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A CRITIQUE OF THE SOCIAL SCIENCE TRADITION

In the above empirical section this book has shown the fruitfulness of the water-system approach in throwing new and interesting light on some of the most researched and central questions in social science and history. This section will discuss how bringing water-society interactions into the picture also challenges fundamental theories and concepts about society and social behaviour.

The first part locates the water-system approach and methodology – as proposed in this book – within the dominant research traditions, by discussing and criticising the viewpoints of the founding fathers of social sciences, Émile Durkheim, Karl Marx and Max Weber, and by contrasting them with the ideas of Bruno Latour and Ulrich Beck and the dominant historiography of the last century. Claiming that the most influential research traditions have been basically waterblind gives a historical-conceptual background to the fact that very few studies of social and historical development take as their starting point the knowledge that our planet is the Water Planet and that evolution, development trajectories and social life are written in water. The architects of modern social science disagreed on most issues, but agreed on one thing: that nature could and should basically be left out of analyses of societies, particularly modern societies, arguing in favour of a sharp distinction and dualism between nature and the social.¹ It also assesses influential attempts at dealing with nature-social relations, and shows how problems of nature determinism can be overcome with the help of the water-system approach.

The second part discusses and criticises Anthony Giddens' structuration theory, Fernand Braudel's notions of time, Garrett Hardin's model of the 'tragedy of the commons' and the widespread argument with ontological implications that 'nature is dead', all analysed with a water-system approach and with a focus on water-society relations and interconnections.

Finally, this part suggests that it is both methodologically necessary and analytically fruitful to deconstruct nature as one analytical unity or entity when mapping and analysing nature-society relations and interactions.

THE FOUNDING FATHERS AND THEIR REDUCTIONISM

More than 100 years ago, at the very end of the tumultuous nineteenth century, when the second wave of the Industrial Revolution had just swept over Europe and the USA, when social relations had been changed fundamentally by capitalism and urbanisation, and old world-views had been shattered by the scientific revolution and new theories of evolution, Émile Durkheim (1858–1917), a young French sociologist of Polish descent, was in Paris, writing the preface to Volume I of *L'année sociologique*. He had just founded the journal as a mouthpiece for the sociological movement he sought to further.

In 1895, Durkheim had published his very influential *Les règles de la méthode sociologique*, making it crystal clear that his mission was to establish a new scientific discipline. He had held a chair in social science in Bordeaux since 1887 and, by the end of the century, his thinking about social science was fully formed. He was working tirelessly to strengthen the prestige of sociology. An indication of how much his writings were influenced by his project to convince the French Government and public of the virtues of the new discipline was that he also wrote that France was 'predestined' to play a central role in the discipline's 'formation and progress', because of France's 'native qualities' (Durkheim 1960c: 383).

Soon to become the first French professor of this new discipline, Durkheim acknowledged that as a scientific field it was still in its infancy, and he wrote that in the 1880s there had probably been no more than 10 sociologists in all Europe (Durkheim 1960a: 354). In his introductions to the pioneering journal he laid out the boundaries and justifications for how the new discipline could grow, primarily concerned with how the aims and topics, methods and identity of the new discipline could be validated and delineated. The central task was to define and uphold its autonomy and distinctive character so as to guarantee that it would not be merged with other disciplines with stronger and longer traditions (Durkheim 1960b: 341–53).

Durkheim defined the new discipline in a way that would make social science more relevant and respected with all that would bring with it in the form of support from the Government and new positions at universities: 'The principle underlying this method is the principle that religious, judicial, moral and economic facts must all be treated in conformance with their nature as social facts' (Durkheim 1960b: 348).

The existence of social science 'can be justified only if there are realities which deserve to be called social and which are not simply aspects of another order of things' (Durkheim 1960a: 354–63).

Durkheim emphasised that the task of the social scientist was to study 'social facts', and that these social facts could and should, whether they were morphological or norms backed by sanctions, be explained in terms of other social facts. His fundamental conceptualisation and justification of social science accepted that the physical environment might be a prerequisite for social life,² but the point was to subordinate them to social facts within the new discipline of sociology. The inter-relationships among the various facets of society were conceived of as cohering into a unity – an integrated system with a life of its own, detached from nature and external to the individual. The justification for these viewpoints lay in explicit and implicit concepts of nature or the physical environment. Durkheim very seldom mentioned nature or the physical environment in his works, but the few references he made are interesting and telling. Nature changed so slowly, Durkheim wrote, that it could not explain changes in societies (Durkheim 1984 [1893]: 285–6). Since regularity and monotony were characteristics of nature, and social science was concerned with change and modernity, there was even less reason for social science to concern itself with the physical environment. He did not once discuss the relationship between nature and social variations or waterscapes and social diversity, as if nature and water were identical or so similar that they had no bearing on social organisation. Durkheim also saw nature as a unity; he wrote that 'the course of nature is uniform' and this 'uniformity' was the reason why it did not produce 'strong emotions' (Durkheim [1925 2nd revised edition] 1976: 85) or interesting social facts. He wrote: 'It requires culture and reflection to shake off this yoke of habit and to discover how marvellous this regularity itself is' (84). And he continues: 'Nature is always and everywhere of the same sort. It matters little that it extends to infinity: beyond the extreme limit to which my eyes can reach, it is not different from what it is here' (Durkheim [1925] 1976). The savage 'could be filled with admiration before these marvels', while the modern soul had been 'much too accustomed to it to be greatly surprised by it' (Durkheim [1925] 1976: 85). Based on this sharp distinction and the dichotomy of 'nature' and 'society', or the 'physical environment' and social facts, social science could develop as a separate, autonomous discipline (Durkheim [1904] 1966: 145.) While the natural scientists had natural facts as their object of study, social facts should be the object of study for social scientists. This distinction could safely be drawn – and this aspect of Durkheim's thinking is overlooked by other commentators on Durkheim – because he held to the idea that the physical environment

or nature had uniform, basically unchanging characteristics, and did not produce strong emotions in modern society.

Karl Marx's (1818–83) fundamental idea of social evolution regarded development basically as a continuous differentiation of society away from the influence of nature. Marx's basic premise regarding the relationship between nature and society in modern society was that capitalism liberated man from the traditional, localised dependency on nature, and with it the absurd 'nature idolatry' with which this relationship was associated.³ Nature might be relevant to our understanding of early agrarian societies (although it never influenced his general universal theory of historical development) but in the modern, capitalist world it was not 'nature' that fettered humanity or influenced human societies – it was capitalism. Marxist philosophy and theory of history thereby assessed emphasis on nature to be not only irrelevant but implicitly a thing of the past. A concentration on the various roles of nature in diversifying or impacting patterns of historical development and of contemporary societies was therefore later regarded as a criticism of Marxism and Marx himself, or even worse, as revisionism.⁴

In Marx's works there are, however, comments that show that he himself took a more ambivalent approach to the role of nature and to the way that the distinction between nature and the social sphere should be drawn. In his 'Paris Manuscripts' (1844) Marx argued that human beings are part of nature: 'Nature is man's inorganic body – nature, that is, insofar as it is not itself human body' (Marx 1959 [1844]: 31). That man's physical life is linked to nature means simply that nature is linked to itself, for man is part of nature, he argued in the same manuscript. In *Das Kapital* Marx hinted at the role of nature, especially in the Nile valley at the time when civilisation had emerged (he talked about 'the mild air there' (quoting Diodorus), the papyrus stem and marsh plants, and claimed that children therefore were very easy to bring up in the Nile valley and this minimal cost in reproducing the labour force was a main reason for the Egyptians' ability to build the pyramids!⁵ Marx also suggested a nature-deterministic explanation of the 'mother-country of capital' and the 'physical basis for the social division of labour', which, by changes in the natural surroundings, 'spur' man on to the multiplication of his wants, his capabilities, his means and modes of labour. But favourable natural conditions alone gave only 'the possibility, never the reality, of surplus labour, nor, therefore, of surplus value and a surplus-product'. Marx was also interested in the exchange and transformation of matter, energy, labour and knowledge between the social system and nature, and in the process of labouring, nature was seen as a kind of substratum. He called this 'social metabolism' and wrote about the potential exploitation of natural resources by capitalist production. Marx's dominant view on

nature had, however, some of the same traits as Durkheim; there was a certain kind of antagonism between man and nature and nature was generally seen as an undifferentiated material basis or condition for social life, and progress consisted in the movement from naturally determined human relationships to historically evolved social relationships.⁶

But in Marx's writing there is one striking exception to his general lack of interest in and disregard for geographical structures in general and water in particular. What he called the 'Asiatic mode of production' was explained basically as a product of geography, or of particular waterscape. A brutal ruler controlled a semi-arid environment and a river valley, ran armies of bureaucrats and soldiers, and regulated the way great rivers run and exploited them in large-scale irrigation projects. The state became extremely strong relative to the rest of society, and the despot above and the masses below prevented the emergence of a middle class and a bourgeoisie such as had emerged in Western Europe. One might say it was yet another variant of the old theme: the static East contrasted with the dynamic, progressive West. This theory puzzled later Marxists when they tried to make a coherent development theory of Marx's writings, since in this case he gave nature a decisive role in forming even the most fundamental social and ideological structures not only of one society in Asia, but of Asia as a whole. Marx explained this area's particular social development as a result of the existence of large river basins and how these determined the emergence of specific forms of production that structured society in general. But Marx and especially his followers did not develop this type of analysis further because doing so would presumably have threatened to undermine the Marxist theory of history which was soon regarded and revered as a universal theory of history.

The notion of 'the Asiatic mode of production' was a rather mechanistic model of how waterscapes in Asia directly affected societal formations. Marx here analyses relationships between geography and social development as if the river systems of Asia are so similar that they can produce the same social and economic system. He did not differ between river systems and irrigation systems in China, India and Sri Lanka, all of them being irrigation civilisations, but developed along very different paths. If Marx had been familiar with the system of the irrigation kingdoms in northern Sri Lanka, or with how these compare with the major river basins and monsoon patterns of China (and these are also internally very diverse), and how these again are quite unlike the river basins of the Indo-Gangetic plain and the Deccan Plateau, like the Himalaya and Karakoram ranges, the Vindhya and Satpura ranges in central India and the Sahyadri or Western Ghats in Western India, he could not have developed the simplistic and water-deterministic theory and model of the Asiatic mode of production. Marx's generalisations

about the Asiatic mode of production should be seen as representative of an entire trend: basically uninterested in nature and in water, the social scientists tend to advance explanations that are deterministic when natural issues are turned into a variable in social analysis.

Max Weber (1864–1920) was a pioneer in the way he mixed ‘high-level historical knowledge with social science analysis’ (Shils and Finch 1949) and is therefore highly relevant in this context. His view was that the sciences are separated not only in subject matter but also in interest and the questions they pose. Social science was a science whose object was to interpret ‘the meaning of social action and thereby give a causal explanation of the way in which the action proceeds and the effects which it produces’ (Weber 1968 [1922]: 7). Furthermore, human action is accessible through certain mental processes; they could be understood through reliving. For Weber (and for social scientists after him) it was irrelevant whether the causes of action had a physical background, since action meant something to us only through individuals’ understandings, anyway. He emphasised that ‘action is “social” in so far as its subjective meaning takes account of the behaviour of others and is thereby oriented in its course’ (Weber 1968 [1922]: 4). His goal for social science was a ‘science which attempts the interpretive understanding of social action in order thereby to arrive at a causal explanation of its course and effects’ (Weber and Heydebrand 1994: 1).

Importantly, it was not Weber’s focus on meaning, social action and causes by itself that made him generally uninterested in the role of the physical environment, but the way he understood the issue. Physical geography, therefore, could enter by default, so to speak, into his descriptions for example of the state, although it is unclear how far the actors saw this relationship in the way Weber did, that is, their subjective meanings might have overlooked what Weber described as a non-social fact. He categorised states in many ways, but he also related differences between states to physical variables: (a) coastal and inland states, (b) states of the plains and (c) great river states. According to Weber, physical location also has a dispositional bearing: the coastal and maritime state offers opportunity for democracy and the state of the plains for bureaucracy (Weber 1946: 209–10). Again, when Weber was talking about ‘river states’ the definition was unclear but, even more importantly, he did not distinguish between rivers or explain why only certain rivers could produce a river state. He also mentioned in passing that in old Egypt, bureaucratic centralisation could never have reached the degree it actually did without the natural trade route of the Nile (Weber 1946: 213), i.e., bureaucracy was explained by the physical qualities of the river. He also made a point of what would have been the very far-reaching historical relevance (if it had

been correct) of the social importance of climate when he wrote that the rural social structure in England and Germany was influenced by climate in a specific way, since stock-breeding was not possible in the 'German east on account of the climate' (Weber 1946: 384). Due to Weber's overall perspective on and justification of social science, analyses or, better, descriptions ascribing a structuring role to nature (deterministic in character, it must be remarked) remained anomalies in Weber's overall conceptual approach to social science, and he never did attempt to integrate nature or the physical environment into his overall theoretical and conceptual discussions. In Weber's analysis of world religions and comparisons of the histories of civilisations, natural factors played no role whatsoever.⁷ His very broad and extremely influential comparative studies of religion and his interpretation of the breakthrough of capitalism in Europe were marked by the way he defined social science and its goals, and factors of the physical environment did not enter into his interpretative universe.

Durkheim, Marx and Weber aimed to distance themselves from the discredited nature–culture determinism that was an enduring feature of Western thinking about the power of nature over human mentalities.⁸ Furthermore, their understanding of the dualistic relationship between societies on the one hand and nature on the other reflected and was given status by very influential theories of historical purposiveness and the victorious march of modernity. At that time, history was regarded as a process whereby mankind gradually liberated itself from the dispositional powers of nature. The new historical consciousness that emerged reflected this struggle to escape the shackles of nature. To separate nature and society or nature and history, as the founding fathers did, was therefore in line with a deep-seated cultural and even existential tension between the Modern and the Ancient. In the third place, the nomothetic aspirations of discovering and formulating laws of social development strengthened and cemented the analytical and conceptual power of the topical focus and delineations of the new disciplines.

If knowledge systems, like other systems that seek to sustain themselves, require a specific identity, the definition of the social science project served its purpose. Research traditions that conceptualise society as a set of inter-related social variables or facts, within which those structures that should be studied are defined as belonging only to the social sphere (such as semantic or normative rules and power resources) because only such structures influence choice and opportunities, will naturally tend to refer natural factors more and more to a place outwith the analytical and conceptual universe.⁹

When the founding fathers established the social sciences, they did not or could not know that the waterscape and the role of water in the

earth system were the factors that distinguished it from other planets. The limited knowledge about the universe and the planet had for centuries affected the fundamental understanding of our planet's characteristics, reflected in its naming. In English it is called 'Earth'; in Afrikaans, *aarde*; in Arabic ضَرَا ('land or earth', with a definite article) pronounced as 'arD'; in Hebrew *ertz*; in German *Erde*; and in the Scandinavian languages *jord*. The English 'Earth' developed from the Old English word *eorðe*, which means 'ground, soil, dry land'. *Tellus* is a Latin word for 'land, territory, earth', as is *terra*; 'earth, ground'. Earth got its name because it was regarded as the opposite of the wet elements on this planet, that is, the water of the oceans. Empirical knowledge about differences between continental and national hydrological situations and changes in the water cycle was usually poor at the time, and knowledge about the role of water on different planets was almost non-existent. While Adam Smith wrote *The Wealth of Nations*, Karl Marx wrote *Das Kapital*, Auguste Comte and Charles Darwin formulated their theories of biological and social evolution and, in the 1890s, when Émile Durkheim sat in his office in Paris and formulated what came to be the fundamental conceptual universe of the social sciences and, at the beginning of the twentieth century, when the other father of social science, Max Weber, was editing his *Archiv für Sozialwissenschaften und Sozialpolitik*, they did not know that the uniqueness of our planet lay in its waters and that the water balance was absolutely crucial to the human body and human physiology. There was therefore no reason why the early social theorists or historians should think about world history in terms of a water perspective or about the water cycle as being a particularly interesting factor in explaining development trajectories and social diversity.

This classical legacy of the conceptualisation of and delineation of the research object served as a very useful identity marker for social sciences *vis-à-vis* the much stronger natural science disciplines. Since their modest beginnings in Durkheim's time,¹⁰ millions of students have been taught to study, think and reflect upon society as being produced by the social, actively disregarding or minimising the influence of non-social factors such as nature or water. If all the books on sociological and political science methodology in the University Library in Cambridge are accepted as being reasonably representative of the research interests of these two disciplines, it is telling that none of the books in the library's holdings in the spring term of 2013 offered methodological advice on how to study the relationship between ecology and society or water and society.¹¹ The most influential tradition has held that nature and water are of very marginal or zero interest to social scientists. The dominant theories about development that became a conceptual pillar of the global discourse on development after World War II were all based on a single fundamental conceptual

aspect, be it modernisation theory, dependency theory, basic need theory or theory of rights-driven development. All were radically sociological in their point of view and all disregarded the importance or relevance of nature or water systems in explaining patterns of development, different development trajectories or strategies of development. That makes social science part of the problem it now promises to solve, not only in relation to the debate about the 'green economy', or 'sustainable development', but also concerning understanding and managing the worlds of water.

Contrary to the knowledge situation of today that makes it difficult to justify an incessant neglect of water and water-society relations, at the time when the social sciences were being established no one knew or could know that the way water flows over Tellus is our planet's defining quality. Adam Smith, Auguste Comte and Charles Darwin did not know about it, and Durkheim, Marx and Weber were not mindful of this when they wrote their most influential works on how history and society should be understood and analysed. In what Eric Hobsbawm called the age of extremes,¹² researchers and scholars were preoccupied with modernity, communism, imperialism, capitalism and urbanism, to the natural exclusion of non-ideological issues such as the role of water for social development and in historical processes. When Talcott Parsons and Michel Foucault produced their most influential works, most people were ignorant of, or uninterested in, how the unique character of the waterscape had affected societies' past and how interactions with water framed current urban life. The generation that helped to turn social science into a discipline that attracted millions of students during the 1960s and immediately after was so preoccupied with social issues such as peace and war, women's liberation, social justice, imperialism, the class struggle and Paris '68 that few grasped the long-term implications for the understanding of human history or the human predicament of what was discovered and documented later in 1968 – in space!

POST-MODERNISM AND CONSTRUCTIONISM

A concern with the physical world (or a water-system approach) became even less fashionable when post-modernism and constructionism became influential among social scientists and historians in the last decades of the twentieth century. New theoretical and philosophical arguments relegated the role of nature or non-social variables in societies' development further to the background. While acknowledging some of the conceptual and theoretical problems stemming from the well-established dualism between nature and society, post-modern trends tried to overcome them by doing away with nature altogether, both as a topic and as a term.

Nature itself was now conceived of as a social construction. It had become a *social* fact; nature was nothing if it was not social; similarly in the case of water: water is nothing if it is not social. The idea was that all that we can ever perceive about the world is shadows, and scientific knowledge should therefore not be regarded as a representation of nature, 'but rather as a socially constructed interpretation with an already socially constructed natural-technical object of inquiry' (Bird 1987: 255). In line with the assumption that nothing is knowable and that all truths are equally correct, an epistemology of nature was constructed that focused on cognitive, normative and symbolic constructions of nature. Post-modernism was a way of thinking that should be understood as primarily an epistemological assertion about our knowledge of nature rather than as an ontological assertion concerning the reality of nature itself (Proctor 1998, 2001). Nature *qua* nature was thus emptied of both natural and social significance, and in this perspective Anders' picture and all that it revealed and pointed to was ignored.

In 1993, the French sociologist Bruno Latour, almost exactly 100 years after Durkheim, published a very influential book that opposed the way in which the distinction between nature and society had been drawn. Latour's idea was to get rid of the subject-object distinction altogether.¹³ Nature should not be considered 'as the external background of human and social action' at all (Latour 1999: 308). He suggested instead that there was a need to naturalise society: 'Nature and Society are not two distinct poles, but one and the same production of successive states of societies-natures, of collectives,' he argued (Latour 1993: 139). He also suggested that

Nature and Society have no more existence than West and East. They become convenient and relative reference points that moderns use to differentiate intermediaries, some of which are called 'natural' and others 'social', while still others are termed 'purely natural' and others 'purely social', and yet others are considered 'not only' natural 'but also' a little bit social.' (Latour 1993: 85)

His aim was to highlight the cross-overs through which humans and non-humans exchange properties, taking, according to himself, the argument beyond the polemical war between objects and subjects (Latour 1993: 193–4).¹⁴ Another related approach accepted ontologically the existence of nature but argued that it had become social or, rather, nature had become a product of socio-ecological interaction and was now a socionatural phenomenon.¹⁵ The socionatural was therefore seen as a new, dynamic, geographical configuration where, for example, all sorts of social issues and class antagonisms could be translated into spatial configurations.

The influential German sociologist Ulrich Beck arrived more or less at the same time at conclusions with somewhat similar conceptual and empirical implications, but from another point of departure: he argued that nature *per se* no longer exists, and criticised the fallacies of positivistic scientific truths, writing that nature has been shaped by humans to such an extent that in a strict sense it is not nature any more (Beck 1995: 54). The embedding of human beings in nature is something of the past, eliminated by modern societies. Nature as something peculiar and external to the social is regarded as largely irrelevant in modern societies.¹⁶ Beck's idea is primarily an ontological assertion concerning the 'reality of nature' itself rather than an epistemological assertion concerning our knowledge of or ability to know nature.

A common trait of the above-discussed efforts to understand nature/society interactions is the assertion that nature in itself is of no social interest or is not a variable that needs to be considered in analyses of social development, because it does not exist, whether for epistemological or ontological reasons. This book argues that water exists both on epistemological and ontological grounds, but that the distinction between society and nature must be drawn differently from in the past, not the least because water transcends the conventional boundary or distinction, and is both natural in society and social in nature.

HISTORIANS, NATURE AND WATERBLINDNESS

What about history as a discipline; to what extent is there a historiography of water/society studies? The practice of this discipline is of course extremely varied, but given the question at hand it must be reasonable to use the most influential, respected and quoted historiographies as sources for the reconstruction of recent research profiles of the discipline.

Iggers and Wang's *A Global History of Modern Historiography* (2008) is widely regarded as an authoritative summary of the past century of global historical research. Significantly, in this book that discusses how historians have conceived of their discipline and explained historical developments, there is not one word about nature or environment or ecology. Reconstructing the practice of modern historians, it contains not a single reference to scholars who have grappled with how to analyse the relationship between nature and society or who have offered empirical descriptions of that same relationship. Of course, historians have produced empirical studies about the Hoover Dam, British canals and Norwegian hydropower, and about the Ice Age and adaptation, but no regional or national histories have been written putting water-society relations in focus and when the historiography of the discipline is

written, studies of relations and interactions between nature and society are not included.

Other influential works on historiography confirm the clear impression and picture given by Iggers and Wang; Daniel Woolf's *A Global History of History* (2011), *Writing History: Theory and Practice*, edited by Stefan Berger, H. Feldner and K. Passmore (2003), *Making History* (2004) by P. Lambert and P. Schofield, and Kenneth R. Stunkel's *Fifty Key Works of History and Historiography* (2011) all have no entry on nature, ecology, environment, water, rivers or physical relationships, while the last book does have two entries on nature and two on laws of nature but does not deal with nature as a factor in establishing and developing patterns and histories of interactions.

The evidence makes it quite easy to conclude: during the last century – when the relationships between nature and society and between water and society were fundamentally transformed and such issues as resource use, climate developments and water control were at the heart of development and social engineering – historians scarcely studied nature/society interactions and at best integrated them into the analysis as a static backdrop to human action. There are many reasons for this situation. It is a logical consequence of the methodological stress on written texts as the proper source material of the historian to the detriment of interest in technological artefacts, rainfall statistics, geo-morphological changes in the landscape and so on. It is of course also partly a reflection of dominant thinking about nature and water in modern, urbanised societies, since the Age of Modernity has also been an age of general waterblindness. It is also just one of many signs of how history too has been influenced by fundamental justifications of social science in its early days, and by the ideas of Marx, Weber, Durkheim and others.

But history has its own theoreticians who have pulled in the same direction. Here the Oxford historian and philosopher Robin George Collingwood (1889–1943) will be discussed. He has until the present day exerted a very strong influence via his classic works *The Idea of History*, published after his death in 1946 and following another posthumously published book, *The Idea of Nature* (1945), and his *Principles of History* (1999), and the way he argued has resonated widely in historical departments all over the world.

Collingwood argued in favour of the same distinction between 'Naturwissenschaften' and 'Geisteswissenschaften' that dominated social science after Durkheim. He arrived at this standpoint by reflecting on what was meant by 'history', being influenced along the way by Kant, Hegel and Vico. He emphasised that thinking about historical thought is essentially thinking about the object of historical thought. 'All history is the history of thought' Collingwood 1946: 215, 304). However, history

deals with thought in general and with 'actions done by reasonable agents in pursuit of ends determined by their reason'. And for a man about to act, 'the situation is his master, his oracle, his god' (Collingwood 1946: 316). All history is the history of thought, and the crucial thoughts are those that deal with understanding of 'the situation'. The question that the genuine historian asks is not what kind of event usually precedes the event that is about to be explained, but what reasons make the action intelligible? According to Collingwood, this 'situation' should be analysed without asking questions about how different natural conditions framed situations in different ways. Since the historian should deal with or be concerned with rational connections rather than inductive generalisations, nature becomes both theoretically and empirically irrelevant, even as a background factor.

My point is that we do not need to resort to inductive generalisations or writing 'pseudo-history', as Collingwood calls it, by bringing natural factors into the picture. Collingwood overlooks or is forced to neglect the fact that the natural environment and modified landscapes create and reproduce different 'situations' for those involved, and thus make only some actions rational and some thoughts possible and intelligible. For example: for entrepreneurs to plan to establish factories based on waterwheel technology was a rational idea in parts of England but would have been madness along the Nile in Egypt or in the Sahel belt in Africa. The same action and the same intentions within similar systems of thought would have very different implications. To worship water as a gift of God was a more intelligible ritual in the deserts of Arabia and Palestine than on the Scandinavian raincoast. In *The Idea of Nature*, Collingwood discusses not the history of ideas about nature in general, although he describes the book as though he does so, but the ideas of nature in the specific context of Western Europe's climate and waterscape. His failure to grasp how ideas about nature and individual aspects of nature also reflect the existence of different natures also demonstrates the problem with his ideas about history.

Collingwood is one of the few historians who have been interested in and written thoroughly about nature, also in a theoretical perspective. He did so in congruence with his general programme for what history is: a history of ideas or of human thinking about nature and not a study of how nature as a factor or variable impacting on the situations his actors are acting on or within. It is also highly relevant from our perspective that he conceives of nature as one entity. He relates the development and change in thinking from the Greek cosmology, which regarded nature as an organism with intelligence, to 'Renaissance cosmology', where nature is operating according to external laws stemming from the divine creator or ruler of nature, and is based on a clear distinction

between mind and body. He argues that, in the nineteenth century, a more historical understanding of nature gained ground, especially in the form of different theories of evolution. Collingwood regards nature as a whole, and the history of the ideas of nature that he constructs is seen solely as a product of other ideas and is never analysed as being affected by the nature of the different natures these ideas develop within. The reason why it becomes possible for Collingwood to write a history about the ideas of nature without bringing different natures into the picture is actually twofold: he restricts his analysis to Europe, throughout which natural conditions are quite similar in many fundamental aspects and can thus with some justification be treated as a constant, omnipresent factor that becomes, in the course of time, irrelevant as a factor in explaining different trajectories of development. His approach to nature as a unitary phenomenon leads naturally to a general conceptualisation of nature as an idea rather than as an experience, since in the real social world actors and people experience aspects of nature and never nature as a totality or unity.

In social science it has been conventional to argue that there are four logical possibilities for conceiving the relationship of nature and society: the reduction of society to nature, the projection of nature into society, dualism, and a nature-society-dialectic. This book has argued for a fifth and more fruitful possibility for conceiving the relationship between nature and society, at the same time overcoming rigidities and dichotomies inherent in these approaches.

NATURE DETERMINISM AND WATER

The second section of this part of the book will locate the water-system approach in relation to a critique of some of the social scientists and historians who distanced themselves from the dominant tradition and who sought to integrate non-social variables such as nature and water in their analyses of societies. This is done because the most famous contributions of this counter-hegemony trend have been strongly criticised for their nature determinism, and it is therefore thought useful to compare the water-system approach with these contributions. The approach suggested here is not deterministic but provides rather a means to overcome the fallacy of both reductionism and nature determinism, and far from being suggested as a substitute for other explanations it is pushed forward as an overlooked but crucial addition to existing narratives.

The geographer Ellsworth Huntington aimed famously to explain the development of human civilisations as a result of their interactions with nature and climate. Huntington has been criticised for determinism and

for having a superficial understanding of the complexities of societies. I concur with the criticism of his way of discussing race; the relationship between climate and mentality; and how he used certain aspects of nature to explain social differences. However, this well-known and relevant criticism will not be repeated here. Instead, his work is analysed from a very different angle. The point that is made here is that his understanding of nature and his methodology were more fundamental to his determinism than previous criticism has realised.

Huntington was convinced of the unity of nature and of the 'unity of science'. Subsequently he did not comparatively study particular aspects of nature in their empirical interactions with societies in detail. His model of the role of nature in its relationship with society was therefore basically static. His view on nature and society therefore forced him to study 'everything'. Huntington wrote in line with this that the 'unity of nature is so great that when a subject such as climatic changes is considered, it is almost impossible to avoid other subjects, such as the movements of the earth's crust' (Huntington and Visser 1922: xi). His book therefore discusses everything from the causes of earthquakes to how climatic changes may be related to great geological revolutions in the form, location and altitude of the land and all kinds of potential physical factors which have moulded the evolution of organic life, including man (Huntington and Visser 1922). In his most famous book, *Mainsprings of Civilization* (1945), he aimed to 'analyze the role of biological inheritance and physical environment in influencing the course of history', this being part of a yet larger plan which included 'an interpretation of the main trends of history in the light of these two factors as well as of the cultural factor, which is generally the main topic in histories of civilization' (Huntington 1945: 1). These quotations can serve to illustrate the enormous scope of this project – all of nature, all societies of the world, all of the time. It was rationalised by his unitary view on science and nature. Huntington could not manage, of course, in any comparative, empirical way to study all the actual interconnections between societies and nature. It was therefore to be expected that he should suggest some rather sweeping and basically deterministic explanations of social developments.

Huntington's view of nature brought natural factors into the equation, but the way he approached and understood nature made it difficult to study actual interactions between aspects of nature and societies in a rigorous, comparative way. He mentions both water and rivers (never water systems and river basins) but does not describe water and rivers systematically or discuss how individual rivers or waters influenced particular development patterns and challenges.

Typical of his approach is the formulation that such 'details' as the differences between braided rivers and meandering rivers are of no

interest to people concerned with human development (Huntington and Cushing 1922: iii). In reality, however, such apparently minor divergences proved to be of tremendous importance, for example in the diverse patterns of development of the industrial revolution, as they can partly explain the different situations in which entrepreneurs in various countries and regions found themselves in employing new technology at the end of the eighteenth century (see Chapter 2 of this book). Of course, meandering rivers did not create the foundations of the sorts of regular power sources and trading routes that modern capitalism and production required to thrive. Huntington also jumped to rather general conclusions about water/society relationships, based on what must have been limited and biased empirical data, describing, for example, rivers one-sidedly as only 'barriers' to trade and development (Huntington and Cushing 1922: 130–1), rather than also trade routes or highways to the world market, as he did in his later works (Huntington 1945). The point is that major river systems, due to their different hydrological characteristics, played various roles: in China they were both a highway and a barrier, while in present-day northern Pakistan the Indus really was the most important barrier to trade and exchange, and in England, rivers like the Severn and Thames were among the most important trading routes in the country.

Huntington today is primarily remembered for his natural determinism, which in some cases assumed a racist overtone.¹⁷ Criticism of his attempts to explain sexual matters among the Zulu by tropical heat, for example, has naturally tended to overshadow a discussion about more theoretically important aspects of his conceptual and analytical approach.¹⁸ He failed to be precise in identifying which aspects of climate he studied, for what reasons and in which societies. His assessments of impact overlooked both the complexities of the interactions of specific societies with the physical world and the importance of the latter to them. Instead of studying aspects of climate change and how they impact on particular sectors or activities in society in different ways, he conceives of climate as something reduced to a form of general 'social power'. It is as this form of power, and not as nature *per se*, that climate becomes the mover of this determinist causation.¹⁹ By focusing on water as one aspect of the climate, it will be possible to study precisely how this relation between climate and society is multidirectional and much more open-ended and dependent on social response and pro-activity.

Based on the water-society system approach we may rather say that 'climate' has influenced particular environmental adaptations without having determined historical development; it has influenced where human beings can thrive and live, what crops may be grown, and where cities should be located, but has not decided where cities are, what crops are grown and where human beings thrive.

Other attempts at integrating nature or ecology in social analyses have been suggested by influential anthropologists. One reason for this discipline's interest in the role of ecology is that anthropologists tend to study relatively underdeveloped agrarian or hunter-gatherer societies. They have researched relationships between society and environment in cases where the link is evidently important and apparently easier to study.

Julian Steward and his 'cultural ecology' approach is the most influential proponent of this approach. In his most influential contribution, he traced evolutionary similarities in five ancient civilisations: Mesopotamia, Egypt, China, Mesoamerica and the Andes. According to Steward, these cultures shared parallels in their development of form and function. The main reason was that all of them developed in arid and semi-arid environments whose economies were based on irrigation and floodwater agriculture. He argued that these social similarities stem not from universal stages of cultural development, nor from the diffusion of civilisation between these regions, but from their similar natural environments.

Steward aimed at demonstrating that evolution occurs along parallel lines (multilinear evolution) that are determined by differential environmental adaptation (Willey and Sabloff 1980).²⁰ He was looking for a methodology that could determine regularities of form and processes which recur among societies in different cultural zones (Steward 1972: Vol. 1, 3). He was not looking for a universal theory of evolution but for a theory of evolution of parallels of limited occurrence. Steward argued that different cultures share evolutionary features that can and should be explained as parallel adaptations to similar natural environments. On this basis, he formulated a theory of social evolution that explained social systems in terms of their adaptation to environmental and technological conditions. Or as Steward wrote: 'The cross-cultural regularities which arise from similar adaptive processes in similar environments are functional or synchronic in nature' (Steward 1972: Vol. 1, 5).

The main problems with this 'cultural ecology' approach are twofold: (a) it is not very helpful in analysing modern, more complex societies in which mechanisms of adaptation are much more multidirectional and in which interactions between societies and nature are much more complex, and (b) it is deterministic in the sense that it is not really concerned with the differences in the irrigation system in the areas he compared, and especially in the water systems that provide the foundations of various irrigation systems. The lakes and artificial gardens of the Aztecs, the seasonal rain-fed dams of the Mayas, and the annual floodwater of the Nile in a country where it almost never rained filling the basins along the river are extremely different ecosystems. The agricultural practices they encouraged were also very different. The similarities in social structures that Steward asserts are there can thus not be explained by natural factors

in the way he does. It is therefore an assumed connection, and since he explains these similarities with nature, it is a form of anticipated, deducted determinism. The environment and waterscapes of Egypt, the Andes and China in particular are much more different than the theory of limited parallel development acknowledges. It is precisely by highlighting the great variety and constant flux of different water cycles and waterscapes and the quite advanced knowledge we have of the different agricultural civilisations and their relations to their waters that it will be clear that such general, partly deterministic models of social behaviour must be falsified.

The political scientist Karl Wittfogel in his book *Oriental Despotism: A Comparative Study in Total Power*, forcefully reopened the question of the relationships between modes of production and environmental conditions. He attempted to understand and interpret the abundance of dictatorial regimes in basically geographical terms and saw these political and institutional conditions as direct or indirect consequences of irrigation agriculture in large river basins in dry areas. He generalised his notions of 'oriental despotism' to every dynastic empire with a river running through it – China, Russia, Persia, Mesopotamia, Egypt, the Incas, even the Hopi Indians of Arizona. The origin of despotic government was to be found in the initiation, implementation and operation of large-scale hydrological works.

The typical hydraulic empire government, according to Wittfogel's thesis, is extremely centralised, with no trace of an independent aristocracy. Hydraulic hierarchies gave rise to the establishment of strong, rather permanent institutions of impersonal government. Wittfogel's model has been harshly criticised. Joseph Needham argued essentially that Wittfogel was operating in ignorance of basic Chinese history, arguing that Chinese governments were not in general despotic or dominated by a priesthood and experienced many peasant rebellions, proving that dissent was possible. Wittfogel's analysis of Egypt has likewise met strong opposition from archaeologists and other scholars, who have shown that irrigation started without being dependent on a strong state and a weak society.

I concur with the criticism by Needham and others of Wittfogel's work, but here a very different point is made that is thought to be methodologically more fundamental. The main problem with Wittfogel's thesis is essentially that he was not really interested in mapping the characteristics of the rivers he claimed were 'responsible' for the social systems he describes. His book contains no detailed descriptions of their hydrology and the way they ran through the landscape. In fact, Wittfogel wrote as though the Yellow River and the Nile and the Euphrates-Tigris were similar rivers, or at least similar enough to produce similar types of institutions and societies. Wittfogel mentions the 'specific qualities

of water': its susceptibility to movement and the techniques required to handle it, that it is the natural variable *per se* in a given agricultural landscape, and that it flows automatically and according to gravity (Wittfogel 1957: 15). But more importantly, he does not describe in sufficient detail the different river systems and how they change over time and pose specific managerial and political problems. He implies that the river systems of Egypt, Mexico, Turkestan and China were similar, without specifying to what extent they really shared important characteristics (Wittfogel 1957: 24). He also suggests that only irrigation civilisations were interested in canal building, stating that canal building started in Europe with the Canal du Midi and overlooking much earlier water modification schemes for both agricultural and non-agricultural activities in the Netherlands and in England, and in connection to the Hanseatic cities long before the French decided to link the two oceans by canal. The weakness of Wittfogel's thesis was therefore not that he was concerned with how rivers produced social relations, but that he was not sufficiently interested in how different types of rivers help over time to develop diversity in social responses to river systems.

A last example can be the physiologist Jared Diamond. In *Guns, Germs, and Steel: The Fates of Human Societies* from 1997, he asks the very appropriate question: 'Why did history unfold differently on different continents?' His answer is: different environments, rather than culture or mentality. Diamond puts a great deal of weight on diseases and advances the hypothesis that successful cultures are those that settle continents aligned along an east-west axis. The only cultures that fit this description are Europe and Asia. He makes environmental conditions a cause of historic development.

His model fails to explain the overarching question: why did Asians not colonise the world or organise an industrial revolution in the eighteenth and early nineteenth centuries? He mentions several factors, and although he ascribes the rains of Africa a very important role in the history of that continent he does not carry out more systematic and rigorous comparative studies of the role and character of rivers, the seasonality of precipitation, scale of evaporation and so on and how particular water environments over time helped to establish a foundation for a practical-scientific milieu of entrepreneurs in parts of Europe. This omission is clearly reflected in the way he has organised the index, since it has only one entry directly related to water and that is water power. According to the book and the index water power is on a par with watermelons and water buffalo, the other entries related to water. He has no entry on rivers, none on mills, one on irrigation (irrigation systems) and one on hydraulic management. The last two entries deal with the same point: Diamond criticises the 'hydraulic theory' of state formation because it addresses

only the final stage in the evolution of complex societies and this theory says nothing, he argues, about what drove the 'progression from bands to tribes to chiefdoms during all the millennia before the prospect of large-scale irrigation loomed on the horizon' (Diamond 1997: 283). Instead of what is described as a deterministic version of the 'hydraulic theory' he suggests his thesis of population pressure.

Diamond's criticism of the hydraulic thesis is fruitful, but his comparisons of the Mayas, Aztecs, Chinese, Madagascans and Egyptians are too general. It is necessary to analyse systematically the different waterscapes and their evolution through history and how they have encouraged different development trajectories, or how different societies have adapted to and controlled their waters. Such an analysis would have been less deterministic and easier to check. Diamond objects, however, to his analysis being deterministic: 'It's just that some environments provide more starting materials, and more favorable conditions for utilizing inventions, than do other continents.' (Diamond 1997: 408) The point about the water environment as compared to Diamond's environment is that this is not only a given, quite fixed, external structure, in the way that Diamond conceives of environmental conditions. The waters, or the rivers and the streams and the run-off, can on the contrary be controlled, changed and exploited in very different ways at different junctures in history. A difference and a problem is also Diamond's continental scale as conceptional unit, since variations in the behaviour of the water cycle or in river systems on a specific continent will often be greater than differences between the continents. The consequence is that similarities in climate or water systems must be assumed or ascribed, as is implicitly the case with the theory of the north-south axis.

In his next book, *Collapse* (2005), Diamond suggests that climatic and environmental determinants have been the central factor in the rise and fall of empires. This book too has been criticised for environmental determinism because he argues that in societies where most control was exhibited this was frequently due to the central role played by limited resources in economic processes. This constrained nature made control of supply and demand easier and allowed a more complete monopoly to be established, as well as preventing the compensatory use of alternative resources. The analysis would have been less deterministic had it paid more attention to concrete changes in local and regional climates and water cycles and run-off, since to a large extent Diamond explained social changes in terms of natural phenomena such as droughts in the Mayan region and changes in the form of water on Greenland. A comparative and thorough empirical analysis of the collapse of the Sumerian and the Indus civilisation, and the fate of Pharaonic Egypt and classical China, will show that the relationships between changes

in water cycles and social development cannot be reduced to a simple one-directional causal one.

WATER AND THE 'TRAGEDY OF THE COMMONS' – A CRITIQUE

Since this book is arguing that the water issue and the importance of the water-society nexus have basically been ignored in mainstream social science and history, it opens up an extremely wide array of empirical studies – both of new topics and questions and of old topics and questions in new contexts. The dominant waterblindness has, moreover, also exerted a major influence on theories of social development and social action, not only because the water factor has been overlooked but because water has characteristics that will tend to erode theories and concepts formulated as if water is not found on the planet.

The first question that can be reappraised is a famous one: how can we optimally share common resources? This general question has given impetus to an extensive literature that has had a profound impact on social theory and thinking about society in general. A basic assumption is that common property resources have long been overexploited and misused by individual players acting in their own interests. A long line of collective action theorists has argued that people placed in a situation in which they could all potentially benefit from co-operation are unlikely to co-operate in the absence of an external enforcer of agreements. An equally long line of property rights theorists has suggested that common property resources are bound to be over-exploited as demand rises. Of course this has also been a major challenge regarding the allocation of water resources among national and regional stakeholders, which has produced a number of influential analytical models for understanding river basins all over the world.²¹ Our discussion of the concept here aims to demonstrate how waterscapes' particular form of territoriality and the concept of river basins that also creates a nexus of social relationships questions the validity of the most influential model, that of the 'Tragedy of the Commons'.

The most famous model invoked to explain behaviour and solve problems related to the management of shared resources is that proposed by Garrett Hardin (1968), often referred to as the theory of the 'Tragedy of the Commons'. Hardin located his actors on a pasture shared by herders, where each individual herder acts rationally and wishes to maximise his yield. But each additional animal introduced to the pasture has both positive and negative effects. The herder increases his return but, meanwhile, the pasture is degraded. By 'the remorseless working of things', the rational actions of self-interested individuals do not promote the public good, and

in the end they will also negatively affect the herder who first increased his herd. Hardin wrote: 'Therein is the tragedy. Each man is locked into a system that [causes] him to increase his herd without a limit – in a world that is limited. Freedom in a commons brings ruin to all'.²² The tragedy of the commons arises because resources will be exhausted by rational, utility-maximising individuals rather than conserved for the benefit of all. And the greediest herdsman would gain, but – and that is the point – only for a while, the reason being that mutual ruin is always around the corner. The unmanaged commons will be ruined by overgrazing caused by interest-maximising individuals. Pessimism about the possibility of users voluntarily co-operating to prevent overuse has been widely used to justify both the privatisation and nationalisation of commonly owned resources. The model pasture is ecologically quite uniform, as are the economic activities of the herders and the available rational adaptation mechanisms and strategic choices of the actors who share it. The pasture is the model's ecological environment, but if adaptation mechanisms and strategic choices are different in other ecological contexts, Hardin's model cannot be as universally applicable as once thought.

Two main objections can be raised against this theory based on the water-system approach and an understanding of the characteristics of large rivers and water's confluences with society.

A pasture, as a physical space in nature and thus also a resource, is fundamentally different from a river. Actors operating in other physical resource contexts, such as an international river basin or a large national river basin, might therefore think about cost and benefits in other ways than the pasture-based model predicts. Actions motivated by similar intentions and norms might also have very different implications in different physical settings.

There are waterscapes that have traits that are comparable to those of a pasture, and with regard to groundwater basins, Hardin's theory is instructive. Nobody really owns the groundwater, and it is technically 'up for grabs'. History is full of examples where individual and rational pumping of groundwater has resulted in the depletion of the resource for all. That has led to other losses, most often as saltwater intrusion, very revealingly on parts of the Indian coast and in the Nile Delta, and as land subsidence, as in Mexico City, in Venice in 1984, when the authorities stopped the city from sinking by prohibiting the pumping of groundwater from beneath the seabed. In the ecological context of an aquifer, diffusion acts to spread the effect of the individual's use among all. The mechanisms involved are very clear: depletion by a few means depletion for all. The example shows that it is not water as a physical element in nature *per se* or as a resource in itself that objects to the theory of the tragedy of the commons. It is rather the process of running water over large distances

that may cross several ecological zones and that coincide with and help to develop different water needs and water usage practices that does that.

Most rivers, particularly long rivers, are ecologically extremely varied. For example, the Nile traverses three major climatic zones from tropical Africa with its rainforests, crossing the savannah and running through the Sahara without receiving a tributary for 2,000 kilometres before emptying into the Mediterranean. The Nile basin covers one-tenth of the continent and is part of 11 countries with a population approaching half a billion. Such rivers lend themselves to a wide range of strategic choices and economic adaptations at various points along their courses and among actors occupying different water-related ecological niches.²³ Geography and scale might also be factors explaining differences in water strategies and ideas about water. The theoretical configuration associated with pasture ecology will therefore not be reproduced in the context of a river basin, owing to its physiography, topography and the resulting unequal structural positions of actors in relation to the resource.²⁴

Unlike for pasture, the rather diffuse and shifting boundaries that are a distinguishing physical characteristic of river basins or watersheds have immediate implications for co-operative frameworks and thus for the whole tragedy of the commons model. For example, if countries located upstream in a large river basin develop rain-based agriculture, when and to what extent should use of this water that would otherwise drain into the river be considered part of the common resource or the shared watershed? A more controversial question is whether or to what extent a river basin should be defined topographically rather than according to where the waters actually run. Can, for example, the Egyptians legally and as part of their co-operation with upstream countries pump water across the Suez Canal and into Sinai and can they pump water up from the High Aswan Dam into the Sahara Desert in the Toshka area to create an artificial Nile valley there, and still claim that they are using water within the boundaries of the Nile basin? Egypt argues that these areas belong to the Nile basin historically, although water no longer reaches them, mostly due to human control and modifications of the river. Egypt objected on its side to Tanzania pumping water from Lake Victoria to cities in the Shinianga area to the south of the lake, areas which Tanzania claims is draining water back to the lake. And, in Ethiopia, water planners have long discussed schemes for sending water in tunnels to dry areas outside the Nile basin proper. Because of the physical character of water, and the fact that the actual boundaries of a river basin are always in flux, the whole issue of 'clearly defined boundaries' creates a divisive element precisely because they are not clearly defined.

One riparian actor, be it a state, private companies or individual farmers, can in large river basins use or even control the river to maximise

yield without negatively affecting other users or the river itself. Egypt, for example, exploited the River Nile for thousands of years without any harmful or other effect on present-day Kenya or Tanzania. Even during the past few decades, the country's extensive exploitation of the river has been of negligible importance for its upstream neighbours, since their lack of development of the river was primarily the result of internal development, lack of political stability and technological capabilities rather than of Egypt's use of the resource.²⁵ In river basins, moreover, pursuit of self-interest upstream can *benefit* downstream users. A hydroelectric dam, for example, may protect downriver areas against floods and reduce the problem of silting. The Roseiris Dam in the Sudan would have had very negative effects had it been built during those millennia when seasonal flood irrigation dominated Egyptian agriculture, but after the High Aswan Dam was opened, the benefits of Roseiris far outweighed the disadvantages for Egypt, because it trapped Blue Nile silt, thus protecting the Aswan reservoir. The natural domains and the right regimes of resources alter with time, technological progress and the circumstances of stakeholders. Rivers thus fulfil different demands at different places and times, and it is these natural characters that can encourage co-operative action seen as rational individual behaviour. The relationships are more subtle than Hardin's model postulated, because of river hydrology and physical characteristics and the ways in which these produce diversity in man-river relationships.

Rivers, it should furthermore be recalled, unlike the pasture in Hardin's model, always change (in some cases also dramatically) and will continue to do so, not only as a result of human interference but also as a result of changing rainfall patterns, evapotranspiration, cloud formation, atmospheric pressure and so forth. Permanent insecurity and endless fluctuations from year to year and from season to season guarantee that an individual (or state), acting rationally to maximise yield in certain cases might opt for voluntary co-operation to achieve joint control of the river because it is impossible to manage this alone. The point is that the physical world thus presents social science with a set of variables that should not be overlooked in analyses of social actions in specific resource environments.

The way the tragedy of the commons concept fails to take power relationships into account is also a crucial problem of the model as such since it attempts to explain also management practices in large watercourses that cross national boundaries and climatic zones. In such often enormous physical spaces, people have developed a wide variety of resource adaptations, and in some cases these different water-society relations and systems have even helped to form different types of states and political and economic systems. Just one example will briefly be

mentioned here: Egypt, with a strong and one of the most stable state institutions in the history of the world, shares the river with Southern Sudan, most likely the weakest state in Africa and where anthropologists have always gone to study the most extreme stateless societies.²⁶ The state actors, or the equivalent to the herders in Hardin's model, share the same resource – the river – but they tend to conceive of themselves as living in different worlds and also in different 'water worlds'. Rivers, with their diverse hydrological and physical attributes, encourage different ways of relating to the shared water, and stimulate a wide range of economic activities connected to, and ideas about, the common resource. The classic dilemma of a dominant individual incentive that creates a suboptimal social equilibrium is therefore less likely to emerge in such river basins.

Differences in technological capabilities and other social factors as well as physical location along the river affect the ability to participate in collective action. In any river basin, the distribution of both costs and benefits is decidedly skewed, and will continue to be so as long as people live where they live, because their notions of place and space are influenced by their location within the river's overall physiography, hydrology, topography and longitudinal profile. Transboundary watercourses do not constitute common pool resources that can be exploited jointly and simultaneously and this also makes the tragedy of the commons proposition unsuitable; the pasture and the basin are different types of entity.

A related issue is the puzzle of water and property definitions. The problem of defining and delineating property in water raises issues of an even more general nature. Although water is the most important resource of all it is often overlooked or neglected in general discussions on property. In a recent influential book the water issue is typically ignored. *The Law on Property* by Lawson and Rudden states first that not everything is property: 'For something to be property it must in the eyes of the law be capable of being appropriated, so the air, the clouds, the high seas, are not, for legal purposes, property' (Lawson and Rudden 2002: 220). They continue: 'The most obvious distinction among tangible objects is between those which are (more or less) immovable and those which are (more or less) movable [...] The class of immovable is called real property; everything else is called personal property or personality' (Lawson and Rudden 2002: 22–3). Tangible objects include land, living creatures and goods, while intangible assets are commercial paper, stocks, shares and bonds, etc. Neither international rivers nor running water are covered in their discussion, nor is water even mentioned. If it had been, it would have undermined their basic distinction between immovable and movable goods, because water is both movable and immovable.

This duality of water bodies has affected efforts to define flowing water in legal terms. First, there is the problem of assigning territorial rights to objects that are both stationary and non-stationary. The argument that a river must be treated as a functional whole and in this sense is stationary is based on two false assumptions. First, what is described as the intimate causal connections between numerous uses along the river, down-, cross- and upstream. This is a normatively relevant argument and very important in international law, but the extent to which it is a reality is a question that needs to be assessed concretely, since it is far from being a universal condition in river basins. What Sweden has done with the Klara River in Sweden has had no effect on the same river in Norway and what the Dutch did with the Rhine in the delta had no implications for the river's upstream neighbours. The extent to which upstream use of the river affects downstream users is an empirical question that requires analyses of the kinds of interventions involved, of local hydrological and topographical characteristics and so on. Secondly, there is the idea that a river is a kind of 'immovable' object because its banks (although not its waters) are stationary. This assumption cannot be accepted since very few rivers follow exactly the same course year after year. Most rivers change direction and velocity, at least if left to themselves, due to meandering and the physics of moving water, but also due to human intervention, changes in climate, erosion, and so on. Rivers are drawn on maps, but the path of a river can change dramatically over time and maps constantly become outdated. India is a case in point on a grand scale. The sub-continent is called the sub-continent of 'forgotten cities' because the rivers change courses and leave behind cities established on their banks (Wood 1924: 3). The Huang He has regularly shifted its course, sometimes, in the nineteenth century, by more than 1,000 kilometres from one year to the next! The Semliki River, a Nile tributary, has been the borderline between Uganda and the Democratic Republic of Congo. When it started to change its course it moved the national borders, since the border lies in the middle of the river. It is expected that in the very long run, the Brahmaputra may dramatically change its course and perhaps no longer flow into India. On a smaller scale, streams change course all the time and because of these natural characteristics produce all sorts of social conflicts and co-operation challenges between neighbours and farmers. Rivers are far from stationary even if they are defined by their banks, and are therefore not stationary topographical phenomena. The fact is that it is not only their constituent elements that are on the move, but often also the rivers themselves.

A river cannot be defined as a stationary object, since the water and also its banks are not parts of an organised whole that maintains and

reproduces the river's functions, because the functional organisation does not necessarily remain the same.²⁷ Rivers often continue to water their surrounding environment in the same way year after year, but in very many and important cases rivers do not follow such paths of regularity. In fact their geo-stationary features and functions vary, and since rivers are far from being topographically constant, claims of river control cannot be based on the idea that they are geo-stationary objects. Rivers have banks between which water flows, and in most cases they run from inland to a sea, but not always, and their velocity and water discharge will of course also differ in time both due to natural and social causes. Their waters have an average, approximate depth and speed, but these values change dramatically from place to place and from year to year. But, although they are not geo-stationary objects or 'immovable objects', their waters are amenable to physical division. It is also possible to divide a river, and separate essential elements of the functional organism from the organism itself. Intra-basin water transfers have taken place for centuries in many places, and also on a grand scale as in Sri Lanka, where for hundreds of years rivers have been artificially linked to other rivers in other watersheds, making it necessary to think more deeply about the different physical and man-made levels that constitute a river basin or a watershed. A river is not like a living organism, and therefore it is a divisible mass. The interconnected functions of disparate parts of the river do not resist artificial division.

The point is that, contrary to common wisdom, down- and cross-stream states can exercise vital unilateral jurisdictional authority over their riparian regions without co-operation from up- and cross-stream states. States can also and do exercise unilateral jurisdictional authority over their own section of the river. One can argue on ethical grounds that states should not possess this power, but one cannot argue that riparian states are unable to exercise or incapable of exercising their rights without the co-operation of other states, because of the nature of rivers. There are many good reasons for shared jurisdictional authority, but this 'natural' argument does not 'hold water'.

The characterisation of flowing water as common property generally places it outside the range of things that are capable of being owned. While this is true from one point of view, it is not the characterisation that is the point, nor the social construction of water as a resource. It is the resource itself and its characteristics in nature and in society that evade the usual definitions of property, and it is precisely this that makes this especially interesting and challenging when management issues are involved.

THE ENIGMA OF WATER AND THE QUESTION OF TEMPORALITIES

The water-system approach may also be useful for discussions on how to handle the temporal dimension empirically in social science and history. The nomothetic idea that science should formulate universal laws on the one hand and the idiographic conception of history as a record of particular events on the other both tend to ignore the problem of the temporal dimension (Wallerstein 1998). Given the aim of establishing social laws, the nomothetic tradition is concerned with neither the long nor the short term, since time is basically either a problem, irrelevant or an analytical residue. Historical research primarily concerned with particular events does not naturally require reflections on temporal dimensions. In dealing with particular topics or events located within the 'eternal' relationship between water and society and the diversifying influence of waterscapes on social structures over long periods of time, both approaches are clearly inadequate and reflections on time become a must.

Notions of time and the unequal chronologies of societal and natural developments have laid the foundations for the belief that societies and social change are influenced by social variables alone. Human beings have existed for about half a million years and *Homo sapiens* for about 100,000 years and during all this time they have been forced to relate to the waterscape surrounding them. For most of this period very little happened in terms of social development or control of water, but the water jar was invented which was important for the development of settled agriculture. Agriculture which required some form of active interaction with the waterscapes is only some 10,000 years old, and the classic agricultural civilisations based on irrigation, natural and artificial, date back no more than about 6,000 years. If we think of the entire span of human existence as a 24-hour day, settled agricultural relationship and its new relationship to water would have come into existence at 11.56 pm, the irrigation civilisations in Asia and the Middle East at 11.57, while industrialisation began to develop only at 11.59 and 30 seconds. Yet perhaps as much change has taken place in the last 30 seconds – when the hydrological cycle's geographical variations have changed very little – as in all the time leading up to it. Compared to natural changes in the hydrological cycle in the same period, the links between social development and the physical environment seem therefore to be very weak. However, the eternal laws of nature and of the hydrological cycle have laid the foundations for the diversification of social development, and they manifest themselves within human lifespans, and even minor changes in the way water runs through nature and societies often had major social, economic and political consequences.

One way of discussing the fruitfulness of the water-society system concept in this context is by approaching it via Fernand Braudel's ideas about time. One of the most influential attempts to address the temporal problem in history and the social sciences is that of the French historian. Braudel argued for the usefulness of thinking in terms of different timescales. He wrote:

On the surface, the history of events works itself out in the short term: it is a sort of micro history. Halfway down, a history of conjunctures follows a broader, slower rhythm [...] And over and above the 'recitatif' of the conjuncture, structural history, or the history of the *longue durée*, inquires into whole centuries at a time. (Braudel 1980: 74)

Braudel's famous suggestion was that we should deal with three timespans of history: events, cyclical movements and *longue durée*. He also discusses the '*extrême longue durée*', a potential fourth timespan.²⁸ The second foundation for his notion of time is that of 'simultaneity', which combines the past, present and future in the historical examination of objects (Santamaria and Bailey 1984: 79). The effect of this way of thinking about the temporal dimension in historical and social studies was to enable analysts to 'dissect historical time into geographical time, social time and individual time' (Braudel 1980: 21).

Braudel has been criticised for not being able to reconcile his three time frames or establish clear relationships among them, as well as for a kind of determinism, being primarily concerned with factors which inhibit transformations or the notion of the exteriority of social facts which constrain and channel human action. His ideas of time will be better understood if they are seen as having been developed in connection with his study object and the particular temporal relationships between the different elements in his narratives. He worked out his notions of temporalities in his masterpiece about the history of the Mediterranean world during the age of Philip II, as is also reflected in the way he divided his story into three main parts: the role of the environment, collective destinies and general trends and events, and politics and people. This division of 'different times' was perfectly logical, given Braudel's focus on one of the world's oceans as the ecological and geographical determinant. The Mediterranean is an object of the physical water world, but is characterised by its relative changelessness. It did not change at all in the historical period analysed by Braudel.

In Braudel's narrative, geography is therefore by definition synonymous with the long term, and it had a kind of foundational implication for his understanding of the relationship between environment and time in general. In contrast to this geographical time Braudel discusses the

'resounding events' in societies, described as 'momentary outbursts, surface manifestations of these larger movements and explicable only in terms of them' (i.e., in terms of longer-term social factors or structures) (Braudel 1980: 21). If instead we focus on freshwater systems, rivers and rainfall in the local hydrological cycle, that is, on elements in nature that are characterised by being both eternal and always in flux, and also strongly influenced, in both the short and the long term, by both humans and natural forces, one thing becomes immediately evident: the environment or the physical world as such cannot be put in a box labelled 'structural history' and defined as belonging solely to a history of *la longue durée*.

Resounding events, such as a great flood, may not be surface manifestations of these larger movements. Furthermore, these sudden, 'resounding events' in nature or the man-made environment, may change the geographical conditions and establish a new structure of long-term relevance within which future short-term events may be explained. The role played by water-society relations thus cuts across the temporal dimension and the distinctions made by Braudel. It is much more dynamic and complex than a 'dead sea'; it belongs both to the *longue durée* and to short-term events (sudden floods or droughts or a morning rainfall or a changed river caused by a dam across it). The water-system approach thus avoids the fallacy of relegating nature to an introductory chapter, as a geographical, almost permanent and unchanging backdrop to human action. Research and reconstruction of what are here called hydrosocial disturbances will deepen our understanding of temporalities in general.

A focus on water rather than on geography as such, always conceived of or structured in certain ways, does not entail a particular adherence to any one of these three timescales. The local hydrological cycle and its variations and the role of large river systems do not imply a social reality of a certain duration, or of the long term, in spite of their permanence, since they can undergo and cause or stimulate dramatic short-term changes that lead to social adaptation to a new condition under which other relations between water and society structure social and economic life. The atmosphere traps the moisture of the earth, so the amount of water on the planet is more or less constant, and the water we drink is the water that the dinosaurs drank. There is no such thing as 'new' water, and it is impossible to describe water as undergoing a 'birth, youth, mature period and death', a much-used metaphor for historical periodisation and for life itself. But since the water that falls as rain today is the same water that fell on prehistoric man, the dinosaurs and the earliest forms of life on earth, nature is engaged in a never-ending process of recycling our planet's water. Rainfall lands on the earth, heat evaporates the water, the vapour rises and cools and forms clouds, and once again the rain falls. Water's time is

therefore both cyclical and eternal. There is no new water to create, and there is no old water to lose, and therefore the relationships of societies with this resource are very different from their relationships with other controllable resources. The continuities and changes in how humanity has related to the planet's water are therefore some of the fundamental and permanent conditions of world history. The reconstruction of these interactions will therefore be a history of deep rhythms but also, and very importantly, of sudden events that, if water is put in the centre of the picture, will open up for new periodisations of world history.

However, the enormous variety in society/water confluences can also illustrate Braudel's useful notion of simultaneous times, but from a new angle. The hydrological cycle and the structuring roles of rainfall and river patterns make the combined presence of the past, present and future of water an important aspect of social life. The current way of managing water reflects both the physical and anthropogenic layers of waterscapes of the past as well as expressing the dominant current ideologies surrounding water. As substantiated, efforts at controlling, moving or channelling water will have long-term effects, because of its importance to social life, its ability to stimulate adaptation and the long-term structural implications of dams and canals for economic activities, patterns of settlement, etc. Analyses of the relations between the hydrological cycle and the hydrosocial cycle and the study of the role of water in societies will evade the sense of material necessity often associated with Braudel's notions, simply also because dramatic water events may change the structure of the *longue durée*. During this long history of society-water interactions there are many examples of individual water engineers fundamentally altering the basic structuring properties of a river system. Large dams, for instance, have completely evened out seasonal variations in the very flow regimes, to which societies in their pre-dam existence had adjusted their rhythms. Such structures fundamentally alter the lives of both people and ecosystems downstream 'forever', for several direct and indirect reasons. A single event can thus disturb the regularity and predictability of everyday life, with profound long-term impacts that establish new forms of regularity and predictability to which societies adjust.²⁹

A focus on water-society relations therefore makes the distinctions between geographical, social and individual time more complex. Extreme natural hydrological events and societies' ability to affect river systems fundamentally by sudden water control initiatives may have long-term, potentially irreversible impacts in both the short and the long term. Both the social and the physical water world can be impacted in both the long and the short term, even potentially creating brand-new structures of importance to how people relate to their waterscapes. This type of

simultaneous duality sheds new light on the question of temporality. A water-system perspective permits the simultaneous integration of the *longue durée* and the short term. The latter is not regarded within this way of thinking as solely situated within the longer duration that envelopes it, but, in contrast to Braudel's ideas, it demonstrates its repetitiveness and highlights the logic of the dramatic event but occurring within a structure; it pinpoints the position of the event along the cyclical movements of conjectures but related to a geographical structure of the long term. Dramatic short-term changes in the waterscape may represent a break with the past and should not always be explained as being embedded in it,³⁰ and hydro-historical research, yet in its infancy, will make that clear. The way a sudden flash flood caused by sudden changes in atmospheric pressure and a course change caused by silt being deposited over centuries in the same river at the same time will be located in different temporalities, and these changes are not accounted for by the *longue durée*. The continuing dialectic relationship between human activities and natural phenomena manifests itself in both the waterscape and society at definite periods in history. Where the Braudelian tradition encounters problems in explaining transformation and change,³¹ a focus on human adaptations and waterscape brings such issues to the fore. A dynamic vision of history and geographical time highlights both continuity and the *longue durée*, and cyclical change and short-term political and economic developments.

A historical-geographical archaeology of water-society relations will challenge the idea that there is an irreconcilable divergence between natural and historical time. It is precisely due to this fact – the monsoon brings rain, water always evaporates in the heat, rivers swell with snowmelt in the spring, etc. – that the cyclical and directional nature of water exists independently of human concepts of it at the same time as it influences social and human perceptions and changes of time. Water's elusive imprint is a permanent, though continuously changing feature in nature, society and in the life of every human being in the past, present and future.

Based on an acknowledgement of the role of interactions between society and water over time, the following notions can be suggested: one timescale must be geographical and climatic, a history in slow motion in which permanent structures in the waterscape and this relationship can be detected and highlighted. Unlike Braudel's perspective, however, this approach does not play down the ordinary sequence of political, military and societal events, which are not reduced to something almost insignificant compared to the long geographical cycles of imperceptible, slow, repetitious, endless movement. This difference is related to different conceptions of time that the water issue as discussed here can illuminate.

Time is a very important factor in understanding the types of action and interaction that take place between dynamic water structures and dynamic social systems. By regarding this relationship in different time perspectives it becomes clear that the water-humanity relationship is not one of direct determinism. Since water is universal and has always been a vital though changing and changeable resource for every society, the issue of how to understand duration, time and discontinuity becomes crucial, and a focus on water will deepen our understanding of the role of time in social development.

WATER-SOCIETY INTERACTIONS AND STRUCTURATION THEORY

Anthony Giddens' famous structuration theory overlooks the importance and impact of the water-society nexus and thus cannot be accepted as a universal theory of the duality of structures. It suggests the balancing of agency and structure by referring to the *duality of structure*, but the structuration theory misses the heterogeneous complexity of real time-space distancing and the fact that routine actions take place within or in relation to different natural systems that may also be radically shaped by human actions, whether instantaneously or over time. Giddens' theory was an alternative to the orthodox consensus in sociology that regarded behaviour as the result of forces that actors neither controlled nor understood. He argued instead that social action creates these structures, and that structures exist only in and via the activities of human agents (Giddens 1989: 256). The theory emphasises that action is conditioned by existing cultural structures and creates those structures through the process of enactment; they are products of regularities of social reproduction (Giddens and Pierson 1998). Structures are defined as 'rules and resources organised as properties of social systems'. Human social activities 'are recursive, not brought into being by social actors but continually recreated by them via the means whereby they express themselves *as* actors. In and through their activities agents reproduce the conditions that make these activities possible' (Giddens 1984: 2). Structure consists of rules and resources recursively implicated in social reproduction. Giddens' structuration theory is therefore clearly embedded within the dominant social science tradition where what explain social facts as a structure are other social facts. Giddens conceptualises the social world – what people are saying, doing and believing and their actions and interactions – as something that can be understood as being fundamentally unconnected to or uninfluenced by the natural, physical world,³² and that causes problems in analysing real time-space distancing. According to this theory, structures enjoy

an ontological status that privileges them over agency, and they thus determine material and symbolic relationships of myth or language. The social systems that emerge, consisting of reproduced structures, should therefore be analysed as the result of social factors, all in line with Durkheim's dictum.

Giddens' theory of society and structures therefore takes no account of where in space social life and actions are reproduced, and whether the recurring patterns of social actions occur within, for example, to take some extremes, a desert environment, in settlements in a marshy region prone to repeated flooding or in cities and villages where the pulse of the annual monsoon defines the rhythm of life. The modality of a structural system enabling human action is therefore not only the product of translated actions. The patterns of translated actions over time will reflect different relationships to different waterscapes, and because the hydrological cycle or waterscapes in some cases may even directly impact on social structures (for example in the case of sudden catastrophic floods) it may also occur irrespective of translated actions. The theory overlooks the fundamental diversifying and structuring role of the hydrological cycle and the workings of water. On a grand scale these create climatic zones and diversify landscape formations that will impact on patterns of settlement, economic activities and trading patterns. They create diverse structures of seasonality, precipitation patterns and trading routes that in turn systematically influence human actions and agents, and thus also those structures created by human action. More locally and in a short time perspective, whole communities may be swept away by floods or droughts and social institutions changed or reformed in their wake.

Structures are created by action, but we cannot understand similarities and differences in the acts of the actors without bringing into the picture *a priori* physical or hydrological structures that are also changeable by both nature and by the actors themselves. For example, the structural impact of the Nile on Egypt via social action creates new structures that by far overshadow the importance of any other structure in that society. It allows the 'binding' of time-space within the Egyptian social system, and makes it possible to understand both changes and similarities in social practices existing across time and space. The Nile is not a structure that can be reduced to a structure that enters simultaneously into the constitution of the agent and social practices and 'exists' only in the generating moments of this constitution. This structure is both beyond the realm of human control and can be impacted by man; action does not create it but might impact it, and the relationship may well change over time.

The water-system approach will make it clear that the duality of structures is of a different kind from that proposed by Giddens. In this

context it is essentially a process whereby structures of the hydrological cycle or the workings of water over long periods of time create a systematic foundation for specific actions that continuously enact structures and thus social systems, and these social systems in turn express this duality. This approach recognises both the hydrological and social cycles and, in examining social systems, it examines physical *structures* and human modifications of these physical structures, conceived of as interaction and action, and ideas and plans. The physical waterscapes constitute a long-term structural but also dynamic process that operates behind the backs of humans, and which furthermore shapes actors' constraints and influences choices. Over time, particular waterscapes have produced extremely diverse through fundamental patterns of social behaviour (i.e., rice paddy/potato cultivation, artificial irrigation/rain-fed agriculture, bathing rituals in Indian rivers or cleansing rituals in the deserts of Arabia, etc.). Since every society always needs water for most social activities, the structure of the water cycle helps to delineate what social actions are possible and rational. A social system's enduring patterns of social relationships will be influenced by both the continuous and changing natures of the waterscape or river system. The triple-layer water-system approach reflects and integrates the dichotomy between non-material social structures and material water structures, both of which need to be analysed as structuring human action at any given point in time.

Giddens' concept of 'reflexive monitoring of actions' therefore takes on another meaning in this context. Reflexive monitoring is concerned with the ability to look at actions in order to judge their effectiveness in achieving their objectives. With regard to water and water control and water usage, agents in some cases reproduce structures through action, but in other cases this is impossible because the structures that frame actions are not created by these actions (i.e., the annual flood pattern of rivers or seasonal variations in evaporation and precipitation). In some cases, agents do whatever they can to erode existing structures, but they may end up strengthening other structures that contextualise actions (i.e., building dams that eventually collapse, as has happened many times in history). Waterscapes continually produce structures that fundamentally impact on the arena of agency and human action, enabling the construction of *qanats* at the feet of mountains in Oman followed by the system of using the moon and a stick to allocate water among farmers, or the basin irrigation on the banks of the Nile that required social organisation and high-level state water managers, in order to develop agriculture, and human action produces and reproduces waterscapes that will structure human action again, from large dams to urban water supply and sewage systems. Agency in relation to water can thus lead to the reproduction, continuation and transformation of society.

The character and content of this human–water relationship differ in space and time, and these differences are re-enacted as social structures every day in all societies in different ways. Since water is essential to life and societies will collapse if they lack sufficient water, the waterscape and human relationships with it are fundamental and enduring, though shifting, components of all societies. The combination of physical stability and flux makes water a dynamic force of both continuity and change. The features of physical reality and physical positions, in a river basin for instance, inform the parameters for social action, and therefore the capacity of actors to produce and reproduce a particular social world. The ways in which rivers run have established structures that made some societal adaptations possible and others less likely, both before and after waterscapes were put under human influence or control, and both when rivers behaved ‘normally’ and when their hydrological character changed suddenly and dramatically. Examples of this are the Huang He flood of August 1931 when 88,000 square kilometres of land was flooded and somewhere between 850,000 and 4 million people died, usually regarded as the most serious natural disaster in recorded history, river captures in India, where even major rivers have been captured by other meandering rivers, or dyke collapses, such as in the Netherlands in 1953, that led to an overhaul of the Dutch water system and a strengthening of the water boards.

The water-system methodology enables us to perform comparative research to find out how far similar types of such systems tend to encourage similar social solutions or social structures, and to what extent different social solutions reflect different structures of water-society interactions. The hypothesis is that as far as other historical conditions remain equal, major structural and structuring differences in water-society relations will be an underlying factor in explaining institutional differences, not usually as a direct cause but as a condition encouraging different development trajectories and institutional diversity. There is little doubt that physical structures in some cases encourage the establishment of specific social structures, which can radically change in a moment due to abrupt changes in the waterscapes, such as floods, or to abrupt changes caused by water control efforts. In other words, long-lasting social structures can be rapidly transformed as a result of physical transformations. Thus we cannot understand why certain social structures exist without understanding the water landscapes and the water cycles or how humans have related to them in the course of time. The structure of rivers or waterscapes in societies has conditioned the choice of technology and water control efforts and plans. Waterscapes also structure patterns of settlement. Most cities have been located on riverbanks or close to other water sources out of dire necessity, but rulers, from the Romans to socialist local governments in

Scandinavia to Stalin and Vivendi, have also made water come to the settlements and cities, but always in ways that are constrained by the particular waterscape, whether man-made or not. Different waterscapes and different confluences between society and water have encouraged development of different technological systems and traditions to take these different conditions into account, as they also, although in very different ways, encourage different institutional traditions (e.g., the role of public works departments) and habits of thought (e.g., feminine attributes of Asian rivers and flood myths in many religions).³³ The water-system approach objects to and handles a theory of agency that reduces all acts and all structures to reflections of social meaning and action. It counters the inherent reductionism by acknowledging, for example, the need for understanding what can be called 'water structuration'.

THE 'DEATH OF NATURE' THEORY AND THE UNCONTROLLABLE WATER

A contemporary school of thought will claim that an approach focusing on the relationship between the water cycle and societies is anachronistic, even pre-modern perhaps, because modern society or capitalism killed off nature; now nature is 'dead' and the hydrological cycle has become a hydrosocial cycle. This section discusses and criticises the ideas of the 'Death of Nature' argument and its logical consequence; the idea that the hydrological cycle is not natural any more and should be conceived of as a 'hydrosocial cycle', the aim being to further explain in another context and from another angle the analytical approach and conceptual tools suggested in this book.

There exists a very powerful historical narrative that holds that nature is dead and that 'nature does not exist any more' because of human interference with it during the Industrial Era. The dominant story goes like this: Man's attempts to control nature, at least on a grand scale, started with capitalism and modernism, unleashing forces of control and destruction. Money, greed, technology and organising capacity launched a process that still haunts humankind. This idea of the onslaught of modernity on nature forms the premises of much current research on human-environment relationships. This story captures important developments and reflects the fact that the untouched wilderness is a thing of the past. Humanity has left its footprints all over the globe and there is very little 'pure' nature left, resources have been depleted, and even climate has been affected. But when we consider the relationship between water and society, then the statement that nature is dead is not only unduly anthropocentric, it also contradicts undeniable facts.

First, we cannot talk about 'the situation of nature' in general without talking about water, since no natural resource is more plentiful than water. Arguments that suggest that nature is dead must therefore also mean that 'water is dead'. And conversely, if water is not dead, nor can nature be. Secondly, if the argument is that nature is dead due to human interference then water should definitely be dead since humans have attempted to control and tame this part of nature for a longer time and more systematically than any other part of nature.

Water has been regarded both instrumentally and as a religious, ritual object from the time of the first irrigation canals of ancient Sumeria and Egypt until the present. The canal builders of Mesopotamia, the land between the rivers as the name signifies, had their names inscribed due to their importance for bringing water to the farms and to the city states, while it was the ejaculations of the river god, Ea, that created the world and life. In Egypt the first representation of the first Pharaoh shows him excavating a canal, and thousands of years ago the Egyptians dug a canal from the Nile to the Red Sea, many kilometres across a rainless desert while they worshipped Isis and Osiris and the other gods who presided over the life-giving waters. In China the Jade Emperor Yu became a legend because he tamed the wide, marshy river deltas, thereby creating China and thus the world, while almost 2,000 years ago China started to construct the Grand Canal from Yangtze in the south to Beijing 1,800 kilometres to the north, an engineering project that in complexity and control surpasses many projects in today's world. The Roman emperors radically altered the local waterscape and brought water into the imperial city via aqueducts and underground tunnels from reservoirs outside the city. The Mayas built their reservoirs to store rainwater more than 1,000 years ago, and the rulers of the Mayas were also gods because they were believed to be the guarantors of the water and the water-control system. Water was also controlled in Sri Lanka from the twelfth century and in Yemen where the Dam of Ma'rib dammed the Wadi Adhanah almost 3,000 years ago. Water has thus been controlled, tamed, dammed and piped for thousands of years. So a view of history that limits attempts to control, subdue and tame nature to the period of modernism and capitalism is mistaken. People have long managed to control nature on a grand scale, modifying entire river systems. As far as the most central of all resources in society are concerned, no radical changes in water modifying technologies are connected to the Industrial Revolution or capitalism, except that in some parts of the world the level of technology that made a more intensive exploitation of the energy of water possible was higher, while the fundamental relationships remained the same. During the 1990s, historians and social scientists published analyses about the 'death of rivers'. The Colorado and Columbia Rivers in the USA became

cases in point,³⁴ 'raised, fattened, and slowed', they were dead rivers reduced to pure technology. Columbia River had been transformed to an 'electricity-irrigation-transportation machine'. 'There are no rapids at all, nor are there waterfalls, riffles, eddies, sinkholes, or a single "agitated gut": The Columbia does not flow, it is operated.' These analyses capture a clear historical trend in the twentieth century; due to the importance of water and the growing multifunctionality of water, many rivers running through societies became engineered rivers.

The Colorado River is definitely one of the most controlled and modified large river systems in the world, with the Hoover Dam as its foremost symbol. But to talk about the 'death of nature' in connection with the Colorado River is not very appropriate, because it neglects the issue of scale in the water cycle. Water – unlike other resources that are exploited by societies – is never totally 'killed off' or destroyed. It exists in both nature and in society in the same form and it always re-emerges as clean water as it falls from the clouds – whether on the surface of watersheds in the jungle or on the roofs of skyscrapers in cities. Unlike fossil fuels, forestry, phosphate and other natural resources, the total amount of water does not diminish even though humanity is consuming more and more of it, since there is as much of it now as there was when societies were first established. Moreover, water cannot be entirely controlled, since eventually it always slips out of the hands of the controller, much of it literally evaporating. And, most fundamentally, the governing forces of the hydrological cycle, first and foremost solar radiation and then the wind, are beyond human control. The Colorado River can be controlled by the US Government, so the river with its naturally produced banks and waterfalls may not exist any more, but the waters in the ditch are not dead. The water re-emerges somewhere else, still beyond the full control of mankind. The 2014 drought, which at the time of writing this book is dealing a tough hand to the arid regions of North America, illustrates just how the annual snowfall in the Rocky Mountains – or lack of it – is ultimately establishing the limitations and possibilities for managing and distributing water shortages in Arizona, Nevada and Mexico in the coming years because it is the major force deciding how the water is running in the Colorado.

There can, however, be no doubt that the primary meanings ascribed to water in the twentieth century were produced by those controlling water through engineering, law and economics. Flows of water in many countries in the world thus embody more and more the values and priorities of modern societies and technology as well as 'social struggles and conflicts' (Swyngedouw 2004: 4). But, most importantly, the workings of the water cycle and the enormous amount of water that is not part of this cycle make it evident that the earth's water system is still only

marginally influenced by human activities, although more and more of the water that falls as rain and as run-off is controlled by humans in one way or another. Although most rivers in the Western hemisphere and in China are controlled and tamed and exploited, it seems odd to generalise this situation for the world as a whole. Ethiopia, the potential water power centre of East Africa and the Middle East, had until recently, with the building of the Renaissance Dam, barely tamed any of its major rivers. Nepal and Bhutan have gradually begun to dam some of their rivers. In a world in which enormous river basins, like the Congo in Africa, which is scarcely managed and where seasonal streams run freely as run-off down mountainsides and in the bottom of remote mountain valleys and millions of mountain springs emerge under no form of control at all, it is at best premature to talk about the 'death of rivers', 'death of water' and hence also 'death of nature'.

A logical implication of the concept maintained by the 'nature is dead' theory is that it is no longer fruitful to use the term 'hydrological cycle'. It should rather be substituted by the term 'hydrosocial cycle', because 'practically every body of water on the planet bears traces of human involvement in the form of minute quantities of anthropogenic substances such as chlorinated organic compounds' (Linton 2010: 229). The argument is that everywhere water bears the traces of its social 'background'. The water question is within this perspective not simply 'about water', since water is a 'process' that 'occurs through us', a 'self-identical object', and an identity formed within social relationships. A typical expression within this way of thinking will be that water becomes what it is in accordance with a particular kind of engagement, that is, water becomes what we make of it; it is basically a social construct.

Of course, the water-society cycle is a social recycling process, but it is also impacted by physical processes existing outside the social world, and whether it is conceived by humans or not. New research in the history of the hydrological cycle makes this philosophical argument empirically more and more evident and relevant. The water cycle is still primarily a physical process that to a certain extent and in some areas is influenced by social relationships and is conceived of and understood in different ways by different social actors. To argue that water is what we make of it is unfruitful and empirically absurd, since water exists without humans at all, and existed long before societies were established. First, the hydrological cycle has not therefore *become* social although there are human elements to it, or humans influence or humans conceive of it. Since the cycle is a cycle that is part of the earth system and water re-emerges as clean water, untouched by humans, we cannot describe it as having become social. The very nature of water circulation must not solely or primarily be described in social terms. To do this would be

to overstate the power of human beings. Compared to solar radiation and the force of the winds governed by water's movement, the power of man is negligible. And secondly, to argue that the hydrological cycle has *become* social requires an answer to the questions: just when did it change from being a hydrological cycle to a hydrosocial cycle? What are the variables that caused or represent this extremely important shift in history? And, finally, how can this great shift be described, that is, how exactly has the hydrological cycle been changed and where and to what extent? The proposition cannot be substantiated. To argue that the waters of the oceans, the waters of the Amazon that represent some 25 per cent of all river water in the world or the waters of Lake Baikal, 25 million years old, 1,700 metres deep and containing 20 per cent of the world's total, unfrozen, freshwater reserve have become socialised or are 'a process that occurs through us' is wrong from whatever perspective one regards it. We can say that a lake or a river is destroyed, that forests are destroyed, that oil resources and fish stocks are depleted and have become victims of social process, but it is not possible to say the same about water.

The term 'hydrosocial cycle' has, however, important ontological and epistemological implications. It also overlooks an important characteristic of water, and one that theoretically undermines the 'nature is dead' theory or the concept of the 'hydrosocial cycle'. Water is unique since it does not change its character by being appropriated by society or humans and will always ultimately escape the attempts of mankind to take control over it, since it is always on the move, from one place to another and from one physical state to another (from liquid to vapour to liquid). Thus, by its very character and relationship to humanity, it undermines the conventional boundary between society and nature, with consequences for how we understand nature-society distinctions and relationships in general. The waters in a river may be polluted, or a wetland be destroyed, but the water itself will always reappear, after its 'journey' through society as a social good, as clean natural water. Unlike an apple, which stops being an apple after it has been eaten, or a tree that ceases to be a tree after it has been turned into timber, water is always water, in the environment and even after it has been consumed by a biological organism. For the same reasons, and unlike other resources, it cannot be completely appropriated. The implications of these insights are huge for how society, modernity and history as such are viewed.

What our efforts to control water have demonstrated is that it cannot be completely controlled, and that it always re-emerges as pure nature. The efforts of societies to bring it under social control demonstrate the limits of socialisation. The temporary nature of social power is contrasted and highlighted by the permanence of the hydrological cycle. It means that the water-system approach enables us to study what happens

when natural and anthropocentric forces combine, and when our activity reinforces trends in the landscape and the opposite. Instead of talking about only the hydrosocial cycle, one should analyse both the hydrological and the hydrosocial cycles and their inter-relations and the historical development of hydrosocial redistribution. It has proven to be extremely difficult to disentangle the relationship between nature and society, but the problem should not be solved simply by getting rid of it through definitional exercises, since the water cycle will continue to impact on social and geopolitical developments in the future.

THE 'UNITY OF NATURE' AND ITS DECONSTRUCTION

This book argues in favour of a binary research strategy focusing on water, not as a one-factor explanation but rather as an effort to battle reductionism and determinism: (a) to propose a water-system approach to the empirical study of development and history because of the crucial role played by water on our planet and in social life, and because such an approach will help to solve some important conceptual and methodological problems of research on societies in general; and (b) to dismantle the way in which established dichotomies between nature and society have been drawn, and deconstruct the notion of nature as a useful *analytical* category, not least because this would make it easier to theorise about extremely multifaceted and complex environment–society relationships.

One reason is practical and empirical; it is not possible to examine empirically the relationships between and interdependences of societies and nature or environment as a whole, since both nature and society are such extensive, complex phenomena. The terms 'nature' and 'environment' are such elastic terms and cover such a myriad of variables and aspects of importance to societies that meaningful, empirically oriented research or well-focused discussions become virtually impossible. For the purpose of the argument here it is not necessary to disentangle all the various threads of discourse surrounding the concepts,³⁵ which can refer to anything from the object of study of the natural and biological sciences, to anything 'non-societal', as well as metaphysical issues regarding different modes of being between the human and the natural. As Raymond Williams noted: nature was 'perhaps the most complex word in the language' (Williams 1980: 221).

Moreover, the conceptual and methodological implications of the fact that the relationship between society and nature will vary according to what kind of element in the non-human sphere one is emphasising have not yet been adequately addressed. The deconstruction of the 'nature' concept here has therefore nothing in common with the constructionists'

discussion of 'natures'. They argue that there is no single 'nature', only 'natures', and that 'these natures are not inherent in the physical world' but rather 'discursively constructed through economic, political and cultural processes' (Macnaghten and Urry 1988: 95). The argument of this book is the very opposite: because nature is a physical reality, and because it is so diverse and enters into so many relationships with societies, and that environment without a referent can mean everything that surrounds everything that exists, it is unwise to study the evolution of human-nature relationships or society-environment relationships in general.

Comparative studies of human-nature relationships or environment and socio-cultural relationships have proved to be problematic due to the fact that different elements of nature have played various roles in different societies and in relation to different societal sectors at different times.³⁶ Some of the best-known studies of environmental history and human-environment archaeology have therefore in practice not analysed the relationships of societies to the environment and their interconnectedness with nature as a whole, but only certain elements in nature and/or sub-systems of societies' relation to them.³⁷ The historiographical tradition demonstrates that some sort of deconstruction of nature as a single entity is in practice unavoidable in empirical studies.

The criticism of the term 'nature' should be qualified. To reconstruct how societies' *ideas* or *discourses* about nature have revolved around discourses about nature conceived of as an entity is important.³⁸ The concept of 'nature' has been fundamental to the ways in which science perceives and conducts itself. It has generally been understood as a unity and as an aggregate opposite in relation to society. This dichotomy between nature and society has a long tradition and is deeply ingrained in Western thought (Glacken 1967), traced back at least to Aristotle for whom nature (*physis*) was that which is not made by humans, in contrast to *techné*, that which is of human origin. This tradition in philosophy and religious speculation and discourse has been concerned with nature as a whole – often and for a long time only as a God-given entity – and the place of humanity within it. Romantic and pastoral attitudes have envisioned nature as being opposed to society – as a refuge. As a holistic 'other' it has been regarded as offering physical, psychological and spiritual respite from the fragmented lives of modern society. The literature on the history of perceptions and images of nature and the environment is extensive (Glacken 1967; Worster 1985a [1977]; Pepper 1996; Coates 1998; Buttimer and Wallin [eds] 1999), and it all testifies to the importance of this term. More recently it has also become a core term in the influential normative and ideological project of the 'saving of our planet', and has as such influenced research designs and research questions in fundamental ways. Within this movement, the unity of

nature or environment is a metanarrative, and the term 'nature' has therefore, and is intended to have, a useful and sought-after totalising function. Historical studies of environmental philosophy and thinking have mushroomed during the past few decades (e.g., Pratt et al. 2000; Jamieson 2001; Gottlieb 2003; Selin and Kalland 2003; Turner 2005; Callicott and Palmer 2005; Radkau 2008). The narrative aim of many of these studies has been to foster a holistic approach to nature and the environment, supporting the modern environmentalist movement that has preached and developed a philosophy of human conduct related to 'nature' as a whole. The goal of learning to see nature as a unity comes out very clearly: 'One may hope that research in environmental philosophy will eventually produce a single set of universally valid environmental attitudes and frameworks that will transcend all [...]' (Callicott and Ames 1989). This view on modern ecology as a way 'to healing our planet' indicates the importance of it; it has been described as marking off 'a particular era in history' (Worster 1985a [1977]: 360); the 'Age of Ecology' (Worster 1985a [1977]: 342). In 'deep ecology' ecology is by definition holistic and even self-healing as an organism (Rolston 1992).

The suggestion of a deconstruction of nature for analytical purposes might meet politically and ideologically inspired opposition, since, as Worster has suggested, Gaia is the most widely accepted scientific metaphor in the Age of Ecology, and the main function of the Gaia metaphor is precisely to emphasise that nature should be regarded as a single organism.

Gaia theory looks at the whole Earth from the outside and sees it as a live entity; modern science looks at the surface details and gives us an inventory of the parts [...] There is more to Gaia theory than a change in viewpoint; the theory enters the realm of emergent phenomena; a place where the whole is always more than the sum of the parts. (Lovelock 2000: xii)

The Gaia thesis and the new ecological movement inspired a veritable flood of literature that argued against what was called the 'atomistic-mechanical' image of nature. The failure to see nature as a unity and as an organism has been condemned as the root of the ecological crisis. The holistic-organic reality 'discovered by contemporary ecology' represented the way out (Callicott and Ames 1989), and has been described and hailed as crucial in order to save our planet. The monumental five-volume work *Environmentalism: Critical Concepts* (Pepper et al., 2003) is telling in this context: it discusses a number of critical concepts, but not the fundamental constituting idea of nature or environment as *one thing*.

Nature, through this lens, must be seen as a unity,³⁹ or even as a single organism. Studies within this tradition typically argue normatively in

favour of the nature concept; science 'can be a corrective to the prevalent tendency of humans to see themselves as separate from nature, above nature, and in charge of nature'.⁴⁰ The goal of examining the reciprocal relationship between humankind and nature has been described by some as forging a 'New Ecological Paradigm'.⁴¹ This novel social science environmentalism has often aimed at fostering a holistic approach to viewing and studying nature and the environment. Accordingly, humans and nature should be regarded as an inclusive whole, primarily for political reasons; it will lay the foundation for political success, such as 'green change',⁴² or more 'green politics'.⁴³

As has been shown in this book: water is the one identifiable part of nature that all humans relate to in specific ways and it is theoretically possible and methodologically fruitful to single out water as an aspect of nature for analytical purposes. It is possible to reconstruct, describe and understand its movement and role in nature and in society, and thus evade the problems created both by natural or biological determinism and social reductionism and constructionism. I have suggested an analytical approach and some concepts that have been tested in relation to some central empirical questions in history and social development. To understand the importance of water for human and social evolution and diversity is, however, a long-term task, an unending series of confrontations between explanatory efforts and the hard, pitiless facts of history and empirical social science. This book is just a stepping stone to a future where, with the help of new technology and more data, it will be possible to push the approach to a gradually more complete systematisation of many more combinations in an almost endless number of empirical schemes.