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NOTES

CHAPTER 1: THE NEED FOR A PARADIGM SHIFT

- 1 The image was taken by Bill Anders, one of the astronauts on Apollo 8, through the window of the spacecraft.
- 2 This was demonstrated when Saudi Arabia in the 1990s discussed plans to tow icebergs from Newfoundland to the Arabian Desert, and again when the project of towing water from Turkey to Cyprus in giant plastic bags was launched.
- 3 Diogenes Laertius' more than 2,000-year-old story about the Greek philosopher Heraclitus is telling. Heraclitus, remembered first and foremost for his theories about water being always on the move and that it is therefore not possible to step twice into the same river, died because of his misunderstanding of the role of water in the human body. He died lying under a baking sun, buried in dung, fighting what he thought was the dangerous and unhealthy water in his body. He saw the world within the dichotomy of fire and water, and his aim was to become 'dry', because the 'dry soul' was the wisest and best soul, and for souls it is 'death to become water'. He even 'asked the doctors if one could, by emptying the intestines, make water pour out. However, when they said this was impossible, he stretched himself out in the sun and ordered boys to plaster him over with dung. He stayed there, stretched out, and the next day died and was buried in the agora (DL 9.3–4, quoted in Chitwood 2004: 79). Heraclitus was obsessed with moisture but obviously did not know that the water balance in the body is crucial for survival. In fact, it was quite recently that this fact was confirmed beyond doubt.
- 4 It is said about John Locke in the introduction to the 1824 edition of *An Essay Concerning Human Understanding* that one of his most peculiar traits was that he only drank water and that he drank a lot of it because he thought it was very healthy (p. 30). Well into the twentieth century, the crucial importance of water and the amount of water in our body was not appreciated. When, in 1936, Arthur Shipley in his book *Life* (first published in 1925) wrote 'Even the Archbishop of Canterbury comprises 59 per cent. of water' (p. 18), this knowledge was about to be common knowledge among people who studied the body.
- 5 Also the body temperature is related to water, since it is determined by two parameters: heat gain and heat loss. Heat gain is basically linked to heat production and it is fairly constant. It is related to the basal metabolic rate and increases during exercise and during the process of shivering. Heat loss is related to radiation, convection and conduction from the external surfaces (Milton 1998: 4).

Body heat is lost by conduction to air and other objects in contact with skin. The kinetic energy of the molecular motion of the skin is determined by temperature; energy is transferred to the molecules in contact with the skin if the objects are colder than the skin [...] Water has a high thermal conductivity (0.561 W/m·K),

more than 20 times that of air, and a high heat capacity; thus, heat loss is much higher in water than in air (Morimoto 1998: 86).

To illuminate this point, one may use the sauna as an example. The temperature in a sauna is normally between 65 and 100 degrees Celsius, but the importance regarding the felt experience is the humidity. In the beginning during a sauna the heat is dry but it turns damp as soon as water is thrown on the hot stones. Throwing water on the sauna stove produces steam and makes the air feel hotter; the more water that is thrown on the hot stones the hotter it feels. However, it is only the humidity which changes, not the temperature (Leimu 2002: 72). 'Water has a high heat vaporization, and it is the only mechanism available for the reduction of body temperature when the environmental temperature is higher than that of the body surface' (Morimoto 1998: 80), and one starts sweating. Turning to a coldwater environment, shivering is the opposite bodily function of sweating.

The important factor is that 'The thermal properties of water differ from those of air by a 20-fold higher heat conductivity and a specific heat about 1000 times greater than air. The average skin temperature in a water element will, therefore, be very close to the water temperature' (Nielsen 1998: 133). Thus, the skin temperature of a person without clothes in heavy rain will soon be the same as the temperature of the rain. The colder the water is, the more it affects not only the skin temperature but also the core temperature of the body.

During rest, a fat subject (36 per cent body weight fat) can maintain heat balance in water 10°C lower than core temperature, while a lean person (less than 10 per cent of body weight in fat) can tolerate a water temperature no more than 3.8°C lower than his body temperature without shivering during rest. In other words, the prescriptive zone in water is very narrow – only about 5°C (Nielsen 1998: 134).

- 6 Useful studies of aspects of the history of dam architecture, hydrology and engineering have of course been published but they have not been interested in how developments have been framed and impacted by the three layers and their interconnections.
- 7 Two examples from the two richest countries in the year this book was written: in New York in 2013 the mayor decided to invest about \$20 billion to protect the low-lying Manhattan district from climate change and further billions to ensure that the metropolis gets all the water it needs; the world's biggest engineering project ever started in China in 2002, the so-called 'South-north water transfer project'. The Chinese Government aimed to save Beijing as a capital by building a huge canal that brings water from the Yangtze River, 1,800 kilometres to the south of the city. The project should also save a large number of other big cities, replenish the water table on the North China plain and save the Yellow River from over-exploitation. By 2014, about \$80 billion had been spent. But any modified waterscape, including the Chinese canals, will reflect its physical underpinnings and this might again be changed by both physical and man-made changes in the way water runs. The point is that in the long term all hydraulic structures are vulnerable to climate change. In fact, one of the great questions about the future of China is the future of this project if the climate change and the discharges of the Yangtze decrease significantly. If that happens, China may well disintegrate, as the Chinese Empire could not withstand the grave consequences of changing climate and water discharge of the Yellow River and the Great Emperor's Canal in the late eighteenth century.
- 8 The approach suggested here may also for the sake of clarity be compared to Lefebvre's call for a 'unitary theory'. Lefebvre argued for the need to bring together first what he called 'the *physical* – nature, the Cosmos; secondly, the *mental*, including logical and formal abstraction; and thirdly, the *social*'. He was concerned with what he called 'logico-epistemological space, the space of social practice, the space occupied by sensory phenomena, including products of the imagination such

as projects and projections, symbols and utopias' (Lefebvre 1991: 11. The italics are his). Lefebvre's description of his unitary theory aims to integrate the physical world into analyses of the social world. He proposed three levels of analysis. The first he called *spatial practice*, the second the *representation of space* and the third *spatial representations*. In spite of his theoretical insistence on the centrality of the physical, in his methodological approach space and society are equated only with the social, and the physical will not be a dynamic social force, always in flux, that is typical of water. The three levels of analysis inherent in the water-system approach distinguish more clearly the levels that need to be studied, including the physical, the social and the mental. But the way that these three layers or levels are described are all more dynamic, and they are also viewed in conjunction, in order to take the multi-dimensionality of social space and the complexity of historical development into account.

- 9 Although mainstream social science has been waterblind, in the last few decades a number of studies have been published on water's role in society and history, and good books were also published on the topic early in the twentieth century. The nine-volume series *A History of Water*, presents a kind of state of the art regarding many central issues in the history of water-society relations (see <http://www.ibtauris.com/Series/History%20of%20Water.aspx>). A number of useful monographies have also been written and here it suffices to mention Worster 1985b, Fagan 2011 and Solomon 2010.

CHAPTER 2: WATER-SOCIETY SYSTEMS AND THE SUCCESS OF THE WEST

- 1 Several books propose variants of this model of explanation, the most influential being, of course, Weber 1930 [1905].
- 2 See, for example, Lipsey and Bekar 2004.
- 3 Shiue and Keller 2004, argue that based on their analysis of three centuries of data from China and Europe, relative levels of market function in China and Europe were similar prior to the Industrial Revolution.
- 4 For this kind of explanation, see North 1981; North and Thomas 1973; Landes 1998 and Fergusson 2011.
- 5 Landes 1999: 516. Chapter 3 in the book is entitled: 'European exceptionalism: A different path' (Ibid.: 28–44). This type of explanation has an endless number of forms. Some also explain the difference by 'organisational skills' (see Pacey 1991). Other 'schools' underline different exceptionalist factors. See, for example, the 'Social Change School' (Toynbee 1984 [1884]; Polanyi 1944), the 'Industrial Organization School' (Mantoux 1970 [1928]; Pollard 1964), the 'Macroeconomic School' or the 'Development in Stages School' (see Rostow 1960; Gerschenkron 1962; Fogel 1983) and the 'Technological School' (see Harley 1982). For this assessment, see Crafts 1985. A typical example of how reformers in Britain in the first half of the nineteenth century interpreted the transformation can be seen in the following quotation from 1835:

In no country have these blessings been enjoyed in so high degree, or for so long a continuance, as in England. Under the reign of just laws, personal liberty and property have been secure; mercantile enterprise has been allowed to reap its reward; capital has accumulated in safety; the workman has 'gone forth to his work and to his labour until the evening,' and, thus protected and favoured, the manufacturing prosperity of the country has struck its roots deep, and spread forth its branches to the ends of the earth. (Baines 1835)

Scholars have explained the revolution in terms of the Enclosure Movement in England during the seventeenth and eighteenth centuries. The exponential increase in food production that followed the enclosure laws that drove the peasantry off the land, increased agricultural production and the urban population undoubtedly stimulated the revolution. Others have underlined the fact that Parliament, unlike the situation with the monarchies of continental Europe, was firmly under the control of the merchant and capitalist classes who were pushing legislation in favour of capitalist growth. Others have pointed to the existence of a new class linked to the Protestant work ethic and the particular status of Dissenter Protestant sects that flourished with the English Revolution. Yet others have focused on particular political-ideological traditions; that the society established after the Civil War in Britain established a link between wealth and status that was conducive to the emergence of capitalist entrepreneurship and development (Perkin 1969). All these factors must be incorporated into any comprehensive study of the Industrial Revolution.

- 6 See, for example, Williams 1961 [1944], Frank 1969 and Amin 1974 for early advocates of this theory.
- 7 In one of the most influential contemporary studies (Pomeranz 2000: 107), the author claims that after examining a 'variety of arguments that emphasize internally generated European advantages in productivity before the mid-nineteenth century' he 'found them all dubious'.
- 8 Pomeranz concludes: 'Far from being unique, then, the most developed parts of western Europe seem to have shared crucial economic features – commercialization, commodification of goods, land, and labor, market-driven growth, and adjustment by households of both fertility and labor allocation to economic trends – with other densely populated areas of Eurasia' (Pomeranz 2000: 107).
- 9 See also, among many, Flynn and Giráldez 1995: 201–22.
- 10 For this expression, see Pomeranz 2000.
- 11 See O'Brien 1987 and Roehl 1976 for the view that France had similar potential for development to Britain in the eighteenth century (see also Crafts 1977 and Broadberry 2007). Commercialisation and specialisation went much further in Britain and the Netherlands than in the Mediterranean states, but Britain began to follow a radically different path from the European river delta with the growth of the British textile industry in the eighteenth century.
- 12 For an overview of recent discussions between these two schools, see the transcript of the debate between Frank and Landes at Northeastern University: http://www.worldhistorycenter.org/whc/seminar/pastyears/frank-landes/Frank-Landes_01.html.
- 13 Pomeranz 2000: 34, quoting Adam Smith, *The Wealth of Nations*: 637–8.
- 14 The seventeenth and eighteenth centuries saw the publication of many books on water control. Fu Zehong, *Xing Shui Jin Jian* (*Golden Mirror of the Flowing Waters*) (1725) and Kang Jitian, *He Qu Ji Wen* (*Notes on Rivers and Canals*) (1804), Jin Fu, *Zhi He Fang Lue* (*Methods of River Control*) (published 1767 [1689]) are all mentioned in Ronan 1995: 230.
- 15 Mark Elvin, personal communication.
- 16 Elvin 1973: 286. Elvin also notes examples of making incense and paper, and husking rice in Guangdong, Jiangxi and Fujian during the Qing dynasty.
- 17 For a description of technology in the iron industry in the eighteenth century, see Dharampal 1971.
- 18 These issues will be dealt with in a much wider context in my forthcoming book, tentatively entitled: *The Industrial Evolution and the Rise of the Modern World. Why China, India, Japan and the Ottoman Empire failed and some European countries succeeded*.
- 19 We also need to bear in mind that in Britain, the natural and engineered waterscape eventually proved to be an obstacle to development during the nineteenth century,

as regards both transport and power. Comparative studies of the shift from water power to steam and from waterways to railways could provide new insights into the Industrial Revolution and topics for debate regarding the origins of the modern world.

CHAPTER 3: RIVERS AND EMPIRE

- 1 For an overview and discussion of the literature on the 'Partition of Africa', see Tvedt 2004a, Tvedt 2004b and Tvedt 2004c. See also the summary of the historiography on the issue in Winks 2001.
- 2 The interpretation of British Nile policies in the late nineteenth century discussed in this chapter is put in a much broader context in Tvedt 2004a.
- 3 This expression is taken from Robinson and Gallagher 1961. This chapter quotes from their later edition from 1981. Robinson and Gallagher claim that the overarching British motive in the region was 'Security of the Empire', and that the British became masters of the Nile not because they wanted to, but because they were forced to act by European rivals. What compelled the British to occupy the regions south of Egypt was the fear that other European powers might take control over the Upper Nile as a lever to prise the British out of Suez. The occupation of the Upper Nile was thus seen as a pre-emptive measure by and large forced upon an unwilling and defensive British leadership by other European states interfering in the Nile basin. According to this way of reasoning, the importance of Sudan in British imperial strategy was fundamentally shaped by its conceived role as a buffer state *vis-à-vis* other European powers in the defence of British positions in Egypt, rather than by its intrinsic value to their Nile strategy.
- 4 Quote from Gallagher and Robinson 1953: 15. More or less identical descriptions of the 'value' of the Upper Nile and Southern Sudan can be found in Sanderson 1965; Holt 1967; Collins 1968a, 1968b, 1969; Brown 1970; Collins 1971; Louis 1976; Sanderson and Sanderson 1981; Collins 1983; Bates 1984; Lewis 1987; Collins 1996; Betts 1972; Pakenham 1992; Cain and Hopkins 2002; Johnson 2003; Webster 2006.
- 5 This expression is taken from one of the most politically influential hydrologists in the 1890s, William Willcocks. See, for example, his two-volume study of 1899.
- 6 This was a system of forced labour whereby poor people by the tens of thousands were forced to work to clean and repair the irrigation canals in order to prevent them from silting up, and to help with the maintenance of the canal banks, etc. This system was abolished during the first decades of British rule, mainly due to improvements in the water control system. For a description of the system, see, for example, Willcocks 1899.
- 7 Willcocks 1894: 5. This bad situation was thus stated in what was a government publication, and newspaper reports from the same year confirm this impression.
- 8 Quoted in Robinson and Gallagher 1981: 277.
- 9 Willcocks, *Report on the Nile and Proposed Reservoirs*, in CAIRINT, 3/14/232, NRO. This was written in 1893, and circulated among government officials.
- 10 Ibid.: 5. The direct gain to the state was said to be from the sale of reclaimed lands and the increase in the annual revenue derived from them. Indirect gain to the state, but direct gain to the country, resulted from the increased value of agricultural produce, the rise in the price of land and in land rents, increase in customs revenue, etc.
- 11 'Note upon the proposed modifications of the Assuan Dam Project', by W. Garstin, 14.11.1894, Inclosure No. 166, FO 407/126. (FO is Foreign Office and these archival documents can be found in the Public Records Office, London.)

- 12 'Cromer to the Earl of Kimberley', 15.11.1894, in 'Further correspondence respecting the affairs of Egypt, January to June 1894'. FO/407/126.
- 13 W. E. Garstin, 'Note on the Public Works Department for the year 1894', 19.2.1895, Inclosure 3 in No. 51, FO/407/131.
- 14 W. E. Garstin, 'A Note', in Willcocks, *Report*, 1894: 53.
- 15 See, for example, 'Mr. Rodd to the Earl of Kimberley 3.8.1894', referring to the protest of the London Society of Antiquarians against the proposed Nile reservoir. In 'Further Correspondence respecting the Affairs of Egypt', FO/407/127.
- 16 Memorandum by Sir William Garstin, Inclosure 1 in No. 30, FO/407/144.
- 17 W. E. Garstin, 1907: 'Note on the Sudan Irrigation Service', in Inclosure No. 2. *Report of the Finance, Administration and Conditions of the Sudan*, 1906: 53–8. London.
- 18 W. E. Garstin, 1901: *Report as to Irrigation Projects on the Upper Nile*, in Foreign Office, Blue Book No. 2, 1901 in Despatch from His Majesty's Agent and Consul-General, Cairo.
- 19 For a description of the role of water-measurement stations in the Sudan for rational water planning in Egypt before 1885, see Chélu 1891: 2–38.
- 20 See, for example, Milner 1892: 197–8.
- 21 More than a generation later, the leading Nile expert from about 1920 until the 1940s, H. E. Hurst, summarised what the water planners in the 1890s understood: that the occupation of the Sudan was 'the great landmark' in modern research on the Nile. See Hurst 1927: 440.
- 22 'For a detailed description of the composition and role of *sadd*, see Rzoska 1976.
- 23 Lombardini 1865 and Chélu 1891. See also Willcocks 1894: Appendix III, 10–11 and Mason Bey 1881 discussing how removal of the *sadd* could increase the water flow to Egypt.
- 24 Scott-Moncrieff's own expression in Scott-Moncrieff 1895: 410.
- 25 R.M. MacGregor: 'The Upper Nile irrigation projects', 3, 10.12.1945, *Allan Private Papers* 589/14/48, Sudan Archives, Durham.
- 26 In 1890, there were 18 British officials in the Public Works Department, as compared to four in the Financial Department. The Under-Secretary of State, Inspector-General of Irrigation, four Inspectors of Irrigation, three Assistant Inspectors of Irrigation, a Director of Works and eight engineers (List of Appointments held by English Officials, Inclosure in No. 33, Baring to Salisbury, 26.1.1890, FO 407/99.
- 27 See Chapter 54 on 'Irrigation' in Cromer 1908, II: 456–65.
- 28 Cromer to Salisbury, 21.10.1891, FFO 141/284.
- 29 Ibid.
- 30 Cromer to Salisbury, 14.11.1891, FO 141/283.
- 31 Cromer to Rosebery, 27.12.1893, Further correspondence respecting the finances of Egypt 1893, FO/407/124. Rosebery answered immediately and supported Cromer's strategy.
- 32 Cromer to Granville, 3.4.1884, FO 633/6.
- 33 Cromer to Granville, 21.1.1884, FO 633/6.
- 34 Cromer to Rosebery, 23.2.1886, FO 633/6.
- 35 Extract from a minute by General the Viscount Wolsley, Adjutant-General to the Forces concurred in by H.R.H. the Commander in Chief, and forwarded by the Secretary of State for War, 13.1.1890, FO 141/274/16.
- 36 Cromer to Salisbury, 27.2. 1898, Annual Report for 1898, FO 407/146.
- 37 'Report by Mr. Garstin on the Province of Dongola', Inclosure in No. 12, Further correspondence respecting the affairs of Egypt, April to June 1897, FO/407/143.
- 38 Earl of Cromer, 'Report by his Majesty's Agent and Consul-General on the Finances, Administration and Conditions of Egypt and the Sudan', 1899.
- 39 Cromer's 'Letter of introduction', iii, in Garstin 1904.
- 40 Earl of Cromer, Report by His Majesty's Agent and Consul-General on the Finances, Administration and Conditions of Egypt and the Sudan 1903, 19.

- 41 Cromer to Salisbury, 13.3.1890, FO 141/276/84.
- 42 See 'Correspondence respecting the law-suit brought against the Egyptian government in regard to the appropriation of money from the general reserve fund to the expenses of the Dongola expedition, Egypt'. No. 1 (1897), London: Harrison and Sons, in FO 633/66.
- 43 Salisbury to Queen Victoria, 25.7.1898, CAB 41/24/42.
- 44 The influential book by Langer (1936) argues that Prompt in his speech *Soudan Nilotique* made 'some rather indiscreet speculations'. If the water in the Great Lakes reservoirs were not let out in time, the summer supply of Egypt could be 'cut in half'. If the reservoirs were thrown open suddenly and the whole flood sent down to Egypt, the 'civilization of the Nile could be drowned out by one disaster' (Langer 1968 [1936]: 127). He was therefore one actor on the Egyptian scene creating British fear of French intentions, Langer suggests. The entire first chapter of Bates (1984) is devoted to what is described as the threatening visions which Prompt talked about on that fatal afternoon of 20 January 1893. Bates argues further that Prompt had a real influence on French and probably British policy. Collins (1968b) says: 'Prompt did not confine his remarks [in 1893, my comment], however, simply to Nile hydrology. He suggested that a dam constructed on the Upper Nile could destroy Egypt. He who controlled Fashoda controlled Egypt' (Collins 1968: 16). Collins also writes that Fashoda 'had long been considered the hydrological key to the basin of the Upper Nile', and 'the point where the Nile waters could best be controlled' (Ibid.: 4). This story of the fears that Prompt created is repeated by Collins (1996), and the story of Victor Prompt's role is also mentioned in general books on the theory of peace and war (Brown 1998: 200).
- 45 One was entitled 'La Vallée du Nil', and was given on 6 February 1891; another lecture was 'Note sur les réservoirs d'eau dans la Haute Egypte', on 26 December 1891; then came the notorious 'Soudan Nilotique' on 20 January 1893, and finally 'Puissance électrique des cataracts' on 28 December 1894.
- 46 Ibid.: 44. The text reads: 'Le doute n'est plus permis, et il faut reconnaître que l'Égypte d'aujourd'hui est menacée dans toutes ses richesses et dans son existence même, par la nature des choses, sans avoir besoin, pour cela, de supposer que les riverains au-dessus de Wady-Halfa peuvent utiliser l'eau d'été et en priver l'Égypte absolument'.
- 47 Ibid.: 48.
- 48 Ibid.: 51.
- 49 Ibid.: 56–8.
- 50 Ibid.: 60.
- 51 Ibid.
- 52 White 1899. Silva White communicated with Wingate and was familiar with British policies.
- 53 See, for example, Willcocks 1894, Appendix III. He wrote '[...] all the small ponds and pools cease to aid the stream, and if they are very extensive, as they are south of Fashoda, they diminish the discharge considerably by their large evaporating areas', and he dismisses Prompt, described as a railwayman, and his findings, as the findings of a layman (Willcocks 1894: 17). These speculations were left out of the official report published in the following year, but while Willcocks' ideas were rational and realistic, Prompt's were irrational and not very realistic. Magnus (1958: 138) also repeats the idea that Fashoda 'was regarded hydrographically as the key-point on the Upper Nile'.
- 54 Brown simply misunderstood the nature of the geography and hydrology of the Nile: 'The strategic centre of this region was the ancient fort of Fashoda at the headwaters of the Nile.' Fashoda was of course no such strategic centre. See Brown 1970: 23.

- 55 See Tvedt 2004 for a more detailed discussion of the importance of European rivalry in the valley.

CHAPTER 4: RELIGION AND THE ENIGMA OF WATER

- 1 The extensive literature on the Storm-God includes deities that also might be seen and interpreted as ‘water gods’ or rain gods, since the wind would tell the people that clouds were on their way and that these clouds brought what was most crucial of all: rain. Rain was important in all agricultural civilisations, of course, but it was more important in dry areas. A discussion of how such gods are classified might reveal interesting new relationships between god-making and environment (see Green 2003).
- 2 In Weber’s book there is not a single word about the role of water or rivers in religion, although he is discussing Christianity, Hinduism, Judaism and Islam.
- 3 See Shaw 2006 on the possible role of archaeological studies of landscapes and water in India.
- 4 Tvedt and Oestigaard 2006 and Tvedt and Oestigaard 2010, discussed a wide range of research on the role of water in religions and religious rituals (see, for example, Khasandi-Telewa 2006; Armstrong and Armstrong 2006; Kodiyanplakkal 2006; McKittrick 2006; Namafe 2006; de Châtel 2006; Oestigaard 2006; Gerten 2010; Strang 2010; Sætersdal 2010; Zheng Xaio Yun 2010; Doniger 2010).
- 5 Mircea Eliade wrote: ‘Water symbolises the whole of potentiality: it is the *fons et origo*, the source of all possible existence [...] water symbolises the primal substance from which all forms came and to which they will return’ (Eliade 1979: 188). The point of this article is not limited to demonstrate the importance of water in religions, but to suggest approaches to the comparative study of religion.
- 6 Mimir’s well was the source of wisdom in Norse religion, and Odin, the principal god, was willing to sacrifice his eye to the waters of the well in exchange for its wisdom. The act in the well was a kind of ‘axis mundis’ for Odin’s power and the maintenance of cosmos. Water in the Viking cosmology was conceived of very differently from the water in the desert religions, and was more similar to the traditions of the Celts. There is disagreement regarding how to interpret the fact that people in pre-Christian Norway were also sprinkled with water when they were named and became part of the clan. Some argue that it reflects influence from the religions that dominated Southern Europe at the time, while others regard it as a kind of universal ritual that also happened to be practised by the Vikings. A hypothesis could be that it should not be seen as a universal ritual although it spread to many areas of the world, and that it came to Northern Europe after year 0.
- 7 The importance of rainmaking cosmology in the Norse religion is yet to be studied properly and within a comparative perspective. In Snorre’s sagas of the kings it is, for example, described how King Domalde was sacrificed by his chiefs after three bad years in a row.
- 8 An exception is Best 1999 who, after assessing documents and records about the floods in the region concluded that it is not history, but a mythologised legend, and that it is based on a local flood where a trader called Noah lost his boat.
- 9 In Narayan and Kumar 2003 ecology is defined as ‘(a) physical environment which includes the non-living entities consisting of chemical and biological components, and (b) biological environments consisting of living organism (plants and animals) as called biosphere. The oceans, lakes, streams, rivers form hydrosphere and the air envelope that surrounds the earth is called atmosphere’ (xix).

- 10 See also Hargrove 1986; Holm and Bowker 1994; Gottlieb 2003. See also the literature list for the case studies published by the Harvard programme on religion and ecology.
- 11 See also the discussion in Ayres 2001: 346–53 of the role in the second century AD of Novatian, whose followers were called Cathars or Puritans. He deferred his baptism because he was afraid of the sins he would commit after being baptised. Baptism washed away all sins, but sins after baptism were considered almost unpardonable. Eventually he became sick and, being near death, had to be baptised lying in his bed.
- 12 Personal observation, also described in Tvedt 2014a.

CHAPTER 5: BETWEEN THE HYDROLOGICAL AND HYDROSOCIAL CYCLE

- 1 Herodotus, 1960.
- 2 As the ancients were well aware, water was not the only essential. Without air, death takes place in about five minutes. Without water, it takes three to four days. But the important thing in a historical and social perspective is that air cannot be tamed, piped, controlled or diverted (although in practice this is done for a number of specific purposes such as scuba diving, submarines, firefighting, space travel, etc.). But in a city there is never too much of it, and it is not changing forms and in a constant flux in the same way as water. So the parallel to water, from the point of view of urban development, is not very interesting, except when it carries ‘alien’ matter and becomes a major pollution problem as it did in “smoggy” London’ in the early twentieth century and in Beijing in the early twenty-first century.
- 3 Gradually more and more empirical studies have been carried out on the relationship between water and urbanisation, but the focus and perspective of these studies have not been integrated theoretically and conceptually into urban studies. Blake 1956 is a seminal pioneering work on one aspect of the water/city nexus in the USA. Another very interesting and important work is Guillaume 1988 [1983]. It analyses the history of hydraulic systems in French cities of the Middle Ages. He argues that the hydrographic system did not originate naturally but that its gradient, profile and dimensions were planned and worked out over many centuries – from as early as the decline of the Roman Empire – for military purposes. In time, this system gradually fulfilled a number of other and variable tasks.
- 4 Hall, in his summary of the urban geography tradition, argued along the same lines as Carter had already done when criticising site-and-situation geography. While Carter wrote that this ‘site-situation approach was meaningless when the large urban conglomerates had to be considered’ (Carter 1981: 4), Hall wrote that the development of cities itself had made this tradition obsolete: ‘Original location factors have tended to be overridden by the scale of subsequent urbanisation or have greatly declined in importance as the form and function of urban areas have changed’ (Hall 1998: 20).
- 5 Urban morphology, which for some years was very popular and according to Herbert and Thomas perhaps the only truly ‘indigenous’ line of evolution within human geography (see Herbert and Thomas 1982: 12) has also displayed minimal interest in water/urban links. Urban morphology – the study of the city as a human habitat – initiated many interesting research projects and publications on urban forms, but the whole concept of urban form was considered as being firmly rooted in social and economic processes only (see Whitehand 1977). Urban morphologists focus on urban forms perceived as the tangible results of social and economic forces, and the confluence of city and water is beyond its scope.

- 6 'The functioning of the city as a system, the concepts of growth and decay for example, can be related to processes found in a natural ecosystem. An investigation of cities based on analogy to the physical ecosystem is a procedure that relates all parts to the whole' (see Exline and Larkin 1982: xvii).
- 7 A bibliography of urban geography research between 1950 and 1970 as reflected in the articles and book reviews of 72 US, Canadian, British, Dutch and Scandinavian geographical periodicals listed 2,949 publications. Of them 10 dealt primarily with water issues and a few studies also dealt with the role of rivers for the location of cities and towns (see Strand 1973).
- 8 Different historians criticised Worster's delineation of the topic. Martin Melosi criticised these views in *Environmental History Review* in 1993, arguing that it was illogical for environmental historians to study farming and not the history of cities and towns (Melosi 1993: 4.) and Samuel Hay wrote that the environmental historian should study how people had acted upon the environment over time wherever it was, including in relation to urban history and development. For Joel A. Tarr urban environmental history was primarily the story of how man-built or anthropogenic structures ('built environment') and technologies shape and alter the natural environment of the urban site with consequent feedback to the city itself and its populations (Rosen and Tarr 1994). Melosi suggested a broader definition in which the physical features and resources of urban sites (and regions) influence and are shaped by natural forces, growth, spatial change and development, and human action. Thus the field should combine 'the study of the natural history of the city with the history of city building and their possible intersections' (Melosi 1993: 2).
- 9 Others have suggested a theoretical and methodological justification for doing urban history in a broader sense, including analysing the interplay between city and the physical environment. Urban history should be 'the study of the role and place of nature in human life', and 'illuminate the dialectic interdependence between cities and nature' (Rosen and Tarr 1994: 307). This call helped to open up the field and it coincided with the popular environmentalist idea about nature as a unifying force. But for individual research projects it is an impossible task. No historian will ever be able to accomplish such a study because both culture and nature are two terms that cover too much. The articles that were presented in their volume on *Urban History* did not discuss all these relationships, either, but mostly, in fact, how cities impacted on the local waterscapes.
- 10 In 1980, R. J. Johnston wrote his outline for urban geography. It should be concerned with the 'organization of space within an urban context'. This space was, however, defined as socially constructed. 'The urban system,' he wrote, reflected and interacted 'with the 'economic, social and political structure of the society which occupies it', while nature and water was left out of the picture (Johnson 1980: 26). A couple of years later, another book on urban geography summarised the way ahead: 'The urban geography of the future will surely be more firmly embedded in the wider philosophies of social sciences than has hitherto been the case [...]' (Herbert and Thomas 1982: 25). Influenced as it was by post-structuralism and post-modernism, it was now argued that the term nature itself should be discarded, since nature as such was a social or cultural construct. In urban geography this trend encouraged the 'sociospatial' perspective, rejecting the relevance of physical factors, being instead solely concerned with how human experience gave meaning to and created space (Gottdiener 1994; Harvey 1996a and 1996b).
- 12 See, for example, Doyle 2009.
- 13 See, for example, Diefendorf and Dorsey 2005; Plat 2005; Weiner 2005; Davis 2006; Swyngedouw 2004.

- 14 Lees and Lees 2007.
- 15 See, for example, Kaika 2003 and 2005; Swyngedouw 1996, 1997, 1999 and 2006.
- 16 Roman water engineering for public supply and hydro-therapeutic use set the standard by which urban water systems were to be judged well into the early modern period. Medieval systems for controlling and channelling water were less grandiose, and did not involve complex technologies to transport water over long distances. Instead, medieval water control in Europe tended to be local and open, often serving as defensive as well as a supply system in the case of moated towns. As Guillerme notes, the French medieval city 'knew how to master the hydraulic environment, and it is precisely on this point that these cities differed fundamentally from the earlier Gallo-Roman or the later industrialised city, both of which dreaded surface water (Guillerme 1988 [1983]). Monastic orders were leading the way in water control technology and aquaculture in early medieval Europe, and examples have been found of water supplies being extended from monasteries into local towns.
- 17 See Tvedt and Oestigaard 2006 and 2010 for two volumes containing many case studies aimed at encouraging this type of research.

CHAPTER 6: WATER, SOVEREIGNTY AND THE MYTH OF WESTPHALIA

- 1 A legal definition of sovereignty in *Black's Law Dictionary* reads that sovereignty is the supreme domination, authority or rule and also the supreme political authority of an independent state. Sovereignty has an external and an internal aspect – the external being the power of dealing on a nation's behalf with other national governments, the internal one being the power that the ruler exercises over his subjects. A sovereign state is the state which possesses an independent existence, which is complete in itself without being merely part of the larger whole to whose government it is subject. It is a political community whose members are bound together by the tie of common subjection to some central authority, whose commands those members must obey (1999: 1402, 1401).
- 2 Croxton and Tisher 2002 summarised the problem of historical analyses of Westphalia very accurately: 'Taken together, the congress and the peace are so complex that historians still discover new aspects of it today' (xx). This article highlights only one aspect of this whole process.
- 3 'Treaty of Westphalia. Peace Treaty between the Holy Roman Emperor and the King of France and their respective Allies', see http://avalon.law.yale.edu/17th_century/westphal.asp. The Yale translation talking about the 'advantage of 'the other' is less accurate than the old English translation, but what is significant is that the principle that the sovereign should work for the advantage of each other is common to both of them.
- 4 'The Articles of the Treaty of Westphalia. Peace Treaty signed and sealed at Munster in Westphalia the 24th October, 1648'. 1697. London: W. Onley.
- 5 'The Articles of the Treaty of Westphalia. Peace Treaty signed and sealed at Munster in Westphalia the 24th October, 1648'. 1697. London: W. Onley, 31.
- 6 I was made aware of some of these points by Pierre Beaudry in connection with work on Vol. III, Series II of *A History of Water*.
- 7 For a description of these difficulties, see Mellor 1983.
- 8 Cioc 2002: 32.
- 9 Mellor 1983: 70.
- 10 On the other hand, the agreement closed the River Scheldt to the Belgic provinces, thus apparently ruining the commerce of Antwerp (Kaeckenbeeck 1920: 31), an

- expression of the fact that the agreement was less concerned with principles than with pragmatic solutions suiting the most powerful.
- 11 First after the next big European peace conference, the Vienna Congress in 1815, and after the French Revolution had swept away the old order, partly by establishing the Confederation of the Rhine in 1806, did the countries in the region succeed in developing the Rhine as a transport artery. Then it took place under the leadership of the famous water engineer Johan Gottfried Tulla, who increased the depth of and channelled the Upper Rhine. This remodelling of the Rhine also required, of course, a technological level in river manipulation that was not available in the seventeenth century.
 - 12 Similar conclusions have recently been drawn by historians researching other aspects of Westphalia. The Thirty Years' War was accompanied by permanent negotiations and the opponents never totally broke off political contact, and ideas of mutual destruction did not exercise a decisive influence over the political elites (Kampmann 2010: 204).
 - 13 The point about borders and their increasingly symbolic functions is made by Rudolph 2005.
 - 14 Dinar 2008 is one of the few books underlining the importance of geography for understanding water law, but the approach and explanations are very different from the suggestion put forth here.
 - 15 The role of the Danube Commission was so strong that an observer in the 1930s argued that 'the need for protecting the integrity of the commission will some day lift it out of the twilight of statehood and accord it full membership in the League of Nations'. See Blackburn 1930.
 - 16 Quoted from Bourne and Wouters 1997: 4.
 - 17 Quoted from Bourne and Wouters 1997: 4.
 - 18 Quoted from Bourne and Wouters 1997: 15.

CHAPTER 7: WATER AND INTERNATIONAL LAW

- 1 The Nile Waters Agreement was for a long time hailed as a model. The following quotation is typical: '[...] the Anglo-Egyptian negotiations over the Nile afford an admirable example of how such problems should be envisaged and solved. Here we have no dogmatic insistence upon abstract doctrines of territorial sovereignty or riparian rights, no claim to disregard the history of an ancient land or to veto the proper development of a new' (Smith 1931: 70).
- 2 Lord Lloyd to Mohammed Mahmoud Pasha, 7.5.1929, in *Sudan Pamphlets* 89.
- 3 See especially Garstin 1899, 1901, 1904 and Dupuis 1904. See also Cromer 1908.
- 4 The Blue Nile's annual inundation in Khartoum is on average estimated as 54bcm/yr; at Aswan it is 48bcm/yr. Ethiopia's contribution to the Nile system through the three head streams – i.e., the Blue Nile, Tekeze-Atbara and Baro-Akobo river basins – is 68.7bcm/yr or 82 per cent of the total Nile flow.
- 5 Foreign Office Memorandum, Sperling, 'Resumption of negotiations for the construction of a dam on Lake Tsana', 8.11.1922, FO 371/7151.
- 6 Foreign Office Memorandum, Murray, 4.1.1923, 'Memorandum on the political situation in Egypt', FO 371/8972.
- 7 Kewin-Boyd to Allenby, 14.3.1920, FO 371/4984.
- 8 Allenby to Austin Chamberlain, 15.12.1924, FO 371/10046.
- 9 Quoted in Kurita 1989: 26.
- 10 Quoted in Sir John Maffey to Sir P. Loraine, 15.8.1930, FO 371/4650.
- 11 The crisis in Egypt. Mr MacDonald on the ultimatum. A mandate for the Sudan, *The Times*, 29.11.1924.

- 12 Ziwer Pasha to Allenby, 26.1.1925, 'Texts of notes exchanged between Lord Allenby and the Egyptian Government on January 26th, 1925, regarding the control of the Nile water'. FO 371/10882.
- 13 Allenby to Ziwer Pasha, 26.1.1925 (as put together in the Foreign Office from Cairo telegrams), FO 371/10882.
- 14 Note from Lord Allenby to Ziver Pasha, 26.1.1925, in *Sudan Pamphlets* 89.
- 15 MacGregor found the Egyptian member difficult to co-operate with. In order to come up with an acceptable report, he informed Allenby and the British Government that he had had what he himself called clandestine meetings with the British water-planners Hurst and Butcher, who were employed by the Egyptian Government (Allenby to Chamberlain 25.5.1925, Enclosure 3 in No. 1 by Mr. R.M. MacGregor).
- 16 Nile Commission 1925: 30.
- 17 *Ibid.*: 28.
- 18 MacDonald's *Nile Control* provided, during the period when the Sennar reservoir would be in use, a water allowance at canal head of 15 m³ per feddan per day, including 33 m³ for losses between canal head and the 5,000 feddan blocks. MacGregor had worked out, on the basis of figures obtained from research at Hag Abdulla and Wad-el-Nau, that a water allowance at canal head of 10 m³, including two cubic metres for losses, would suffice. Thus, only two-thirds of the water provided would be actually required, and an extension of 150,000 feddans became possible on the assumption that the reservoir drew upon the Nile from 18 January to 15 April. In terms of volume, this saving amounted to 5 cubic metres per feddan per day on 300,000 feddans for 87 days, i.e., 130.5 million m³. Moreover, *Nile Control* argued that the date from which the canal would have to be supplied from storage was 18 January and the waters could be brought back to the river at the end of March. MacGregor discovered, however, that the former date should be brought back to nearer the beginning of January, which also made it possible to bring the latter date forward to the beginning of March. Therefore it was assumed that the reservoir would be called upon to serve the present area for a period of 60 days instead of 87 as contemplated in *Nile Control*. This saving would amount to 15m³ per feddan per day on 300,000 feddans for 27 days, i.e., 125 million m³. Assuming the period to be 65 days, the volume available would permit an extension of 190,000 feddans.
- 19 Lord Lloyd to Sarwat Pasha, 16.2.1928, Enclosure 1 in No. 1, Lloyd to Chamberlain, 23.2.1928, FO 371/13138.
- 20 Draft of a Note to be addressed by His Majesty's High Commissioner to the President of the Council of Ministers, Enclosure 3 in No. 1, Lloyd to Chamberlain, 23.2.1928, FO 371/13138.
- 21 He wrote a note about the Egyptian Government's consideration of the report of the Parliamentary Finance Commission on the budget of the Irrigation Department for the current financial year. Under the heading 'Sudan', an estimate of £E1,100,000, of which £E130,000 was to be spent in 1928, had been included for the 'modification and improvement of the flow of the Nile in the sudd region', by means of large dredgers to be purchased abroad. Lloyd to Chamberlain, 12.5.1928, FO 13138.
- 22 Foreign Office minute, Murray, 1.8.1928, FO 371/13138.
- 23 Foreign Office to Lloyd, draft, 15.3.1928, FO 371/13138.
- 24 Draft Note, Lloyd to the Egyptian Minister for Foreign Affairs, n.d. [July 1928, my comment], FO 371/13138.
- 25 Lloyd to Chamberlain, 14.7.1928, FO 317/13138.
- 26 Lloyd to Chamberlain, 20.2.1928, FO 317/13137. The Nile Board that should be responsible for the entire Nile should be made up of two representatives of the Egyptian Government and two representatives chosen by His Majesty's Government (Allenby and the Governor-General of the Sudan, Maffey, agreed that they should represent the Sudan Government, and the salaries should be paid by Khartoum).

- 27 Lloyd to Chamberlain, 14.4.1928, FO 371/13138.
- 28 Copy of letter dated 12 April 1928 from the Secretary of the Aboukir Company, Ltd., to his Excellency the Minister of Public Works, FO 371/13138.
- 29 Draft letter, Foreign Office to Sir W. F. Gowers, November 1929, FO 371/13857.
- 30 Parkinson, Colonial Office to the Under-Secretary of State, Foreign Office, 2.11.1929, FO 371/13857.
- 31 They had just organised fisheries surveys in these lakes for the first time (see Worthington 1929).
- 32 Parkinson, Colonial Office to C. J. Norton, Foreign Office, 14.11.1929, FO 371/13857.
- 33 Murray to the Under-Secretary of State, Colonial Office, 2.12.1929 FO 371/13857.

CHAPTER 8: WATER-SOCIETY RELATIONS AND HISTORY OF THE LONG TERM

- 1 The term waterzone might be useful as part of such a research strategy, especially when it comes to agricultural development. Waterzone is a broad water-geographic division, based on distributional differences of precipitation and run-off characteristics that have a fundamental importance on biodiversity, flora and fauna and hence on potential for rural organisation, and covering small or large areas depending on characteristics of the waterscape of differential importance for societal development. The idea is based on the assumption that the probability of encountering similar types of agricultural practices in any given waterzone remains relatively constant, and within an acceptable range of variation. The concrete deliniations must be adapted to what is fruitful in order to understand local circumstances. It is a more complex term than an ecozone because the latter is only concerned with 'the natural' while the waterzone must also reflect man-made changes to the waterscape. But it is much more empirically manageable than an 'ecozone' which covers basically everything. Each waterzone shares a large majority of both species and agro-rural dynamics, and since the confluences between water and society are quite similar, the interactions also show patterns of similarity that might be reconstructed and analysed.
- 2 It is not mentioned in Nordström 1986 or in Imsen and Winge 1999. In these books dealing with the dictionary of Scandinavian history there are no entries on either 'drenering' [drainage] or 'grøfting' [trenching], while there are entries on relatively esoteric topics such as 'drengbåt' [boat belonging to a merchant in Bergen], 'drette' [to raise cattle/ drag a harrow], 'drinke [tynt øl]' [to drink very light beer], while instead of 'grøfting' there are entries like 'grønnsaltet' [extremely heavily salted meat] and 'grøtstein' [soapstone or steatite]. In fact, there is no entry on water at all, but room has been found for entries on 'vannfarken' (water-gypsies). The issue is not once discussed in the most influential multi-volume series on Norwegian history edited by Knut Mykland. Kåre Lunden in his volume on the history of Norwegian agriculture explicitly stated that drainge was of no importance in Norwegian agricultural history (Lunden 2002).
- 3 The only places in Norway where there has been some form of water shortage are in the Lesja and Sjøå areas in the upper parts of Gudbrandsdalen. Here the annual precipitation could be less than in parts of the Sahara. The area never became a desert, of course, because of the melting of snow in the mountains and because of the modest evaporation and the ability of the soil to retain the water. These are the only villages in Norway that for hundreds of years depended upon irrigation.
- 4 Jan Lindegren (1988) described the interest that King Gustav Vasa took in ditch digging for Sweden. He warned that the whole country was going to ruin and would become bog and marsh, where 'wild rosemary, bog myrtle, bilberry and cranberry' grew, all because 'the fields have not been held by ditches as they should'. The exhortation was clear: 'drain your fields'.

- 5 The Egyptian Prime Minister in 1890 summarised Egypt's predicament: 'The Egyptian question is the irrigation question' (quoted in Tvedt 2004),
- 6 See Bloch 1935; Forbes 1956; White 1978; Gimpel 1988; Reynolds 1983.
- 7 Dyrvik et. al. 1979 describes Norwegian economic history 1500–1850 and also discusses Norwegian agriculture. It fails to include or integrate the water-society nexus in the perspective. The implication is that the book fails to explain fundamental and particular preconditions for early Norwegian mining industries, timber export, fishing and agricultural development.
- 8 For some sources for this chapter's analysis of Norway, see Tvedt 1997.
- 9 Willcocks 1889.
- 10 Williamson and Panza 2013. Landes 1991: 59 describes Ali's industrialisation effort as 'a project that was doomed from the start and already in its death rattle'. The reasons Landes gave were only political and cultural. Batou describes him as a '*roi industriel*' (Batou 1993: 94), but without explaining why he failed by other than British opposition.
- 11 In spite of the fact that the British at the beginning of the twentieth century could not dam the entire flow of the Nile – mainly due to the amount of silt in the Blue Nile flood – they could have harnessed the river for power production on a smaller scale. But in addition to the hydrological challenges of the Nile, river control presented a water-political dilemma: the needs of agricultural irrigation required uneven flow and more water in the summer season, while power production required a quite even flow all year.
- 12 This was the expression used by Lord Cromer, the British ruler of Egypt between 1883 and 1907.
- 13 Holmsen 1961: 261.
- 14 See Lunden 1981.
- 15 See Lipset and Rokkan 1967.
- 16 For this discussion see, for example, Wittfogel 1981 [1957] and Butzer 1976. Wittfogel argued that a distinctive type of political system, absolutist and bureaucratic in nature, tended to develop in arid or semi-arid regions which made the transition from hunting and gathering to agriculture. Butzer refuted this thesis, arguing that it had been falsified by empirical findings, especially in Egypt.

CHAPTER 9: WATER AND CLIMATE CHANGE

- 1 For some relevant literature, see World Water Assessment Programme 2003; Kabat et al. 2003; Nijssen et al. 2001; Arnell 1999; Frederick and Major 1997; Major and Frederick 1997; Boorman and Sefton 1997; Rind and Goldberg 1992; Loáiciga 2003; Stefan et al. 1998; Qin and Huang 1998; Bonell 1998; Kabat et al. 2013.
- 2 Scientists from the University of Potsdam, Germany and the GFZ German Research Centre for Geosciences analysed organic remains extracted from Meerfelder Maar sediments from the Eifel region in western Germany, to reconstruct changes in precipitation patterns in unprecedented detail.
- 3 Von Köppen also discussed the role of temperature, but a close look at his classification system makes it clear that it is water in all its different forms that was the most fundamental basis for his system.
- 4 It deals with the soil water budget using evapotranspiration, monitoring the portion of total precipitation used to nourish vegetation over a certain area (employing humidity and aridity indices to determine an area's moisture regime). Thornthwaite co-authored with Mather the monograph 'The water balance' in 1955.
- 5 WHO 2013 presents data on new research findings about climate change, but offers no direction for further research. It represents the perspective and projections and

- scenarios of WHO, but without explaining or justifying them. Given their focus and institutional interests, it should be hardly surprising that the report does not mention the role of water in climate.
- 6 It is argued that another ‘uncertainty’ will be more important for the future of the water issue, at least in the short run. Impending global-scale changes in population and economic development will dictate the relationship between water supply and demand more than will changes in mean climate (Vörösmarty et al. 2000).
 - 7 Two examples of how different opinions of the water landscape of tomorrow are turned into contemporary politics: When the conservative Italian Government under Prime Minister Silvio Berlusconi decided to build the Mose Project to save the lagoon of Venice, it did so based on opinions about the predictions of how the water level would rise in the future due to global warming. The Green Movement in Venice regarded the building of the barriers as an ecological catastrophe, partly on the basis of alternative assessments of climatic trends. The Greens questioned the idea that the sea level would necessarily rise. In India, governments of different states have objected to the National Water Link plan that aims to connect many of the large river systems into one national water ‘grid’. They claim that they may well have surplus water at the present, but due to the uncertainties regarding tomorrow’s water landscapes they have no excess water to give away permanently to water-deficient states.
 - 8 In the Framework Convention on Climate Change, climate change refers to ‘a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods’.
 - 9 Wheeler and von Braun 2013.
 - 10 There are surprisingly few studies of the importance of snow, in spite of its importance for economic patterns and agricultural cycles, and the fact that snow is one of the true wonders of nature, unique in the forms in which its crystals fall from the skies and remarkable in the way it changes not only the landscapes but also urban centres in a matter of seconds.
 - 11 The IPCC special report on climate change adaptation estimates that around 1 billion people in dry regions could face growing water scarcity in the decades to come.
 - 12 Capon et al. 2013.
 - 13 Taken from Oliver 1973: 27.
 - 14 Hassan 1997.

CHAPTER 10: A CRITIQUE OF THE SOCIAL SCIENCE TRADITION

- 1 Weber and Durkheim were editors of the two major sociological journals at that time: *Archiv für Sozialwissenschaft und Sozialpolitik* and *L’Année* respectively. Both journals derived their basic approaches from intellectual traditions as different as French rationalism and German historical thinking, although they still agreed on the issue of the social. In his book on Durkheim’s influence, Giddens omits to discuss his most influential idea – that of delineating the object and task of social sciences to that of social factors (see Giddens 1986). Giddens in his *Human Society* ends his introduction thus: ‘Sociological thought must take an imaginative leap beyond the familiar, and the sociologist must be prepared to look behind the routine activities in which much of our mundane life is enmeshed’ (Giddens 1992: 4). When it comes to societies’ relation to nature, Giddens as a theorist was conventional; in this work on human societies in general there was no chapter or index entries on these topics.

- 2 See Durkheim 1893 (1984): 285–6 for this assessment.
- 3 There is general agreement about this assessment. Marx's ideas here build on Hegel who held that freedom, or humanity's realisation that it is free, entails its recognition that it is separate from and sovereign over nature, where 'nature' is both the external environment and the natural inclinations of man himself.
- 4 Especially in his later writings one can find formulations suggesting a productivist logic that sees nature as an enemy opposed to man, as a resource and object that must be mastered, exploited and controlled. Marxian ecologists argue, however, that there are ideas of an alternative society–nature relationship and of nature conservation in his writing.
- 5 In footnote 6 of *Das Kapital*, Vol. I, Marx quotes: 'The necessity for predicting the rise and fall of the Nile created Egyptian astronomy, and with it the dominion of the priests, as directors of agriculture' (Cuvier 1964: 141). Here, in one sentence, Marx argues that the whole social fabric of classical Egypt can be explained not by social relations or productive forces, but by the irregularities and regularities of a river's fluctuations or hydrology. This way of integrating physical waterscapes in the analysis is not followed up or systematised, and it was not made an object of theoretical reflection. See Marx 1906 [1867].
- 6 The debate about this Marxian concept has lasted for many decades. A common trait of most discussants is that they have only raised issues of a sociological nature. We can take Krader as an example. His point is that the nature of the state and the nature of unfree labour have to be understood (Krader and Kovalevskii 1975; Fogel 1988, who debates the situation in Soviet Russia, China and Japan).
- 7 Weber 1978. See the paragraph on 'Types of Technical Division of Labour', where Weber lists these divisions and mentions watermills but never discusses how different waterscapes established different potentials for this form of differentiation of labour (Weber 1978: 120–1).
- 8 Hippocrates wrote over two millennia ago in *Airs, Waters, Places*: 'For in general you will find assimilated to the nature of the land both the physique and the characteristics of the inhabitants' (Hippocrates 1923: 137), and scholars from Aristotle, via Montesquieu, to Hegel had attributed cultural and psychological differences to dissimilarities in environment. Sociologists like Herbert Spencer and zoologists like Huxley based their works mainly on analogical methodologies that would make it possible to investigate the characteristics of nature and of societies and human beings contemporaneously, by assuming that these phenomena were regulated by the same laws of behaviour and of evolution.
- 9 See also Edward Soja. He summarised that the emergence of the social sciences was closely tied to the disappearance of physical space as a category of knowledge accumulation: 'the explicit theoretical rejection of environmental causality and all physical or external explanations of social processes and the formation of human consciousness. Society and history were being separated from nature [...] a relative autonomy of the social from the spatial' (Soja 1989: 34–5).
- 10 Durkheim exerted an 'extraordinary influence over the development of modern social thought' (Giddens 1986: 7). His conception of social science became infused into a number of disciplines.
- 11 The author went through all the relevant books in the University Library, Cambridge, in April and May 2013.
- 12 Eric Hobsbawm's famous book about the twentieth century is entitled *The Age of Extremes: The Short Twentieth Century, 1914–1991*. It was published in 1994.
- 13 Donna Haraway also suggested dropping the nature–society dichotomy in favour of a sociology of *hybrids* (see Haraway 1991).
- 14 Two of the most influential thinkers about society after World War II, Habermas and Luhmann, shared this disregard for nature, but in different ways. On the one hand,

Luhmann argued that only when nature became an object of communication did it exist for society and then as a communicative product. On the other hand, Habermas in his attempt to reconstruct his version of Marxist-inspired historic materialism tried to replace the concept of labour, which by Marx was tied to nature, with the concept of interaction, which was tied to morality. Historical development was now seen as a result of a moral evolution and as an outcome of social self-organisation through interaction (Habermas 1979).

- 15 Swyngedouw 1999.
- 16 Beck writes: 'Nature is not nature, but rather a concept, norm, memory, utopia, counter-image. Today more than ever, now that it no longer exists, nature is being rediscovered, pampered' (Beck 1995: 65).
- 17 Huntington assembled an imposing mass of data and did much to establish the fact that there had been significant post-glacial changes to climate, and he was one of the first to write about the ozone layer and the passage of cyclonic disturbances, but he also wrote 'The character of races', in which he discussed from a racial perspective the origin of 'civilized man'.
- 18 Huntington wrote: 'England, as we have seen, probably has the best climate in the world. It keeps people out doors, and makes them tough and sturdy; it stimulates the mind, and makes it easy to think clearly and act energetically. Thus when the British are pitted against other nations their extra energy has again and again turned the scales and enabled them to hold parts of the world against their rivals' (Huntington 1922: 395). Many versions of this idea have been put forward: 'No one believes it to be an accident that the progressive and energetic peoples who dominate the world are found in the intermediate zones' (Whitbeck 1932: 87).
- 19 He argues:

The variations in the rate of human progress from region to region and century to century, however, can be understood more readily. Just as the windings of the motorist's road are influenced by mountains and rivers, so the march of civilization is influenced by man's physical environment as a whole. On the other hand, the sharpness of the curves, the smoothness of the tire roadbed, and the steepness of the grades are cultural qualities. They depend on man's work and correspond to the cultural background against which historic events take place. Finally, the element of biological endowment is represented by the character of the motorist, on the one hand, and of the people in any historic epoch, on the other. Thus, the course of the car depends on (1) the general direction of the road; (2) its curves and grades; (3) the quality of the road; and (4) the quality of the driver – that is, upon all four of our factors.

- 20 The re-emergence of evolutionary theory in archaeology came about with the neo-evolutionary theories of V. Gordon Childe, Julian H. Steward and Leslie White (Eddy 1991). The opposition to cultural stereotypes and racism stimulated the interest in ecology. Through a synthesis of the original concepts of classical cultural evolutionism, the Historical school, and the British social anthropologists' Functionalist approach (as represented by the theories of A. R. Radcliffe-Brown and B. Malinowski), neo-evolutionary theory was developed (Eddy 1991; Wolf 1964; Garbarino 1977).
- 21 Axelrod 1984; Bartlett 1990; Beach et al. 2000; Born and Sonzogni 1995; Nunes Correia and da Silva 1999; Dufournaud and Harrington 1990; Keiter 1994; Falkenmark and Lundqvist 1999; Frey 1993; Hardin 1968; Martin 1994; Priscoli 1990; Starr 1991; Homer-Dixon 1999; Morrisette and Borer 2004; Arsano 2007.
- 22 Hardin 1968: 1244.
- 23 For the many works on Nile discharges, rainfall and other hydrological phenomena by H. E. Hurst and his colleagues in the Egyptian Ministry of Public Works, and for

- other works on these subjects in general, see Tvedt 2004c, which lists almost 1,000 entries on the physical characteristics of the river.
- 24 The extensive literature assessing Hardin's thesis includes Aggarwal and Narayan 2004 and Ostrom et al. 2002.
 - 25 For Tanzania and Kenya, see Ngowi 2010 and Mwiandi 2010.
 - 26 See Tvedt 2014 for a more detailed discussion of such differences along the River Nile.
 - 27 Rivers have been understood in the same way as John Locke's famous discussion of how a tree continues to be the same thing, even after its parts have changed. A tree differs from its mass of matter, since the mass of matter changes and its parts are constantly shed and replaced. Yet the tree is still the same tree; it persists despite its changing composition, because its mass is constantly organised to maintain the life of the tree (Locke 1910: 240–1).
 - 28 Braudel used this analytical framework in Braudel 1975. He also made the point that the three levels are a conscious simplification: 'History exists at different levels, I would even go so far as to say three levels but that would be only in a manner of speaking, and simplifying things too much. There are ten, a hundred levels to be examined, ten, a hundred time spans' (Braudel 1980: 74).
 - 29 Another issue of time and water, but related to our discussion, is how changes in a society's management of water can 'create' new social time. Since water is a dire necessity for all people every day, how water is provided and how it is brought to the 'individual' consumer are two of the factors with the most bearing on the time-use of a society. Reconstructions and measurements of how much time people – and what kind of people – have spent and spend to get their daily requirement of water will tell much about changing material limitations for social development.
 - 30 When the British erected the Sennar Dam on the Blue Nile in 1924, they fundamentally altered the structure of the river and the economy of this part of the Sudan; i.e., they invented structures within the structure that will influence the development of the Sudan 'for ever', but this event was not in any way embedded in the structures of the waterscape of the past.
 - 31 See, for example, Aymard 1972: 496–7.
 - 32 In Giddens' book *The Constitution of Society* (1984), there is no reference to or entry for nature, water, environment or the physical external world. Society is constituted totally independently of such factors. He argues that geography and sociology have come closer, because geography 'has come to contain many of the same concepts [...] as sociology' (Giddens 1984: 364). Giddens' definition of contextuality is also very telling in this context. 'Contextuality means space as well as time' (Giddens 1984: 363), but both time and space are defined as social variables.
 - 33 For a study of this, see Feldhaus 1995.
 - 34 Typical titles include: *A River No More: The Colorado River and the West* (Fradkin 1984), *A River Lost: The Life and Death of the Columbia* (Harden 1996), *River of Sorrow. Environment and Social Control in Riparian North India 1770–1994* (Hill 1997) (20) and Richard White's *The Organic Machine: The Remaking of the Columbia River*.
 - 35 See, for example, Williams 1980: 68. There he argues that nature is one of the most complex words in language altogether.
 - 36 See, for example, Pratt et al. 2000; Part 1 of Jamieson 2001; Gottlieb 2003; Selin and Kalland 2003; Turner 2005; Callicott and Palmer 2005; Radkau 2008.
 - 37 See, for example, Crosby 1972; Warren 1995; Opie 1993.
 - 38 Glacken 1967; Worster 1985a [1977]; Pepper 1996; Coates 1998; Buttimer and Wallin 1999; Pratt and Brady 2000; Jamieson 2001; Gottlieb 2003; Selin and Kalland 2003; Turner 2005; Callicott and Palmer 2005; Radkau 2008; Allen 1963.
 - 39 This literature is very extensive, but one book that exemplifies the point is O'Neill 1993.

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- 40 Hughes 2006: 4. See also Simmons 1993 and Cronon 1992.
- 41 Catton and Dunlap 1980. This paradigm is discussed by Dickens 1992. For an early expression of this idea, see Catton 1983.
- 42 See Benton 2001.
- 43 See, for example, Barry 1999.

EPILOGUE

- 1 This quote is taken from Gare 1995: 58.

GLOSSARY

- 1 This term was first used in the TV documentary ‘The Journey of Water’ from 2007 and in the book from the same year, translated into English. See Tvedt 2014a.