Reifenberg, A. *The Struggle Between the Desert and the Sown: Rise and Fall of Agriculture in the Levant*. Jerusalem: Government Press, 1955.
- Robins, Gay. «Mathematics, Astronomy, and Calendars in Pharaonic Egypt.» In *Civilizations of the Ancient Near East*. vol. 3 and 4. Ed. Jack M. Sasson. Peabody, Massachusetts: Hendrickson Publishers, Inc., 1995.
- Saggs, H.W.F. *The greatness that was Babylon: a survey of the ancient civilization of the Tigris-Euphrates Valley*. London: Sidgwick & Jackson, 1988.
- Steinkeller, P. «Notes on the Irrigation System in Third Millennium Southern Babylonia.» In *Irrigation and Cultivation in Mesopotamia*. Bulletin on Sumerian Agriculture. vol. 4. Cambridge: Aris & Phillips Ltd., 1988: 73–92.
- Tubb, Jonathan N. *Canaanites*. Norman, OK: University of Oklahoma Press, 1998.
- von Grunebaum, Gustave E. *Unity and Variety in Muslim Civilization*. Chicago: University of Chicago Press, 1955.

- Wetterstrom, Wilma and Murry, Mary Anne. «Agriculture.» In *The Oxford Encyclopedia of Ancient Egypt*. vol. 1. Oxford: Oxford University Press, 2001: 37–44, 2001.
- White, K.D. *Roman Farming*. Ithaca, New York: Cornell University Press, 1970.
- Wittfogel, Karl. *Oriental despotism: A comparative study of total power*. New Haven: Yale University Press, 1957.
- Woolley, C. Leonard. *The Sumerians*. New York: W.W. Norton & Company, 1965.

Presentation of authors

Silvia Álvarez is Professor of anthropology at the Department of Anthropology, Universidad Autónoma de Barcelona, Spain

Claudia Gonzalez Andricaín is a PhD student at the Department of Anthropology, La Universidad Autónoma de Barcelona, Spain

Frode E. Jacobsen is an Associate Professor of Anthropology and Health sciences at the Department of Public Health and Primary Health Care, University of Bergen, Norway

Øystein La Bianca is Professor of Archaeology and Anthropology at the Behavioral Science Faculty, Andrews University, Michigan, USA

Nina Laurie is Professor of Development and the Environmental Studies at the Department of Geography, University of Newcastle, England

Jorge Marcos is Professor of Archaeology and Anthropology at the Escuela Superior Politécnica del Litoral (ESPOL), Guayaquil, Ecuador

John-Andrew McNeish is a Senior Researcher at Christien Michelsen's Institute (CMI). Bergen, Norway

Franck Poupeau is a Post-doctoral fellow in Sociology at the Institut français d'études andines (IFEA) in Bolivia, and editor of the review *Actes de la recherche en sciences sociales*, created by Pierre Bourdieu in 1975.

Pablo Regalsky is a PhD student in anthropology at the Department of Geography, University of Newcastle and Director of the Centro de Comunicación Social y Desarrollo Andino (CENDA), Bolivia.