

WATER AND SOCIETY

CHANGING PERCEPTIONS OF SOCIETAL AND HISTORICAL DEVELOPMENT

Terje Tvedt

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I must especially, however, thank my family since almost every summer vacation for the last 30 years have been ‘travelling holidays’ – on the search for stories about water in societies. We have journeyed along winding river basins and visited stunning water bodies, confident that when following water we will also enjoy fascinating journeys in cultural history, in art and in technological development. Most often they have liked the trips just as much as myself, for after all: what is more beautiful than water?

This book is dedicated to those who have helped me throughout the years, but also to all the experts, politicians, researchers and ordinary people who will be forced to analyse and reflect upon the past, current and future roles of water in society in the new age we just have entered: the age of water insecurity.



THE NEED FOR A PARADIGM SHIFT

This book addresses a major paradox: in spite of the innumerable confluences between society and water, the social significance of water has made surprisingly little impact on our contemporary understanding of human history and development. New discoveries about our planet, as well as developments in society and nature, demand a shift in how we think about the world, a reorientation of social science and historical research. This book, encouraged by a growing interest in the role of water in history and social development among historians, engineers, social scientists, politicians and the public at large, promises to open up radically new fields of social enquiry. It distances itself from powerful and conventional viewpoints on the relationship between nature and society and on how the distinction between the two has been drawn. It shows how a reorientation of the social sciences and historical research can happen, and proposes an approach that will enable us both to ask new and fruitful questions about social and historical issues, and to answer old questions in a more inclusive, non-reductionist way.

The dominant conceptual and theoretical traditions are still fundamentally water-blind in their analyses and understanding of society, history and climate. But it is a blindness that cannot any more be justified by lack of knowledge. When on Christmas Eve 1968 the first picture of Earth from outer space was taken, we could all suddenly see the vast blue oceans covering three-quarters of our planet's surface; the white expanse of the polar ice caps; and the grey vapour-laden cloud systems enveloping the globe. This image made it dramatically clear that our planet is truly the Water Planet,¹ and we could all see, with our own eyes, what none of the founding fathers of the social sciences could have known. This image of Earth and all the societies on it – small dots surrounded by water on the move – illustrated both the centrality and the particularities of the waterscape on Tellus. It was in this unique environment that

the human race became the dominant species and that societies were formed and developed. We now know that the hydrosphere, including the cloud systems, contains an estimated 1.5 billion cubic kilometres of water (enough to cover the entire planet beneath it with hundreds upon hundreds of metres of water), that oceans cover about 70 per cent of the planet's surface, and that much of the remainder – which is normally but wrongly classified as 'dry land' – is actually crossed, and made habitable, by thousands of rivers, or is dotted with lakes, underlaid by huge reservoirs of groundwater, or covered by enormous amounts of water in frozen form: the Antarctic Ice Sheet alone covers an area larger than the USA and Mexico combined!

What that image from 1968 so unmistakably shows is that water and hydrological processes are at the very heart of the Earth system. Biologists have long ago shown that of all the requirements of life the need for liquid water is paramount. We know that every seed and embryo begins its life in water, and that wherever water is found it is theoretically possible that something is metabolising. Everybody agrees that water makes life possible, but more challenging, when it comes to understanding society and nature, is reconstructing the human experience: life should be seen in terms of a continuous and complex series of organic reactions and social actions, all of which are accomplished in an aqueous environment.

The more discoveries that are made about water on other planets the clearer it becomes that what is special about our planet is not the presence of water here, but the unique way that water flows across the planet in huge but varying amounts. Without this water in liquid and gaseous form, in the oceans and in the wind, neither soils, bacteria, plants, animals nor human beings would have developed, nor, of course, would civilisations have evolved. The hydrological cycle and its spatial variations are therefore nothing less than a key component in any non-reductionist explanation of broad-scale patterns of evolution itself as well as of the evolutionary diversity of social and civilisational change.

Research has proven beyond doubt that the water that characterises this planet is also the vital component of the Earth's energy and climate machine. Water circulates continuously throughout the system in a solar-powered process. The land part of the hydrological cycle brings the water back to the oceans via streams and rivers, although some of it disappears into the soil and into underground channels and aquifers. The amount of water in the pores of the soil influences the interaction between land and atmosphere, but also vegetation patterns and types of agricultural production all over the world. Evaporation and re-condensation are the primary energy source for atmospheric motion, so water is not just a passenger on passing winds. It creates to a large extent the breeze that

transports it across the oceans and the continents; water is thus both the parent and sibling of the winds of the North Sea and of the monsoons of South Asia. Nowadays we also know that this water cycle is more and more influenced by what happens to water as it passes through society and as societies leave their water footprints. The water cycle should therefore now be conceived of as the product of both nature and society, a coupled result of the hydrological cycle and the hydrosocial cycle influencing each other and where historical development implies a hydrosocial rearrangement.

In general, the effects of climate change have always manifested themselves in changes to the hydrological cycle and in how water runs in the landscape. This has been so in the past and will be so in the future. It is thus of great social interest that water acts as the planet's most important solvent by far, continuously transporting all sorts of natural material and societal waste from one place to another. Water is also the planet's most powerful erosive agent. Today's landscapes are largely a legacy of hydrological processes which, in the course of millennia, have shaped the land through weathering, erosion and sedimentation, and that is also why the same landscapes are vulnerable to changes in the water cycle.

The more that scientists study the human body, the more they find out about how absolutely crucial water is for most bodily functions. Human evolutionary success among the billions of other organisms on earth must to a large extent be explained by our unusual ability to exploit and adapt to variable and changing waterscapes. Like amphibians and reptiles, we have evolved from continuous immersion in water, and water is still absolutely crucial for reproduction and life. Life itself can be seen as a journey from watery birth in the womb to a dehydrated death. Between these two points each and every one of us must struggle to maintain his or her precarious water balance. Most of the components of fluid balance are controlled by homeostatic mechanisms that are activated when deficits or excesses of water reach only a few hundred milliliters. These mechanisms respond to the state of body water, whether we are aware of it or not, and thus water is the body's busiest substance. And unlike a diet, which can easily be replaced by another diet because food can be transported over great distances, there is no substitute for water, the transport cost of which can be prohibitive over large distances.²

Since people who lose 10 per cent of their body water mass go insane, and die if they lose 20 per cent, all individuals have their history written in water – from Heraclitus, who died because he misunderstood the need for water balance in his body when he tried treating himself by drying himself in the sun,³ to the philosopher John Locke who only drank water because he thought it healthy,⁴ to the anonymous worker who has a pint of beer every afternoon. Mostly we manage this without giving a single thought to the enduring and complex webs of vital relationships that

make this possible.⁵ Human actions are notwithstanding fundamentally influenced and structured by the requirements of the components of this fluid balance, whether the actors reflect upon it or not. It is intriguing that these repeated acts and all that they require of social organisation, forming and framing humans' daily lives in a multitude of ways as they do, have been theoreticised in social science to such a limited extent.

Of course, it has gradually become more urgent to understand the interconnections between water and social development because of the growing gap between supply and demand for water in many places in the world, and because of the uncertainty about future waterscapes. The phenomenal growth in irrigated agriculture, industry and urbanisation during recent decades, coupled with the devastating consequences of water-borne diseases, have made water control the number one issue in many areas of the world. Indeed, the water issue is one of growing political and ideological importance – as evidenced by the emerging water crisis in different parts of the world, the fact that climate change manifests itself in societies in the form of drought and flooding, and popular notions that pollution and the damming of large river systems are the very symbols of modernity gone astray. Because water is an absolute necessity for all, within this overall context of supply and demand, the water issue has become a global political and ideological battlefield. Some researchers are calling for a Blue Revolution or a new water revolution, seeing current water crises as mirrors of a wrong development path.

The motivation for this book, however, goes beyond current ideological and political battles over water and its meaning. The overall aim is to further our ability to understand social and historical development as such, and the role of water within it. It forwards a methodology that can be employed in contrastive studies, and in both diachronic and synchronic perspectives, but perhaps more than anything it provides an approach for studying societies in the long term, since all societies have a history in relation to water from the time they first emerged until today and as long as they will exist in the future.

BEYOND IDEOLOGY: TOWARDS AN ONTOLOGY OF WATER

This book does not limit itself to the crucial task of criticising the water blindness that exists in history and the social sciences. It proposes, in addition, ways to study water-society interactions in a systematic, comparative way. As a starting point it suggests an ontology of water in line with analytical concepts and approaches that can provide a fruitful means of interpreting society and history.

What makes our understanding of water-society interactions so crucial is that since water has been essential to all people at all times, all societies – without exception – have been forced to adapt to, or control in one way or another, the water that flows across their landscapes. Water is thus universal. At the same time, the way in which water moves across varies from place to place and from time to time, even at the same location. Water is therefore also particularistic. This particular combination of the universal and the particular is the fundamental reason why it is especially fruitful to study water-society issues comparatively. No other issue can be studied across the board both in time and space in the same way. All societies can be studied from the perspective of (a) how they have been affected by the physical waterscape, (b) how they have modified this waterscape and changed themselves and the environment in this process, and (c) how they have thought about water, its cultural meanings and value. The water-society nexus thus provides a rare opportunity for broad and, at the same time, rigorous comparative research of developments both in nature and in society, and in time and in space.

THE 'WATER-SYSTEM APPROACH'

We thus need an approach that recovers water as an autonomous actor in society, always acknowledging that it is located in a particular place and time, but also tied intrinsically to the larger scale and longer time frame in such a way that it inherits from them many of its structural (hydrological, topological, energy) properties. The historical-geographical archaeology of water-society relations should also maintain the autonomy of the social, including the cultural and spatial contexts and distinctions, as well as those related to the management of and thinking about water. There is a demand for an approach that manages to grasp how the water that flows across and on the planet exists independently of the different cultural perceptions of it, but also accepts, as a truism, that water is always being understood through such cultural lenses, be they religious, engineering or political. In order to be able to map and analyse the intricate, historical and spatial relations between societies and water, this approach must abandon both constructivism and positivism.

Only by looking at water in society and nature in this broad, inclusive way, can the role and impact of water be properly analysed and understood, and the actual history of the growing influence of the hydrosocial cycle and rearrangement be reconstructed. Water is eternal in nature and in society, but it is also always changing in nature and society. Water is both creator and destroyer in nature, as well as in society. Expressed in the language of the social sciences it is both a prerequisite for

social development and frames what development options are possible at every junction in time and at every place. It exists both as a physical object and as a non-physical entity, and as an instrument of the engineer and an object of God for the believer.

This book argues in favour of a historical-geographical archaeology of waterscapes and water-society relations, and will at the same time engage critically with past discourses on particular spatially bounded water-society issues. It will reconstruct and analyse how such discourses have reflected cultural traditions and interactions with particular waterscapes and how belief systems and knowledge about water have been rooted in history and must be analysed from a spatial, geographical perspective.

Theories and methodologies will be suggested here that aim not to reduce the natural world or the world of water to a blank slate on which only human actions matter, or to reduce different development trajectories to a question that can be explained with social variables only, as if structures and events in the natural world are of no relevance. The book underlines the importance of realising that hydraulic works and designs reflect both the natural and the social world, and that hydraulic calculations should therefore be an interdisciplinary effort. It must be crucial from this same perspective to be able to analyse and reconstruct changes in the hydrological cycle, in river discharges and floods, but also how people have interacted with and sought to control their water resources and how they have been thinking about their waters, all the time concerned with understanding how waterscapes and societies have been coupled and have co-evolved.

What is here called the 'water-system approach' is intended to encourage this kind of broad, inclusive yet still rigorous analysis, and it therefore consists of three different but interconnected analytical 'layers'.

First layer

The first layer is water's natural (physical and chemical) form and behaviour. This layer highlights the hydrological cycle and the natural, regional and local waterscapes, based on the notion that such geographical and climatic factors have affected and still to varying degrees affect issues like the broad patterns of human migration and settlement, the general emergence and locational patterns of agricultural centres, food-producing regimes and cities, the birthplaces and structure of early industrialisation and important aspects of the current globalisation of industrialisation in new countries. A focus on this layer will also enable fruitful research on how the hydrological cycle has contributed, and still contributes, to the evolution of societal diversity and different development trajectories. Within this perspective it becomes essential to reconstruct issues such

as seasonal and annual precipitation and evaporation patterns, river discharges and velocity measurements, aquifers and their behavioural characteristics, and energy transport in water – all in order to understand empirically the actual interconnections and relationships between nature and society when it comes to water.

Since water's unusual natural characteristics have a wide variety of implications for society, it is not sufficient to understand hydrology only, or to reconstruct the patterns and history of the local variant of the water cycle. Water is unusual in many respects, and almost all of its exceptions to many of the rules of nature are reflected in the fabric of social life. It has the highest surface tension of all liquids, it can absorb and release heat more than most other substances, it expands instead of contracting when it freezes, the solid form of water floats on the heavier liquid and water changes from liquid to vapour or ice and vice versa in the blink of an eye or over millions of years – all factors that have far-reaching and amazing social implications. Furthermore, the fact that water as a substance is on the move, and in most cases ultimately evaporates due to solar radiation before it returns to the Earth as rain or snow, makes it difficult to appropriate and claim effective ownership of it. The mere existence of water therefore brings into question dominant theories of property and management, theories fundamental to most discussions about society, but too taken-for-granted in current mainstream research. There is an endless number of cases demonstrating the need to explore in more detail water's different characteristics and the social implications, also because it is precisely these natural characteristics that have made it rational for humans to spin webs of significance and meaning around water in ways that no other element can match.

Finally, since the workings of the hydrological cycle established water as both the most common substance on earth and the most unevenly distributed resource on the planet before the birth of societies, one cannot fully understand social diversity, social distinction and conflict without understanding this physical aspect of water and how societies adapt to it. In most regions the precipitation and the rivers have created and shaped the valleys they water and drain, and they have thus determined where people have settled. How the rivers run and where the run-off from precipitation goes reflect complex interactions between precipitation, catchments and topography, and affect energy and nutrient turnover and the storage and processing of organic substrates, again influencing all sorts of social activities.

An analytical focus on the physical, natural aspects of the water-system highlights another very interesting theoretical and empirical aspect of water: it is both exogenous and a part of society at the same time. Water is not like other elements in nature transformed by being

'socialised'. Water is H₂O in nature just as it is H₂O in society: the same water that thunders down gigantic cataracts flows from taps and in toilets, and is trapped behind massive stone dams to produce electricity. But at the same time, water is always changing radically in form. The ways in which water runs in society and is socialised without changing its character make the nature–culture dichotomy, and the way it has been portrayed and delineated, both unclear and not applicable. By virtue of its very existence in nature and society, water refutes the manner in which the dominant dichotomous distinction between society and nature has been drawn, yet at the same time it makes it fruitful to operate with another distinction: that between a natural layer and a layer influenced by human modification, or a waterscape influenced by both natural and social variables.

This opens up what can be called a hydro-historical approach: a cross-disciplinary method utilising all kinds of data – from traditional archaeological and climate data, GIS watershed modelling used in reconstructing past water-society relations, to palaeontological, hydrological and geological data, making it possible to reconstruct the long history of river basins, underground aquifers, precipitation and evaporation patterns, as well as different types of written sources, and so on. In practical research these enormous and complicated systems must be spatially delineated, decided and defined by those aspects conceived as relevant to social development, and can thus form bases for comparisons in time and space.

Second layer

The second layer of the analytical approach here called the water-system approach captures and highlights the anthropogenic changes in the way water flows through the landscape. Water control and water utilisation are a major aspect of most societies. They form a very wide area of activity, ranging from the human impact on the hydrological cycle, evaporation patterns and forms of precipitation, river modification schemes and the digging of canals and the construction of dams across valleys, to the millions upon millions of pipes beneath cities for drinking and sanitation, and the carrying of water in jars that so evocatively represents one of the first signs of settled agriculture. It covers everything that humans have done, and do, to bring natural water to and from their settlements – in all sectors and for all purposes, including protective measures to prevent water from destroying or undermining communities, technology, transport routes, and so on. This layer enables us to make systematic comparisons of river and water modification projects, small- and large-scale irrigation and drainage projects, sewage and canal systems, run-off

regulations, the organisation of river basins involving different countries, regions, places and cities, water consumption patterns, etc. – in both time and space. In the modern world, human modification of water systems is particularly striking, even though in many places the water's lack of naturalness is masked by the way in which the river has been engineered – beguiling because it seems so natural, but made possible because water by its appearance does not signal or reveal to where it belongs.

Water and society are now deeply interwoven, and many natural processes in the water cycle are influenced by humans; but even so, there are still river basins (both large and small) that have not been subject to human intervention, and there are enormous underground aquifers, underground river systems, cloud systems and precipitation patterns that remain unaffected by humans. The hydrological cycle does not reign unimpeded any more but crucial elements of it have evaded human control or interference, and it is this 'struggle' between the natural and the cultural, becoming an ever more important aspect of the relationship between water and society, that this two-layered approach can make intelligible in a systematic and unbiased way.

By integrating description and analysis of the two layers, it becomes possible to produce a narrative that acknowledges how many existing waterscapes are the product of both long-term and short-term cumulative interactions between human purpose and hydrological and other natural hydroprocesses. The water-system approach makes it possible to analyse the relative importance of the two layers, and how they are related. Both the layers and their interactions have effects on limits and patterns of action and their combined product will reflect the natural waterscape and the economy and technological level of society. A framework that encompasses these two layers and their relationships makes the analytical approach neither nature-centric nor anthropocentric but rather enables this crude dichotomy to be avoided in practical research.

A focus on these two layers and the relations between them will be able to capture how diverse physical water landscapes have supported the location of societies in the first place, and produced and reproduced different potentials for, and limitations of, development and simultaneously enabling analyses of how the same, particular water environment has been 'appropriated' and controlled by these same societies for the sake of particular demands and reasons at different junctures of its development. The benefit of analysing systematically both these layers is that it becomes possible to factor in how most societies at any specific point in time are enveloped by both an engineered waterscape and a waterscape that mirrors, to various degrees, the local character of the hydrological cycle. This approach also enables comparative analysis of how societies on the one hand have always had a need for water for various purposes in one

form or another that their particular waterscape is expected to fulfill, and that due to population growth, shifting economic and social activities and technological capabilities the trend will tend to put greater and more multi-faceted stress on water resources. It will thus make it possible to capture how the growing multi-functionality of water, both as a physical resource and a social good, is a central aspect of long-term human history.

A specific and systematic focus on modifications of waterscapes will take into full account the economic, cultural and political importance of the diversifying roles of such actions. Water has always been an unevenly distributed means of maintaining and creating hierarchies and has thus functioned as a structuring principle in society. In some societies, control of water has been at the very heart of state-building processes and imperial legitimacy since time immemorial. Dams and large hydraulic systems are not mere technological installations: they are symbols of power. In many cases the conquest of water has served as a potent example of how some people have been able to use power over nature as a means to subjugate others. Huge water control installations clearly have economic, cultural and political importance, and their centrality and scale reflects their national standing. In some areas of the world – particularly in the dry Middle East, where water control has been especially important throughout history – dams have often been named after state leaders because few things there have as much potential to bestow prestige and authority. Similarly, since time immemorial, fountains have been symbols of urban life, distinguishing the city from the natural hazards that dominate rural life. Fountains, usually placed at the very heart of the city, have had many functions, but one of them has surely been to symbolise humanity's control of nature – a manifestation of societies' appropriation of the forces of nature; the unruly element tamed to serve the human need for aesthetic beauty.

The analytical purpose of these distinctive though interconnected layers can be made clearer by contrasting it with how the more commonly used term 'built environment' is understood. The 'built environment' is normally regarded as a product of the culture of a society, and is therefore analysed as applying solely to the socially constructed environment. The modified waterscape should on the other hand be seen as a reflection of 'culture' but also as a product of the physical character of the waterscape. The actual water that flows in a 'built' river or through a canal must therefore also be analysed in terms of the physical water context of its location, and this location's particular tradition is the product of local hydrology and geology, past water control measures and entrepreneurial action, factors which in turn, of course, are located within broader natural and societal relationships and rhythms. The relations and distinctions between the physical waterscape and modified waterscapes should also be understood

as something very different from, and more complex than, the widely used pair of concepts 'managed' resources' and 'not managed' resources. It is impossible to define clearly what constitutes 'managed' resources and 'not managed' resources, because their meaning will vary from time to time and from place to place, and cannot therefore be used as a basis for comparisons or precise analyses. Moreover, the term 'management' carries a modern connotation and is somewhat out of time and place if the subject of research is, for example, adaptation and modification of water landscapes and local hydrological cycles at the time of the hunters and gatherers. People might also disagree on whether or not a particular controlled water body is 'managed'. On the other hand, provided that the necessary data are available, it is possible to reach agreement about whether a body of water has been modified or not, although there will always be disagreement regarding the degree to which it has been altered and whether or not the results have been beneficial. The two-layered approach takes as a starting point the fact that water is the same both in nature and in the most modern cities; it is the same substance that runs through distant forests as out of the tap. Water as observed in societies is both material structure and a cultural product, thereby underlining the fact that definitions and concepts of materiality in general must not be reduced to mere matter or to a static 'foundational' structure; water is always in flux and forms part of a dynamic social process. This contradicts directly the conventional viewpoint that argues that matter is a part of the natural world and thus only acts upon itself, whereas man is a human, self-conscious subject that acts upon nature and society.

The physical and man-made layers of 'open and complex water systems' underline the need, and provide a framework, for analysing how the flow of natural and social water through social space has played a pivotal role (even if occasionally in opposition to each other); one and the same water resource may have acted as a blind force of destruction via flooding, and as an encouragement to the organisation and mobilisation of co-operation and urban technological development. Water has both caused disease, squalor and human misery, and provided the means to battle these very same problems. From the familiar space of the bathroom to the buried space of the sewer, from the sparkly drops in a fountain to the tamed but still powerful force contained by dams and reservoirs, water provides a link between material and immaterial aspects and dynamics of social development. The approach can also capture how this human-modified waterscape in its turn changes the physical waterscape in an everlasting cycle of mutual interaction. It acknowledges the fact that most waterscapes are not completely natural and no waterscape completely controlled. Water expresses a paradox in nature–society relations: development presupposes modification of the natural waterscape and water always escapes its

developers as it evaporates back into the hydrological cycle. The same paradox gives a particular context of analysis of the long term: the most sophisticated hydraulic structures are the most vulnerable to dramatic changes in the climate or in the hydrological cycle.

By giving due weight to anthropogenic initiatives in changing the waterscape, this analytical approach to nature–society relationships appreciates the roles of the ‘entrepreneur’ and of human action. Interventions in and efforts to control waterscapes can in particularly dramatic ways change fundamental social as well as physical structures, both in the short and long term. Historically, individual water engineers, planners and ‘water lords’ have radically changed the nature of physical water systems, be it rivers, waterfalls or lakes and, by so doing, they have also changed fundamental societal structures and institutions. Water control structures can revolutionise the way water runs both in nature and society, and can thus transform societies in their very core and also diversify social developments in entirely new ways, as exemplified by the aqueducts of Rome, the Canal du Midi (which linked the Mediterranean to the Atlantic via the River Garonne in France), the Grand Canal in China, the High Aswan Dam in Egypt (which created new cultivation seasons and electrified Egypt) and the Panama Canal (which crosses the Isthmus of Panama and raises ships up to the artificial Gatun Lake). Much social science has become an abstract science of general spatial relationships, often without reference either to nature or to a subject. By including the two layers as part of the same analytical exercise, it becomes possible to analytically incorporate the creative power of human actions and aims, while still look for deeper structures that influence and constitute societies and their patterns of development. By integrating these two layers in the analytical process, this approach enables us to focus on structures while avoiding the writing of a history without subjects, or describing a society without actors and their intentions, or a nature without humans.

Focusing on the relationship between these two layers also enables us to examine and better understand a paradoxical historical trend of great and yet unknown consequences. On the one hand, more and more river systems and water bodies are the product of engineered interactions between physical water sources and human agency, but, on the other hand, societies are simultaneously becoming ever more vulnerable to substantive changes in the way water runs in nature and society.⁶

Third layer

The third layer of the water-system approach recognises and focuses on how water as an element of nature and society – as a natural resource and a social good – will always be culturally constructed and filtered.

It is concerned with how water is ascribed different meanings and has symbolised different things, from time to time and place to place for different actors (see Tvedt and Oestigaard 2006 and 2010). The history of the ideas of water has not yet been written, and what this approach underlines is that it is important to understand how these notions reflect and impact on both the physical and modified layers of water-systems, but that they also should be seen as something much more wide-ranging than those expressed in actual water control technology or water architecture.

It is crucial to acknowledge that societies' and people's ideas of water have been developed and formed in relation to a broad range of issues, water as a means of exerting social and cultural power, as an object of management practices, as religious and cultural symbols or objects, and as a signifier of social and cultural distinctions. Water has, moreover, always been used as a metaphor, most likely in all societies, although in various ways. It has been widely used as a metaphor for the stream of history and as the end of all things; it may stand for both youth and age, for power and timidity, for the female and the male, for strength and tenderness. The variations and contradictions of metaphors reflect the fact that humans' relationships with water differ both in space and time and that water plays central though different roles in people's lives.

The special character of water makes it a unique medium for cultural constructions and metaphorical traditions. Since water is at the same time particular and universal, nature and culture, physical and ideological, uniting and separating, giving life and taking life, it has been a phenomenon to which people naturally ascribed meanings. The holy water for rituals such as baptism, ablution or purification belongs to a different world of meaning from the water involved in a river's annual inundation for irrigation, or the water that nomads draw from wells in the oases, or the snow used to build igloos, or the water stored in dams for hydroelectric power generation. But from nature's point of view it is the same water. To what extent are these cultural manifestations and elaborations of the same H₂O the result of cultural diffusion or the outcomes of interactions with different types of water? The ways in which the water worlds or waterscapes are used practically, interpreted symbolically and ascribed values according to local and regional traditions and norms have to be analysed as a result of the continuous and long-term anthropogenic interaction and mediation of cultural and natural variables in the society-water systems.

Peoples' ideas about water and how water is crucial for identities and values in a broader cultural context should be analysed in relation to which types of waters are present, or in which combinations they occur at a given time, because the different waters and their constellations are actively incorporated into the collective body of knowledge, in turn

because water matters for humans at many levels (personal, societal and religious). More meticulous cultural analyses at micro-level in combination with ecological variables open up a vast ocean of hypotheses about how water has structured values, norms and hierarchies. The ever-changing qualities, capacities and forms of water enable it to function as a medium whereby we can express and negotiate social relations and problems, and communicate about the world we live in to ourselves and others.

A study of the history of conceptualisations of water must also be a study of water in religious thinking and rituals. This book suggests that a study of the role of water in religion and myth amounts to a comparative history of religions, since water plays such an important part in most people's ideas about divinities. Water is part and parcel of the history of the cosmos in most religions and provides an almost universal arena or medium for religious practices. The water-system approach argues for the need to break out of the conventional analytical framework of nation-states and civilisations in analysing ideas and cultural constructions. The reason why a focus on the ideas of water must depart from this tradition is partly that diverse water-society relations and water-society systems do not necessarily coincide with state-borders or cultural boundaries. Additionally, many notions about water are shared by a number of religions and geographical and climatic regions, so specific civilisational or cultural frames of reference are not particularly helpful in this regard. The idea that God punished humankind with floods, for instance, is shared by Judaism, Christianity, Islam and many traditional religions (Allen 1963; Leach 1969; Dundes 1988; Kramer and Maier 1989; Cohn 1996). In order to explain the complex relationship between the structuring role of particular and different human/water situations on social constructions of water on the one hand, and diffusion and acculturation regarding ideas about water on the other, a comparative and historical perspective is needed.

By operating with this distinct layer dealing with ideas about water, research can also acknowledge that the differences in how water is understood are one of the most conflictive issues in the contemporary world. In transnational river basins ideas about how the shared body of water should be harnessed are crucial to understanding regional politics and power plays between different stakeholders and upstream/downstream users and states. The strong alliance between water engineering bureaucracies and modernising politicians and their instrumental view of water has obviously played an important role in many countries in the last 150 years, and constitutes an important aspect of the history of ideas and of modernisation in general. The worldwide political schism with regard to big dams reflects different ideas about water and what it should be used for, as well as conflicting opinions about the role of water in society. In recent decades, the ideas that water should be seen as a normal

market commodity and as a universal human right have provoked unrest from Sri Lanka to Africa. Finally, the global movement for 'greening the rivers' and protecting wetlands has also advanced important ideas on water that have had a great influence on societies.

By giving emphasis to ideas of water as something distinct from, but at the same time connected to, the physical character of water and its modifications through time, an analytical framework is provided that enables us to analyse both the differences and the connections between specific physical waterscapes (which will always be filtered through a wide range of cultural lenses), the modified and controlled water resources that exist at any given time (which will always reflect past actors' ideas about their water and how it should be handled), and religious ideas, cultural conceptions and managerial plans regarding water.

The water-system approach aims to break away from the reductionism of the social sciences and to counter those tendencies within social sciences that shrink the natural world to an empty stage on which only human actions matter, where societal development is conceived as something that can only be explained in terms of social facts. The approach recovers water – and thus nature – as an autonomous actor, and encourages research on the physical aspects of the relationship between water and society as well as urging an understanding of water as seen through cultural lenses. Such studies of the water-society cycle will be based on the notion that water as nature not only exists but changes, both of its own accord and as a result of human actions and in its many interactions with society, and in so doing not only changes the context in which human histories unfold but becomes part of human history itself. The water-system approach deals with analyses of the inter-relationships between three distinct but comparable factors in all societies on a continuum and over time. The historical trend is clear: more and more river systems and waterscapes are the engineered results of *interactions* between water and agency, but at the same time societies become more and more vulnerable to physical changes in their sources of water. While waterscapes in modern societies have usually been modified (there are still exceptions), even the most tamed river is still vulnerable to changes in nature because it is still connected to the hydrological cycle at different local, regional, global and atmospheric scales, which is the fundamental reason why, most likely, never before has so much money been spent on defending societies from the vagaries of their water sources as today.⁷

Documenting and analysing these clearly distinguishable but interconnected layers will make it possible to conduct rigorous comparative studies within an analytical framework that at the same time is adaptable and not rigid. Research should be thought of as a tripartite exercise, studying the distinct layers and specifying the interactions between water,

technology and ideas, and structure and agent. No single discipline can manage this alone, and that is why a water-system approach will need input from all kinds of natural science disciplines as well as from the humanities and social sciences. The material foundation of human interactions with the waterscape or nature is given credit, without compromising reflexive accounts of human action and consciousness, because the approach fully recognises the importance of agency. Nature and environment are comprehended as material structures existing independent of human conceptions of them, but this perspective also acknowledges that nature and water are socially modified and constructed. Within this approach the natural exists but is not always or only natural, and the social exists but is not always or only social. Employing an analytical framework that covers all these different aspects of the social/water nexus might enable us to perform analyses that do not fall into the trap of mechanical determinism or voluntarism. And most importantly, the reductionist tradition, be it natural or social, can be overcome.⁸

It should be underlined that this water-system approach is very different from the quite influential socio-ecological system concept. While the ideas about the three-layered water system suggest a methodology for empirical research, the socio-ecological system concept is a system-theoretical concept where the system consists of what is described as a bio-geo-physical unit and social actors and institutions related to it. It is seen as a complex and adaptive systemic whole delimited by spatial or functional boundaries. Socio-ecological theory draws heavily on complexity and system theories and on a range of discipline-specific theories, such as microeconomic theory and optimal foraging theory, and incorporates ideas from theories relating to the study of resilience, robustness, sustainability and vulnerability (for example, Levin 1999; Berkes 1989; Gunderson and Holling 2002; Norberg and Cumming 2008; Mouri 2014; Bousquet et al. 2015). The socio-ecological system is therefore defined as a coherent system of biophysical and social factors that regularly interact in a resilient, sustained manner.

A conceptual, theoretical and empirical challenge with many notions of ecological systems is that such systems are perceived as a totality, as closed units. Changes within such systems are often understood in terms of different degrees of 'equilibriums' where radical changes may threaten the whole existence of the systems leading to their collapse. The problem is that what constitutes a system and its 'sustainable equilibriums' is a construction, or what would belong to level three in a water systems perspective, but water in nature is not restricted to closed ecological systems, even if these were 'original' or previously unchanged by humans. While the damming or draining of wetlands may significantly alter and even destroy habitats, they also create new water systems (a

combination of levels one and two) impacting on humans and being impacted on by humans. A water-system approach represents a much more open-ended attitude, being not based on a preconceived and valued frame for understanding human–nature relations and what they should be, for better or worse.

The water-system approach aims to liberate research from any such presupposed or implied specific or fixed ideas about resilience, sustainability and regular interaction. The suggestion of studying water-society relations according to three interconnected layers aims at helping empirical analyses in time and space, and is not a theoretical concept presupposing certain ideas about specific systemic properties in a system theoretical sense. It integrates a focus on water as a physical phenomenon in social analysis, but is at the same time able also to handle analytically all those cases where water is not resilient, sustainable or part of a ‘regular interaction’. The water-system approach is not based on general ideas about water as always being a critical resource whose flow and use is regulated by a combination of ecological and social systems as the socio-ecological concept presupposes, because water does not have to be a critical resource and can be regulated by either nature or society or by both together. The term ‘water-society relations’ assumes that this relationship is perpetually dynamic and complex, but again, to employ the approach does not presuppose a notion of continuous adaptation as the socio-ecological system concept does. The socio-ecological concept holds, moreover, that social and ecological systems are linked through feedback mechanisms. The water-system approach, however, is not based on any general assumptions of this nature since history is full of examples where a focus on feedback mechanisms will downplay the often revolutionary role of individual entrepreneurs in changing water-society relations or how sudden and fundamental alterations in the waterscape are often unrelated to the social. The water-system approach encourages all kinds of research in a pragmatic, open manner, while the socio-ecological concept is a theoretical model, based on a specific understanding of the relationship between ecology in general and society in general. There is still a great need for the connection of analyses of the social and the natural and their interconnections, and the contribution here is to suggest an open, non-dogmatic framework that can capture both long-term continuities and dramatic changes.

TESTING THE ‘WATER-SYSTEM APPROACH’

This book is based on the idea that it will be rewarding for the social sciences to reconstruct, describe and understand water’s movement and

role in nature and in society.⁹ The argument is that the relationship of societies with water makes for a general structure of social continuity through time, and that the triple-layered water-system concept evades the problems created both by natural or biological determinism and radical constructionism. The approach distances itself from extreme anthropocentrism in a double sense, while recognising the revolutionary role human modifications of water systems often have. The water-system approach and its concepts must, however, be tested empirically. The following chapters do that as part of what should be an unending series of dialectical confrontations between explanatory efforts and the hard, pitiless facts of history and social life.

The first chapter in this part presents a new explanation of one of the most important and thoroughly researched questions of all: why did the Western World and Britain succeed in transforming their societies to initiate the Industrial Revolution, where leading agricultural civilisations like China and India failed? The second chapter deals with European imperialism and the partition of Africa, and suggests a new interpretation of why Britain marched up the Nile basin at the end of the nineteenth and beginning of the twentieth centuries. The third chapter reconsiders urban studies and offers interpretations of the history and development of the city as a global phenomenon. The fourth chapter discusses the study and understanding of religion from a water perspective, and demonstrates how the importance of water and the workings of the hydrological cycle can be employed to analyse core religious cosmologies and myths and the diversity of religious practices. The fifth chapter revisits the whole debate about state sovereignty and questions both the 'myth of Westphalia' and ideas about the 'death of Westphalia' based on an analysis of the empirical role played by European continental rivers and the theoretical problems raised by a resource that cannot be controlled by territorial owners. The sixth chapter discusses international resource law and argues in favour of furthering both a historical and a physical understanding of the resource in question, using the Nile and a detailed study of the Nile Waters Agreement of 1929 as an example. The seventh chapter deals with climate history and climate change and argues that water is fundamental to any understanding of climatic processes in themselves and the challenges they pose for societies. The eighth chapter presents a case study of how the water-society approach can be useful in comparative and general studies of the history and development of countries.