# 1 A History of the Ideas of Water: Deconstructing Nature and Constructing Society

**Terje Tvedt and Terje Oestigaard**

## THE TRADITION

Everybody concerned with the history of ideas knows that the history of ideas itself has a history. The history of ideas of water has, however, no such history, since it has yet to be written. Few scholarly works have been published about how water has been conceptualised and perceived at different times and in different societies, although all social systems have a hydraulic dimension and water has been interwoven with social interaction from profane activities to religious ceremonies all over the world from time immemorial.

This historiographic state-of-affairs continues even though water's centrality in many belief systems has been acknowledged: The influential historian of religious ideas, M. Eliade, for example, writes: 'Water symbolises the whole of potentiality: it is the *fons et origo*, the source of all possible existence … water symbolises the primal substance from which all forms came and to which they will return' (Eliade 1979: 188). And religious texts from all over the world underline the same point. The wording of the famous sanscrit text *Mahabharata* (XII.83–4) summarises water's general position: 'The creator first produced water for the maintenance of life among human beings. The water enriches life and its absence destroys all creatures and plant-life.' Images of and ideas about water have been and are central in creation stories and in narratives about 'the end of the world', in rituals and *rites de passage*, in scientific theories about creation and evolution and as a seemingly unending reservoir for metaphors in languages all over the world. So why, then, has so very little attention been given to a reconstruction of its history?

The literature on the history of perceptions and images of nature and the environment is, however, extensive (Glacken 1967; Worster 1977; Pepper 1996; Coates 1998; Buttimer and Wallin 1999).

Historical studies of environmental philosophy and thinking have mushroomed since the beginning of the 1980s (e.g. Pratt et al. 2000; Jamieson 2001; Gottlieb 2003; Selin and Kalland 2003; Turner 2005; Baird Callicott and Palmer 2005; Radkau 2008). The ideological aim of many of these studies has been to foster a holistic approach towards nature and the environment. This research tradition will therefore tend to be sceptical of analyses of the history of ideas and images of water – because such analyses will necessarily imply the singling out of one element in nature or in the environment which, according to this dominant tradition, ought to be seen as a whole. The modern environmentalist movement has if anything strengthened this tradition; it has provoked fundamental questions about man's attitude to nature, and it has preached and developed a philosophy of human conduct related to 'nature' as a whole. The monumental five-volume work *Environmentalism: Critical Concepts* (Pepper et al. 2003) is in this context revealing: it discusses a number of critical concepts, but not the fundamental constituting idea of nature or environment as *one thing*. A common thread in this literature is therefore a focus on nature as an entity or unity, as a thing which humans have images and conceptions of as a whole, and to which they have adapted.

But nature consists of different elements, and the relation between society and nature will vary according to what kind of natural element we are focussing on – whether it is, for example, gold, oil, trees, birds or flowers. Natural landscapes can, moreover, from one perspective be seen as a catalogue of different waterscapes (deserts, savannahs, tropical forests, arctic areas, etc.); as water worlds or waterscapes which all the time are in a flux according to season and climatic variables. The hydrological cycle – the amount of precipitation at a given time, the form in which it occurs (rain or snow), when it occurs in the different seasons, and how long it lasts or how soon it disappears from rivers, lakes, waterfalls, wells, ponds, underground pools or in the form of snow – fundamentally influences the world humans have lived in and live in. Humans have adapted to, used, exploited and changed this world according to their technological know-how, cultural traditions, ideological and religious worldviews, and what is highlighted here and what can be studied in detail and comparatively: their images and ideas of water. A focus on water may throw new light on the general history of nature images since, unlike all other elements in nature, water has played a role in all societies at all times and in the lives of all human beings.

Since human existence and social development have always been dependent upon water, people have developed ideas and images of water – from the first myths of Sumer, where Enki brings order and

life to the earth by pouring water into the beds of the Tigris and the Euphrates, to the present-day visions of Armageddon, where global warming is turning frozen water into running water and drowning civilisations. A history of water in general must deal with its material, political and ideological aspects. Material water history concerns itself with changes in the hydrological and physical environment, and how these changes have affected human societies from the birth of the first irrigation civilisations to how changes in the hydrological cycle today will influence societies. Political water history considers state policies as they relate to the natural water world and water management issues – from Hammurabi's Code in Babylon that was written around 1750 BCE to the gigantic water projects implemented during the twentieth century and until today. The history of the *ideas of water*, in contrast, emphasises images, ideas and representations of water in religion, arts and letters, and how these have changed, and what these ideas and their changes can tell about the societies that produced them.

A history of the ideas of water will transcend conventional understandings of nature, and therefore also of the relationship between what was normally seen as a nature–culture relationship.[1] In most social analyses, regardless of whether the theoretical position was social constructionist or neo-evolutionist, nature has been treated as a whole and single unit. This is the case regardless of whether nature is categorised as a physical place, as 'unspoiled nature' or 'conquered nature'; as the collective phenomenon of the world or the universe; as an essence or quality informing the workings of the world or universe; as an inspiration or guide for people or as a source of authority; or as the conceptual opposite of culture (see Coates 1998: 3).

The need to reconstruct histories of the ideas of *water* reflects an analytical approach that is convinced of the general fruitfulness of deconstructing the notion of nature as a single entity. It underscores the need to criticise a research tradition that treats nature as an entity, which assumes that humans interact with 'nature', while they in fact only ever interact with elements of this environment or nature. It is important to advance comparative and historical research on the relationship between nature and humankind or nature and culture in general. Nature is such a wide, complex phenomenon that is very difficult, if not impossible, to reconstruct ideas and images about it as a whole, not least across times and cultures, especially since different elements of nature have played various roles in different societies at different times.

By deconstructing the concept of nature as a unified entity, as if there were an externality mankind had been forced to relate to and

been impacted by in more or less the same way, it also becomes easier to discover an empirical reality with wide-ranging theoretical implications: water has a number of particular and peculiar characteristics no other natural elements have. We all know, of course, that all living beings, plants, animals and the life cycle itself are sustained by the movement of water, and that water is the most familiar liquid. It is, however, also a very unusual one, since it not only expands when it is heated, but also when it freezes.

## THE CONVENTIONAL NATURE–SOCIETY DIVIDE AND THE WATER ISSUE

Water is empirically and theoretically interesting also because of the fact that it is nature and a social factor *at the same time and in the same form*. Water is $H_2O$ in nature, in remote waterfalls, as it is $H_2O$ in society, where it flows from taps and in toilets and forms part of modern policy-making and mega-projects. Thus, by its very existence, it refutes the dominant, rigid and dichotomic distinction between society and nature. It does this in a very original way that also throws new light on theoretical and conceptual attempts at overcoming this dichotomy. Water is a unique natural element, because its character and substance do not change by becoming socialised, as other natural resources do. It is not the least this physical and social character of water that has turned it into something which humans have been spinning webs of significance and meaning around (Geertz 1973) in ways that no other element can equate. The way water runs in society and is socialised without changing its natural, chemical and physical character makes the nature–culture divide and the way it has been portrayed not only unfruitful, but also irrelevant and limiting. The fact that water by its very physical, natural and social character undermines this fundamental distinction should indicate its potential as a source, or as a reservoir, for asking new questions on a number of other areas.

Water is culture, but it is also nature. It is never either or, but always both. Despite the fact that water is in flux and constantly changes form, the most striking feature of water is nevertheless its sameness: wherever the water is in the hydrological circle/cycle or in the 'social circle', whether the water is domesticated or forcing its way down in huge waterfalls in remote mountain areas, it is basically the same. This nature of water is universal, common to all people through history, and, because of this shared feature, water offers unique possibilities to compare human lives and societies across cultures. A history of the ideas of water can therefore be used

to address theoretical questions about relationships between universalism and particularism.

By deconstructing nature and understanding water as both 'nature' and 'culture' it becomes possible to discuss and rethink, from new and original angles, a number of conventional and unfruitful, analytical approaches and conceptual frameworks.

## SOME THEORETICAL IMPLICATIONS

A focus on ideas and images of water opens up new avenues for empirical research and makes it possible to raise some fundamental questions about core concepts in science as well as in environmental philosophy and thinking. Below we will discuss some examples that can demonstrate this potential.

### *Nature 'benign' or 'ephemeral'*

Popular myths and images about 'nature' as an entity or a unity function as a cultural filter. They make people predisposed to see specific things about the environment and to construct specific knowledge about it. Beliefs about the unity of nature and society's relation to it are linked to particular rationalities and also reflect the interests of political–ideological movements. One 'truth', for example, that has been contested in the last decades, is the idea that nature is capable of quick recovery from human interference, especially if aided by wise management policies. Schwarz and Thompson (1990) call this a myth of 'nature benign', criticised on the grounds that it is an idea adherents of free market economics often favour. Radical environmentalists embrace the opposite 'truth' that nature is very vulnerable and can potentially be damaged by human activity (Schwarz and Thompson 1990). This is the myth of 'nature ephemeral'.

Deconstructing 'nature', enabling a focus on one element in nature only, might help to make discussions on these myths or ideas about 'nature' different and more precise. Water has particular capabilities to heal itself, even in the short run, and in the long run it always heals itself. It is constantly reborn as pure water falling from the sky (even unaided by wise management policies). Water will always recover – and at the end of the day, without human intervention. Rivers – as specific homes to moving water for a short period before it ends up in the ocean or becomes vapour – can on the other hand be destroyed in the long run – more so than many

other elements in nature. The water issue reveals that the *pro et contra* discussion on 'nature benign' or 'nature ephemeral' is dogmatic. This distinction is based on inscribed, narrow ideas about 'nature'.

## *Deep ecology and 'going with the flow'*

Basic assumptions in radical environmentalism in the form of 'deep ecology' can also be approached in a new way by deconstructing the notion of nature. 'Deep ecological' thinking holds that humans form an intimate *part* of the natural environment; they and nature are one (Næss 1973; Tokar 1987). Næss argues that all organisms are 'knots in the biospherical net' or field of intrinsic relations, and the very notion of a world composed of discrete separate things is denied. Deep ecologists oppose anthropocentrism, which is defined as a worldview that sees human values as the source of all value and thus the desire to control and manipulate nature for the sake of human beings. Deep ecology begins with unity rather than with the dualism which dominates Western philosophy (Devall and Session 1985). Their alternative is often described with a water metaphor: 'going with the flow', instead of controlling nature or going 'against the flow'. It is also argued that there are links between deep ecology and the understanding of the world that underpins it on the one hand and the understanding of nature in Islam (see Engel and Engel 1990), Buddhism, Hinduism and many other Eastern religions (see Tucker and Grim 1993) on the other hand.

But how well does the idea of 'going with the flow' express human experience with the great flows, or rivers? To 'go with the flow' on the Yellow River or the Yangtze has always been regarded as impracticable, due to the extreme violence of these rivers caused by variations in rainfall and ice-melting. To go with the flow would often have been catastrophic in these hydrological contexts. Lao Tse said more than 2,000 years ago that the Sage transformed the world by controlling the water, and the first dam was built in China some 2,000 years ago. So while humans have been part of nature and the Chinese civilisations developed to a large extent thanks to these rivers and their usage, they also fought nature; not as 'knots in the biospherical net', but as opponents to the river's unruly forces, which they saw as a struggle with the 'dragon forces' in their great rivers. The Sumerians dug canals, the rulers of India built dams and wells wherever they could, while the Muslim rulers of the Middle East and Moorish Spain became famous for their ability to control water and create man-made parks and gardens like the Alhambra.

When it comes to water, it is very difficult to discover the fundamental differences in attitudes and images between Hinduism and Islam and Western ideas that the defenders of deep ecology refer to. Water allows us to do precisely what deep ecology prevents us from doing; by approaching nature as a series of distinct, separate elements, it becomes possible to discuss critically some of the premises of this ecological philosophy unless one sees a water-centric approach as anti-holistic.

## *'Socialising nature'?*

This focus on water as both nature and society differs fundamentally from science sociologist Bruno Latour's discussion of nature and society, in spite of the fact that they have some superficial similarities. Latour writes 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 2003: 320). Bruno Latour introduced hybrids and the concept of 'actant-network' or 'actor-network' to solve the conflict with modernism, which presented a clear-cut division between nature and culture that, in his opinion, has never existed (Latour 1993, 1997, 1999). Whereas 'actors' are commonly understood to be conscious humans, the term 'actants' describes all kinds of forms or figures that constitute the world, including material objects, artefacts, and elements in nature as well as humans. Latour argues that nonhumans are fully fledged actors in the collective, and when 'nonhumans are no longer confused with objects, it may be possible to imagine the collective in which humans are entangled with them' (Latour 1999: 174–5). Agents can be both human and nonhuman, but the term 'actant' refers solely to nonhumans in order to distinguish them from human agents (ibid.: 180). Latour's aim is to highlight the crossovers through which humans and nonhumans exchange properties (1999: 201). The aim is to take the argument beyond the polemic war between objects and subjects: 'The name of the game is not to extend subjectivity to things, to treat humans like objects, to take machines for social actors, but *to avoid using* the subject-object distinction at all in order to talk about the folding of humans and nonhumans … Science and technology are what *socialise* nonhumans to bear upon human relations' (Latour 1999: 193–4). Despite the potentials of such an approach, it is not sufficient due to

the changing qualities of water and the fact that humans consist of water, being both culture and nature. Our point here is not to naturalise society by integrating it into nature or to socialise nature as Latour aims to, but the very opposite: nature and the physical water world, and society and culture, exist as two distinct systems, and this differentiation is indispensable and real. What the character of water forces us to rethink is not the need to naturalise society or socialise nature, but the particularities and shifting boundaries of these two distinct systems, because water is the same in both nature and society and is also both a natural object and a natural bond, as well as a social bond and a discourse.

### *Post-modernism, primitive ecological wisdom and the water problem*

Post-modernism's dogma of mind's superiority over matter, particularly evident in landscape studies where nature is included (seen simply as a social construct) by in fact excluding it as an agent conceptually, can also be criticised from a new angle with water as a starting point. Within this tradition 'landscape' refers to the meaning imputed by local people on their physical and cultural surroundings, and the cognitive, cultural and representational aspects are emphasised, positioning the actors somehow outside the landscape itself (Hirsch 1995). When it comes to understanding water, this viewpoint is irrelevant for many reasons, partly because 60 per cent of a human's body is water that has to be refilled regularly every day from nature, and the human body is only a temporary station in water's endless motion from the clouds to the sea and back. Due to water's physical characteristics in nature and role in society it cannot be subjugated simply to nothing but social construction. A river landscape, of the Rhine, of the Mississippi, or of the Yellow River for example, is of course given meaning by people (both local people and non-locals) and characterised as floods, flashy regimes or low seasons, and so on, but everybody will know that these rivers have an existence and a character independent of the meanings people have given them, and that they even 'act' on societies with tremendous force without people really understanding what is happening.

In fact, by bringing water into the centre of the picture, even the commonly used watershed, the modern/pre-modern period has to be reconsidered. Before the modern period, the lenses in the cultural filter were composed of religious myths and teachings and these were gradually replaced by filters consisting of the modern scientific worldview. But water is still filtered through religious myths

and belief-systems, not only in India where millions are taking the holy bath in the Ganges and at Allahabad where the three holy rivers – Ganges, Yamuna and the mythological Saraswati – meet, but also in one of the most secularised, rationalistic countries, France, where millions of people every year come to Lourdes to take the holy water.

Another influential 'myth' is that of primitive ecological wisdom, and this myth is fundamental to the environmentalist critique of industrialism or modern capitalism. The range of cultures championed as paragons of environmental virtue, or as defenders of nature, or as the embodiment of the practical manifestation of the holistic view on nature, will appear in another light if one focusses on water. The history of these 'primitives' shows that even they have often attempted to control the water resources in one way or another and disregarded the waters' effects on the environment. The classical Indian Maya and Aztec civilisations, in present-day Guatemala and Mexico, are well-known cases in point.

A number of examples about both practices and ideas of water show that the myths about primitive ecological wisdom are not well founded. This myth continues to exist although it has been refuted a long time ago. The reason must be that this myth is important, as a dogma, and as a foundation for environmentalism, as something to believe in and as a platform for criticising modern industrial society. Knowledge about the ideas of water is lacking, which could partly explain this situation. This view coincides with the post-modern mistrust and critique of the Enlightenment (eighteenth century), seen as a way of thinking about nature that promised control and manipulation for the betterment of humankind, but produced mass war, environmental threats, global warming, and so on. This general criticism of the Enlightenment cannot be sustained if control of water and ideas about it is brought into the picture, because modern scientific ideas about water and modern technology of water control allowed the development of large cities, the successful battle against epidemics, the irrigation of crops, and so forth. This reaction against modernity has caused many to long for pre-modern ideas about nature but, we will suggest, not pre-modern ways of managing and thinking about water.

## *Risk societies and development theories*

When water is brought into the centre of the development narrative – as it should be because of its fundamental role in stimulating the industrial revolution in England and Western Europe at the end of the eighteenth and the beginning of the nineteenth century – it is

possible to formulate a quite opposite theory of social evolution: the more humans seek to control water and socialise it, the more power water and variations in the water landscape will exercise over societies. After all, hurricane Katrina, the droughts in Spain and south-east England and the prophecies about future climate change are all changes that first and foremost have manifested themselves in societies as changes in the water landscape whether they were man-made or not.

Therefore, water and ideas and images about water are also relevant to the discussions about modern society as a risk society. The sociologist Ulrich Beck argues that 'Risk society begins where nature ends' (Beck 1998: 10). He encourages a shift in focus from what nature can do to us to what we have done to nature. He also says that risk society begins 'where tradition ends', when, in all spheres of life, we can no longer take traditional certainties for granted (Beck 1998: 10). He deals with how the end of nature and the end of tradition have altered the epistemological and cultural status of science and the constitution of politics. The notion of risk society clarifies a world characterised by the loss of a clear distinction between nature and culture. Beck continues: 'The notion of risk society clarifies a world characterized by the loss of a clear distinction between nature and culture. Today if we talk about nature we talk about culture and if we talk about culture we talk about nature.' We live therefore, he argues, in a hybrid world which transcends old theoretical distinctions, where risk is seen in man-made hybrids only (Beck 1998: 11).

The contributions in *The Ideas of Water* take another approach, because humans have always associated water with both risk and hazards, and will continue to do so, because changes in the water landscape can not be reduced to changes inflicted by humans. 'Risk' in the future is of course to a large extent something which starts before nature ends, unless one accepts wholly the thesis that all climate change – and thus all changes in rainfall patterns, in river levels and thus in dams and reservoirs – is caused by human action. So here we maintain that there is a distinction between nature and society, and oppose the idea that when we are talking about nature we talk about culture. We uphold Durkheim's distinction but in a different way, by arguing in favour of bringing nature, or water, back in.

## *Modernity and the uncertainties of water*

Understanding the particular character of water makes it possible and necessary to rethink general theories about modernity that have

been formulated within a nature–culture divide. Such theories often emphasise human development as liberation from nature and the powers of nature. Modernity has conventionally and typically been seen as mankind's conquest of nature. According to authors such as Anthony Giddens, before the industrial era people were at the mercy of natural disasters such as plagues and famines, whereas in 'industrialized countries today we are largely immune from these insecurities; our uncertainties about the future derive from the social forces we ourselves have unleashed' (Giddens 1989: 632). According to Giddens, the end of nature does not mean a world without a natural environment, but that there are few aspects of the physical world untouched or unchanged by human intervention: 'For hundreds of years, people worried about what nature could do to us – earthquakes, floods, plagues, bad harvests and so on. At a certain point, somewhere over the past fifty years or so, we stopped worrying so much about what nature could do to us, and we started worrying more about what we have done to nature … It is a society which lives "after nature"' (Giddens 1999: 3).

A focus on water, on rainfall patterns and river discharges, will make it clear that Giddens' general theories about what he calls nature–society relationships and modernity are wrong. The floods and droughts in England that occurred both in the 1950s and in the years after he published his theories, hurricane Katrina and the flooding of New Orleans, the flooding of the Rhine and the enormous destructions in the Netherlands in 1996, and the havoc created by the 2002 Elbe flood are but a few examples that show that this crucial and fundamental developmental argument is flawed. Industrialised countries are definitely not 'immune' to the insecurities inherent in any water landscape; they never have been and never will be (Tvedt 2007).

## *Sustainable development and water*

A focus on water may also throw fresh light on the debate about the term sustainable development. Since the late 1980s the most fashionable environmental concept has been the concept of sustainable development, elevated to the status of some over-riding criterion of policy. An enormous amount of literature and a great number of research institutions have been involved in propagating the concept, and innumerable commissions and committees have been set up to report on it. The term has been hailed by many as a revolutionary breakthrough in ecological thinking and politics. Others argue that the term is defined in such a way that it is either

morally repugnant or logically redundant. The term has a complex etymological background, but we will here concentrate on the most famous definition of sustainable development, the one contained in the World Commission on Environment and Development, commonly known as the 'Brundtland Report' (1987). The report defined sustainable development as '… development that meets the needs of the present without compromising the ability of future generations to meet their needs'. This criterion has been criticised for being useless, since 'needs' is a subjective category. The report was also seen as a call for protecting the environment more or less as we see it today. The report stated: 'The loss of plant and animal species can greatly limit the options of future generations; so sustainable development requires the conservation of plant and animal species.'

It is in this context noteworthy that the report which aimed at discussing all the major environmental issues in the world did not address water problems at all, not with a single word. Again, by bringing water into the equation, interesting things happen. The Brundtland Report carried no images of water since it described the world as if it was waterless or as if water had not been, was not and would not become an issue in the debate about sustainability! This negligence is remarkable, since the report was published just a few years before the World Bank and other UN organisations warned the world that crises over water and conflict over water would be one of the most contentious issues in the years ahead, and it was published almost at the same time as the then Egyptian Foreign Minister, Boutros Boutros-Ghali, declared that the next war in the Middle East would most likely be about water. It was also issued in the middle of the UN Decade of Water, and just a few years after Mrs Brundtland had faced perhaps her toughest challenge as a politician in Norway: the strong protests against a large hydroelectric plant her government wanted to build in the Sami minority area, threatening a unique plant life and animal species. The Norwegian government and Brundtland overran the protests and argued that the dam was necessary, because of the growing need for electricity in Norway. To dam a river or divert a river course even on a small scale will always threaten plants and animal species, but it would be very difficult to justify a ban on such works that may increase the food production and the safety of millions of people – as a defence against floods and droughts – in order to save plant species.

The above examples may be sufficient to demonstrate that it might be fruitful to deconstruct the notion of nature as a whole or as one thing, and to focus on the ideas of water and how water has been understood and integrated in social analysis and historical narratives.

## APPROACHES TO THE STUDY OF THE HISTORY OF THE IDEAS OF WATER

Turner once described a peculiar unity as 'that which is neither this nor that, and yet it is both' (Turner 1991: 99). Similarly, water is particular and universal, the one and the many, nature and culture, physical and ideological. With water these oppositions are dependent upon each other and consequently unite and separate at the very same time: at a universal level, all water is the same, but at a particular level there are numerous and different types of water bodies. Actual water is always somewhere in time and space and therefore wrapped up in the qualities of its temporal and spatial context. This peculiar quality and character of water makes it unique as empirical data for analyses of social phenomena. While it is physically the same water, holy water for rituals such as baptism, ablution or purification lies in a different category from the water involved in a river's annual inundation for irrigation, the water nomads draw from oases, the snow used for building igloos or water stored in dams for hydroelectrical purposes. All of these cultural manifestations and elaborations are outcomes of the particular characteristics of water, and hence water transcends and unites culture and nature because it is simultaneously both.

This highlights the importance of addressing how different types of water are attributed with specific characteristics and why. Water represents the one and the many at the same time, and the plurality of cultural institutionalisations and perceptions puts emphasis on water's structuring principles and processes. Thus, the very nature of water as it appears in the hydrological cycle creates diverse water worlds, which limits and creates possibilities for human adaptation and cultural elaboration.

In general, ecological diversity is an entrance to a given society's ideas about the importance of water (e.g. Fagan 2000). The amount of water – and how it annually reoccurs as rain, in rivers or in lakes and oases – influences and affects the way in which water is incorporated into people's lives and worldviews or how it becomes socialised. Consequently, the ways the various water worlds or waterscapes are used practically, interpreted symbolically and given value to according to local and regional traditions and norms are a result of humans' continuous and meticulous interplay and mediation of cultural and natural variables.

Thus, different waters are attributed with specific qualities, capacities and values according to both ecological variables and cultural traditions. People's ideas of water and the way water is crucial for identities and values in a broader culture have to be seen

in relation to which types of waters are absent and present, or in which combinations they occur at a given time, because the different waters and constellations are actively incorporated into the collective body of knowledge, as water matters for humans at a personal, societal and religious level.

Moreover, even within these overall bodies of water, the water continuously changes its character. More meticulous cultural analyses at a micro-level in combination with ecological variables open up a vast ocean of how water has been a structuring agency creating values, norms and hierarchies. The silent flow of a river may be interrupted by violent cataracts and rapids, but still it is the same water. The dew during chilly mornings is different from the water droplets after heavy rain. The water in oases and underground wells as waters from beneath rather than from above attain particular characteristics. The transformative capacities of water which goes from a fluid substance to steam by cooking, a process parallel to the hydrological circle in nature, emphasise transgression and fluidity of borders and categories. These ever-changing qualities, capacities and forms of water as well as the various types of water enable the substance to be a medium by which it is possible to express and negotiate social relations and problems, and people can communicate the world they live in to themselves and to the outer world. Hence, the role water plays in defining, maintaining and negotiating identities and cultural values work at many levels, which may either oppose and contradict each other or strengthen and highlight unity and solidarity within a community or between communities.

The history of the ideas of water in science and philosophy starts many thousands of years back and has continuously been developed, challenged and changed to today's recent advances in molecular science. It draws upon the conceptual categories and research techniques initially developed in the study of the scientific revolution, including the general theory that the course of science has proceeded, not by gradual accretion of knowledge, but by discontinuous transformation of the perception of nature. In Western history the 'Scientific Revolution' of the sixteenth and seventeenth centuries is a major event that cannot be overestimated. The way water was perceived shaped other perceptions by which the world has later been conceived. The literature about this revolution is very extensive, but so far not much has been written specifically on how it also changed the understanding of water. The metaphysical foundations of this modern science, not the least the fundamental idea of the water cycle as an expression of God's plan for the world, gave rise to the understanding of the interactions between land

surface, atmospheric and ecosystem processes, which changed the way water was conceived. When hydrology – as the science of the occurrence, movement and properties of water upon and beneath the land areas of the globe in relation to the global water circulation – broke through in the late seventeenth century, it was demonstrated quantitatively that river flow and groundwater were generated by the precipitation falling on the river basin. This new knowledge signified a shift in ideas about water and it also had a far-reaching influence on how water was controlled.

Water has been a means of hierarchy and functioned as a structuring principle in society, whether its distribution was egalitarian or stratified. Throughout history, the control of water has been at the very heart of state building and imperial legitimacy since time immemorial. Dams, hydroelectricity and hydraulic systems are not mere technological inventions, but also symbols of power. Man has conquered nature, and by such demonstrations of power humans have also been subjugated to those who conquered nature. This relation between water and power is best exemplified in the great irrigation civilisations of the world. The control of rivers by dams and irrigation systems had not only been symbols of power, but the means by which particular ideas about water have established social systems and structures creating hierarchies and distributing wealth. Water has been power and, consequently, an agent in the constitution and continuity of societies as well as a driving force for those who wanted to change existing structures and traditions with subsequent implications for cultural change.

A study of the history of the ideas of water also has to be a study of water in religious thoughts and rituals, and one might even say that a study of the role of water in religion and myths amounts to a comparative history of these religions, since water plays such an important part in ideas of divinities, the rationale for religious practices, and in the history of the cosmos in most religions. Hence, in order to be able to tell a fruitful story about the history of the ideas of water, one has to break out of conventional analytical frames, since it is not very rewarding to talk about specific Western or African ideas of water. Rain-making might today be identified with Africa and African traditions and belief systems, for example, but ideas about how humans and the gods have influenced precipitation patterns can be found in most areas of the world at different points in time. Most narratives of histories of ideas in general and of histories of environmental thinking are histories of a particular country, civilisation or continent's ideas: that is, a history of European or Western ideas, or of Asian intellectual traditions, African mythology, and so on. The reason why a focus on the ideas of water must depart

from this tradition is partly that variations in water ecology and the physical character of rivers and waters and how humans have related to them do not coincide with the borders of states or the boundaries of cultures. Secondly, many notions about water are shared by different religions and different geographical and climatic regions, so specific civilisational or cultural analytical frames 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).

Therefore, in order to understand and explain the complex relationship between, on the one hand, the structuring role of particular and different man–water situations on social constructions of water and, on the other hand, diffusion and acculturation regarding ideas about water, a comparative and historical perspective is necessary. A history of perceptions and ideas of water must reflect that water in societies is unique as an element in the sense that it is *both universal and always particular*. This dual nature of water makes it unique as empirical data because it enables studies of both universal and particular aspects of water at the same time. The history of the ideas of water is very difficult to study as a history of diffusion and direction, precisely because all societies have had experiences with this fluid but life-giving resource. Hence, in social and religious studies it is possible to analyse structural similarities by diverse empirical practices. Shared ideas of water seem to have encouraged religious beliefs and practices, making it possible to identify underlying structures in the use and beliefs of water, and 'holy water' may illustrate this issue. Although one finds similar ideas about holy water at very different places and at different times, this fact cannot be interpreted as the outcome of ideas travelling from a centre, from a birth place, so to speak, but reveals the uniqueness of water in nature, culture and religion enabling global historical studies.

## HOLY WATER – THE UNIVERSAL AND THE PARTICULAR

Holy water is usually understood as a singular phenomenon, but it is not. What characterises holy water is the numerous qualities, capacities and cosmic structures that are ascribed to the various types of holy water. Holy water is not only a mediator between humans and god(s); the element is also seen as a divinity in itself. In India, Ganges is the Mother Goddess of Hinduism, and as such the water with its life-giving capacities is perceived and worshipped as a

divinity (Darian 1978; Eck 1983; Feldhaus 1995; Oestigaard 2005a). In Christianity, the water used in baptism is not perceived as a divinity, but as consecrated water (Beasley-Murray 1962; Harper 1970). Both types of water are traditionally within the religious realm, but their qualities and internal capacities differ. Ontologically, there is a fundamental difference as to whether the river *is* a divinity, as with Ganga, or whether the divinity transfers healing or blessing power *to* the water, as with the waters at Lourdes and Christian baptism water respectively. Moreover, in Judaism, the 'living waters' do not represent an embodiment of Yahweh, but they do have spiritual qualities that allow humans to get closer to God. All of these waters are commonly referred to as 'holy', but the internal qualities, structural properties and uses vary greatly. Hence, the various ideas of different types of holy water may reveal how unique practices and perceptions still share fundamental and structural aspects.

Water may constitute the very embodiment of the divinities; the divinities may manifest themselves in water and as water. The waters may also relate to cosmic processes and the very creation of the cosmos; they definitely belong to the divine realm but are nevertheless not considered as the divinities themselves. The waters in Paradise, which Judaism, Christianity and Islam share, belong to such a category of divine waters, as does the cosmic water from which everything originated according to Hinduism as well as the cosmic waters in Buddhism, which can still be found in Muktinath in Nepal. The cosmic waters are truly seen as divine, but not as divinities, and these waters have an important function in the creation of the cosmos by bridging this world and the Otherworld. Hence, these kinds of water of divine origin, which may even predate the origin of the divinities and the cosmos itself, shows that holy water may have several properties and qualities.

Holy waters are not only revelations of the divinities themselves, but may also be imbued with certain divine powers and qualities in the form of a spiritual or physical substance (Marriott 1976; Marriott and Inden 1974, 1977). Logically and practically, different holy waters work for certain purposes, but not for others. Ganga is an exception since the river is holy and a true divinity in itself; hence it is possible to use it for any purpose because it encompasses the whole cosmos and everything within it. From a religious point of view, Ganga is the ideal holy water because she is the supreme goddess who may be used for absolutely every purpose. The water in the Christian baptism is, on the other hand, of a very different kind. Although God transfers spiritual and divine qualities into this water, through the consecration by priests, the sacred powers are limited and defined for a certain purpose such as baptism. Nevertheless, despite all these

different qualities, divine revelations and manifestations through water, structurally there are some ideas which reoccur throughout beliefs and rituals concerned with water.

Firstly, holy water has the capacity to purify and annihilate human sins. Water and religion are inevitably connected to sin and defilement, and to the erasing of sin and the preparation for life after death (e.g. Parry 1985, 1994; Douglas 1994; Hertz 1996; Lehtonen 1999; Oestigaard 2005a, 2005b). The main aim of purifying water rituals is to reduce the Otherworldly punishments for perpetrated sins. In this world, water has the capacity to reduce misfortune and punishments in the realm of the hereafter. This quality of holy water is perhaps the most important aspect of water irrespective of religion. Holy rivers or bodies of sacred waters mark the end of the profane and the start of a divine journey, and as such the water alters the bio-moral character of objects or persons who have been immersed in the river or partaken of the waters. Those who arise from the water are different from those who were immersed in it, as they are now invested with divine qualities and grace.

Secondly, holy water reveals divinities and divine powers. Water is used to prove the truth or to reveal that a god *really* is the god he or she claims to be. A striking testimony of water's ability to prove the power and legitimacy of divinities is recorded in the Old Testament where the cosmic drama and battle between the Jews and the Baal-worshippers unfolded on Mount Carmel (1 Kings 16–45; Tvedt 1997: 85). In the barren desert of ancient Israel, Yahweh and the Baal-worshippers argued not only about which god was the most powerful, but which one was the *real* one. They did this by testing who of the religions' respective devotees could, by prayers and performing rituals to their gods, generate rain. The Baal-worshippers started, but failed. Then Elijah sacrificed and prayed, and Yahweh let the precious water fall from heaven, which proved that he was the only true god. Although the gods may exist ontologically regardless of their interaction with humans on earth, devotees perceived it the other way around. An impotent or powerless god will not be obeyed and worshipped, even if he or she is strictly speaking still a divinity, and the gods' power is often measured through their ability to provide humans with life-giving waters in the form of rivers and rain (McKittrick 2006).

Thirdly, holy water heals and works as a medium of prosperity and wealth for humans. Water's sacredness or holiness is widely believed to cure any kind of sickness or disease. Some bodies of water have multiple and all-encompassing qualities, such as the holy Ganga; others have more limited potential. The sacred waters at Lourdes in France have the particular and specific power to cure humans, and Lourdes is today the most visited pilgrimage shrine in Christianity (Gordon 1996; Harris 1999). Thus, the healing and curing aspects of water are fundamental for defining how devotees see their place in the cosmic realm and how they interact with the divinities. To be healed is *to be blessed*. Hence, the healing and curing aspect is not only a physiological transformation, but also a sign of receiving the Holy Spirit in the case of Christianity, or divine grace in Hinduism, Buddhism, Judaism and Islam. Being cured allows devotees to see that the divine grace is bestowed on them, and water is one of the media through which the divinities reveal themselves and bestow their grace upon an individual.

Fourthly, holy water represents the meeting point between the different cosmological realms. The topography of the world includes the meeting point of heaven and earth, which is revered because of its association with divinities (Harpur 1994: 11). Water often constitutes the links between the human and divine realms because it possesses various divine qualities. The Ganges is the river of heaven on earth *par excellence*, but the holy Jordan River in Judaism (Issar 1990) and Christianity and the Zamzam spring in Islam (Haleem 1999) also share the same structural properties. According to Buddhist mythology, in Muktinath in the Himalayas the original fire burns in water in harmony, and the rocks and the soils are as they were in the beginning of time (Lhalungpa 1979; Snellgrove 1979; Messerschmidt 1982).

Fifthly, holy water is seen as god's grace onto humanity, giving prosperity and life to humans. These waters are not holy as such, but they nevertheless enable life and human wealth and prosperity. Even though the waters in themselves do not have any spiritual qualities *apart from being a gift from the divinities*, the greatness of the gods may be revealed. Hence, from a cosmic perspective, the seemingly neutral water is also incorporated into the religious realms since humans are dependent upon the divinities and cosmic premises.

All kinds of water are thus included in the divine and cosmic realms; they are holy or ontologically an embodiment of the god or goddess itself. They may have specific qualities because the divinities transferred some of their powers to the water, which humans use in their daily life and for purificatory purposes, thus allowing them to face and improve their own situation in the cosmos. Water may be seen as neutral and as having no divine qualities and properties, but since it is given by the divinities for the benefit of humanity, it is part of a greater cosmological scheme. All these capacities and ideas of holy waters are not unique to a given religion, but are shared across religions despite theological and ritual differences. Water is structurally used to express the same ideas and premises, although the context and form of the rituals through which they are acted out vary greatly.

The belief in the holy waters' various divine capacities, powers and structures constitute or form religions. This may also explain why water rituals have been so intricately interwoven with religious practices throughout history; *using water as a medium in ritual practices* allows devotees to express and explain numerous and often incommensurable ideas of the world and the cosmos and how they are related. Ideas of different types of holy water make sense because it has generally not been necessary to provide any other explanation or answer, and water also transcends different religions. In religious practice, water expresses meanings in symbolic forms which have been fundamental for the believers (e.g. MacCulloch 1911; Bord and Bord 1985; Gribben 1992). Many of these beliefs are common within different religions because of this particular and at the same time universal nature of water.

One special feature which should be noted here is the natural character of water; namely that it is always in flux, a capacity that enables water to express cultural and religious values. This theme is widespread from philosophy to, for instance, an English hymn that has the lyrics 'time, like an ever rolling stream …'. Philosophically, when we say that time is flowing or passing by, it presupposes that time is similar to a river, and that it flows from the past towards the present and the future, and this river metaphor has persisted from the time of Heraclitus (Merleau-Ponty 1995: 411). This movement in time where 'the water which has just passed *is* now a little further downstream in the valley' (ibid: 412) reveals a fundamental capacity of water: it transfers and points towards the future.

With regards to pollution and contamination, water transfers and removes impurity to a future state of purity. The capacity to remove impurity and *still remain pure* is at a structural level essential in all

religions revealing the divine capacities in holy waters. Its floating character may also enable metaphors which bind together the different spheres, and the most common idea is that water is a blessing simply because it is and always has been a necessity for life. Hence, the devotees may perceive that the gods *established the principles of the cosmos through water*. These ideas of what constitutes religion and the creation of the cosmos as well as how humans interact with the divine are to a large extent ideas of water (Tvedt and Oestigaard 2006).

## AN EMPIRICAL EXAMPLE: THE SUN, THE NILE AND THE PHARAOHS REVISITED

The potential fruitfulness of a water perspective can be underlined further by an example discussing one of the most central issues in the history of ideas: the sun cult in Egypt and the ideology behind the construction of the pyramids. The building of pyramids started at the beginning of the 3rd Dynasty during the reign of Djoser (ca. 2650 BCE). Sneferu, the first king of the 4th Dynasty (ca. 2625–2585 BCE), constructed three major and two minor pyramids, which together contained more cubic metres of stone than the Great Pyramid of his son Khufu (ca. 2585–2560 BCE). Khufu's pyramid is the world's largest pyramid and Khufu's successor, Khafre (ca. 2555–2532 BCE), built the second largest pyramid at Giza. Three generations in the 4th Dynasty did the bulk of pyramid building, and from the Old Kingdom, 21 of the 23 major pyramids stand like sentinels on a 20-km stretch, including those at Giza (Lehner 1997: 14–15).

The pyramids manifested and expressed the sun ideology; Ra was the sun and all the pharaohs were the Son of Ra-Horus (Assmann 1995). This has been the the main and dominant theory with regards to the ideology that gave rise to the civilisation and the construction of the pyramids. But why was the sun in a desert country the obvious source for worship and metaphors? How do we understand the sun? And how do we understand that the Nile never attained the greatness of a supreme deity? Is there a connection between the sun and the Nile that can be discovered if we focus upon the role of water in Egyptian society?

All Egyptian dynasties were dependent upon the Nile, and the fluctuations in the Nile flood created an inter-annual variability in the volume of water. Still, despite its fundamental and vital role in Egyptian civilisation, the Nile was apparently never important in their cosmology, while the sun became Egypt's greatest deity. 'Although

the Nile was the obvious giver of life to the early men of Egypt, it was not the great river and its precious waters that first stirred thoughts of worship in their primitive minds. It was the sun, relentless bearer of death, that they supplicated' (MacQuitty 1976: 50). This is seemingly a paradox, and also makes Egypt different from the other river civilisations that developed around the same time in Mesopotamia and in the Indus Valley and later riverine civilisation and religions (Trigger 2003) where the rivers and the water were worshipped.

Why worship the sun in a desert environment when summer temperatures approach 50°C? Were the ancient Egyptians recklessly water blind? Why did they not worship the precious and life-giving river? In many places in Africa, the sun is seen as the enemy of mankind because it contradicts life. Among the Bari along the White Nile in Southern Sudan, for example, too much sun was seen as the work of a malevolent rain-maker who could be killed if he 'willed the sun' and failed to make rain (Seligman 1934, 1965). At the outset, thus, the sun cult in the Egyptian desert seems mysterious and illogical. On the contrary, one would have expected that the Nile and the life-giving waters were integrated into culture and religion, particularly in a desert environment.

A water perspective may give new insights into these apparent contradictions. Ecologically, the end of the Neolithic Wet Phase coincided with the rise of the Egyptian civilisation from ca. 3000 BCE onwards. The rainfall patterns became unstable and the climate drier, and the Egyptians had to rely entirely on the annual floods (e.g. Butzer 1976; Said 1993). Together with this ecological change, a ritual and religious change took place as well. When the seasonal rains became unpredictable, there was a religious change from rain-making rituals to rituals which aimed to control the life-giving waters in the river. As opposed to other civilisations with a rich mythology and corpus of water metaphors, this change, however, was not expressed explicitly with water symbolism. What took place, it may be suggested, was that the existing water cosmology was for different reasons expressed and understood through sun symbolism as evident in the mythology.

We present a short version of the story here, in order to exemplify the empirical potential of a water perspective, in this case regarding one of the 'big' issues in the history of ideas; namely, what was the ideology or religion which gave rise to the building of the pyramids in ancient Egypt? Originally, the main gods were Horus the Elder and Seth. Horus was the sun god and Seth a rain and storm god – 'a god of the blessed yet dangerous storms' (Bell 1971). When rain became

rarer with the decline of the Neolithic Wet Phase, everything from the desert was conceived as being sinister to the people living in the desert land, and Seth eventually became the personification of evil (Bell 1970, 1971). This is also evident from the central myth theme: the feud between Seth and Horus, which features two parts. First, Horus is sexually violated by Seth and loses one of his eyes to him, while Horus tears off one or both of Seth's testicles; the second part of the myth tells how Horus found his lost eye and regained his eye's sight (Griffiths 1960; Te Velde 1967). The former rain god was replaced by Horus, whose most prominent symbol was the solar eye, which after the feud also contained the Nile. Hence, the life-giving waters were transferred from one god to another and the terrestrial river became celestial water. The *Coffin Texts* (translated by Faulkner 2007), appearing for certain from the 8th Dynasty (ca. 2150 BCE) and onwards, say that mankind arose from the sun's eye, or in other words the Nile and its life-giving waters.

Several sky gods were castrated by others, and in general this represents the supplanting of one by another. Horus inflicted this on the storm god Seth (Wainwright 1935: 154). The removal of Seth's testicles does not necessarily mean castration, but it can also be seen as theft of seed (Te Velde 1967: 31). Seth did not become a eunuch, but became impotent (Te Velde 1967: 33). After the battle, Seth was no longer seen and worshipped as the virile god of thunder and rain. Seth's homosexual act threatened the cosmic order because he no longer controlled the life-giving waters (Te Velde 1967: 43), but stability was restored by Horus through the transference of power and the life-giving water from rain to river, symbolised by the sun and the solar eye.

Horus the Elder was not only the sun, but encompassed everything; he was Horus the Falcon, the Lord of Heaven, and the earthly king (Anthes 1959: 171). Paralleled with the climatic change when the rains became rarer, the old sky and rain gods were either transformed into fertility gods or could become solarised (Wainwright 1938, 1963). Horus was solarised and gained absolute power, whereas the god of rain and storm Seth lost all his powers and became an incarnation of evil. Thus, there was a transformation and transfiguration of power, and what was at stake in the feud between Seth and Horus was, it may be suggested as a hypothesis, the life-giving waters – rain or river – and consequently the life and prosperity of all of Egypt. Instead of becoming terrestrial, the river god remained celestial: Horus as the former sun god incorporated all of the river's ideological qualities and capacities in the form of the sun. Hence, the river god was clothed and masked in a former

rain-making cosmology as the sun. In the divine Parthenon, the old divine forms and figures continued, but their contents and cosmic functions changed. The seeming paradox of sun instead of water worship in Egypt can be understood from this perspective precisely because the Nile's inundation had its origin in heaven and the solar disc following the myths of Horus. The water cosmology was expressed and understood through sun symbolism.

The pharaoh's realm was often described as 'that which the sun encircles' or, in other words, the earth (Frankfort 1948: 19; Redford 1995: 172), and the name Ra probably simply means 'the sun-disk' (Anthes 1959: 180). The sun god was extremely closely associated with ablution and purity. Before the pharaoh could enter the temple, he was washed, and, when dead, he was purified by ritual ablutions before he could enter the sun god's kingdom. The sun god was reborn every morning from the womb of the sky goddess, and underwent daily lustrations at dawn from sacred pools (Blackman 1925: 206). The Pharaoh underwent the same ritual washing when dead as he did when alive in the 'House of the Morning' (Blackman 1925: 207). Both in life and after death, the immanent life-giving qualities of water were of utmost importance: 'This cold water of yours, O Osiris, this cold water of yours, O King, has gone forth to your son, has gone forth to Horus. I have come and I bring to you the Eye of Horus, that your heart may be refreshed possessing it' (Faulkner 1969 [text 22]). Water was life, but only through the eye.

Moreover, in some of the earlier allusions Seth seems to be the giver of light when he was transferred to heaven. More importantly, Seth was also seen as the power of the sun's heat (Griffiths 1960: 125). Hence, sun worship was not the worship of the sun as a warm and intensely burning disc in the sky – these were Seth's deadly qualities. This may explain why there were qualitatively different ideas associated with the sun in ancient Egypt and for instance among the Bari along the White Nile, where it was a heinous sin to allow the sun to dominate the life-giving waters in the form of rain.

In ancient Egypt, the sun disc and the sun god represented the numerous life-giving aspects expressed in water metaphors, which we would initially not have associated with the sun. Our ideas and conceptualisations of the sun as a scorching and deadly enemy in the desert are not sufficient when trying to understand the water world of the old Egyptians and the ideas they had about water. This example may serve to illustrate that historically important information can be garnered by recreating the actors' water worlds and perception of water. It may also explain apparent contradictions, such as the apparent worshipping of the sun and not the Nile when the Egyptians lived in a desert where the river was the life artery of

the Pharaonic dynasties. In this respect, the Pharaonic cult and the sun ideology behind the pyramids can be considered from a water perspective, giving life and prosperity to humans and gods. A water perspective may enable an approach to sun worship not based on biased and prejudiced perceptions of the sun where we transfer our ideas of the sun to the minds and ideology of the ancient Egyptians. Although more research needs to be conducted on this and similar topics, it clearly illustrates the pervasive role that ideas of water may have had in history and in the shaping of conceptions of the cosmos.

## CONCLUSION AND THE CONTENTS

Science is first and foremost concerned about gaining new knowledge of the world, and it must always, as Charles Darwin said, develop as a critique of established truths and ideas of the world. One way to do this is to emphasise the history of the ideas of water. By deconstructing nature and focussing on water, one may gain new knowledge of historic and development processes, including religion, culture and science itself. Water is not only natural, but also cultural, transcending common dichotomies and research traditions, and hence an empirical entrance to new knowledge of the world. From a cultural and religious perspective, the understanding and conceptualisation of water is as wide and varied as the waters themselves, which give a rich base from which metaphors, metonymies and reveries can express social matters or aspects of life (see Lakoff and Johnson 1981, 1999; Bachelard 1994). The way water has been conceived in science has also shaped and defined our understanding of the world. Together, approaching the history of the ideas of water from different traditions such as the ideas of water in religion and myths, ideas of water in culture, society and development, and ideas of water in science and philosophy, one may contribute with new knowledge in both natural and social sciences.

Since the history of the ideas of water includes most aspects of the world history, it is impossible to include all facets and aspects, and the chapters in this book should therefore be seen as examples and entrances to such a history.

The first part of this volume deals with really fundamental questions; like competing notions about what water is; the role of this unique substance in the cosmos; and the development of the theory of the hydrological cycle. Robert Kandel discusses the role of water in the cosmos from the Big Bang to the presence on Earth. Water, $H_2O$, is a combination of hydrogen and oxygen. While hydrogen is the basic stuff of the universe, production of water

depends on production of oxygen, which is the result of complex cosmic processes. The production of hydrogen took place during the Big Bang, but the production of oxygen was dependent upon the first and succeeding generations of massive stars. Even if both hydrogen and oxygen are present, specific conditions are necessary to form $H_2O$ molecules, which are produced in extended envelopes of cool giant stars. Early in the planet's history, the Earth was bombarded by asteroid belt debris and comets containing water. Initially, this cosmic bombardment turned the Earth's surface into a hot boiling soup, but the appearance of water on Earth transformed its environment. Although it passed through icy snowball phases, the globe evolved to today's waterscape where on average seawater is 2,800 m deep.

Philip Ball analyses water in science and scientific discovery and asks what exactly the nature of water is. Traditionally, water has been seen as an element; the understanding that water is a combination of elements (hydrogen and oxygen, giving the chemical formula $H_2O$) is a recent development. Intriguingly, although water is everywhere on this planet and is considered to be an archetypal liquid, the nature of water is still not understood and continues to be a conceptual challenge in science. Water seems to be a unique substance, presenting many anomalies compared to other liquids. It does not easily evaporate, it has a high heat capacity, the melting and boiling points are unusually high, and it becomes less dense when it freezes. In the changing conceptions of what water is, we can read the history of scientific development more broadly. In future, a better understanding of water and its roles in biology may help us understand why terrestrial life forms are adapted to water, and whether or not alternative life forms could be supported by different liquid solvents on extraterrestrial worlds.

Paul Needham traces the historical development of the understanding of water in the light of the development of the general concept of chemical substance. From the times of the earliest known ancient Greek philosophers, water has played a central role in the conception of the material constitution of the world. But it was Aristotle who developed the most sophisticated understanding of water to have come down to us from the ancients. He viewed it as part of an intricate and systematic theory of chemical substance, which classified water as an element along with earth, fire and air. His view exerted a considerable influence on Arabic and European thinkers throughout the Middle Ages, and wasn't successfully challenged until the eighteenth century. After Lavoisier, it was recognised that water, though unlike air a single substance and not a mixture, is neither an element nor always liquid. General features of

chemical substances, distinguishing elements, compounds and mixtures, were elaborated in a general theory and harmonised with the mechanical features of matter towards the end of the nineteenth century. Finally, the continuous conception of matter underlying the Aristotelian view, which had been unsuccessfully challenged in the seventeenth century, was definitely overturned in the twentieth century, and the intricate microstructure of water was revealed.

Rodney Farnsworth analyses the development of the idea of the hydrological cycle as a metaphor by thinkers in the sixteenth to nineteenth centuries. This metaphor influenced the scientific understanding of the hydrological cycle and vice versa. On the one hand, the human landscape was a water landscape and Romantic thinkers used the cycle as a metaphor for cultural hopes and fears, and the flux and reflux of water was crucial in Romantic culture in Europe. On the other hand, technology and the Industrial Revolution, in particular the steam engine and the science of thermodynamics, influenced Romantic ideas of the cosmic model as the hydrological cycle. Hence, artists and scientists were intimately influenced by each other.

The second part of this volume focuses on how different forms of water related material, artefacts and culture reflect and embody different ideas about water in different societies and social settings, from the Roman aqueducts and baths to modern spas and sanitation systems, explicating continuities and change in cultural and social notions about water. Rina Faletti analyses water and power in the history of the aqueducts in the Roman Republic in the fourth and third centuries BCE. The first two aqueducts in Rome were not built to satisfy a basic need for domestic water or to supply public baths and gardens, as scholars often assume: they were a means for economic development, political prowess and ideological dominance. The aqueducts symbolised class and economic distinction and the water works made ideological statements sponsored by the state. The importance of the control of water for ideological purposes is evident in the fact that the building of the aqueducts marked the first time war profits were directed into public projects. Thus, ideas of water shaped cultural institutions and urban identities during the republic that served Rome continuously through the Empire.

Garrett G. Fagan analyses the social uses of water in the ancient Mediterranean by focussing on public baths. The Greeks developed the practice of public bathing in the course of the fifth century BCE. To this end some basic technological developments in the fields of water supply, drainage and heating systems can all be traced to the Greeks. But it was the Romans who popularised bathing for the

public at large. Communal bathing was first and foremost a pleasure and a social activity; hygiene was a secondary consideration. While the disproportionate popularity of the baths was criticised by contemporary moralisers, the emperors took the activity to new heights. The baths became pleasure domes which reinforced the imperial image through their opulence. And while men and women, and the elite and the slaves, might mingle together at the baths, they were at the same time the place where social status was reinforced and social distinctions stressed. Water culture thus manifested and reproduced the social order.

David Mosse analyses the rule of water in South India with an emphasis on uncertainty and cultural ecology. He argues that the two main paradigms, the 'engineering paradigm' and the 'management framework', are insufficient. These two approaches see water as the subject of professional engagement and irrigation as a technological input in the production. While the third approach – the 'indigenous knowledge' approach – seeks to challenge the two others, it has often reinforced the limited conceptions of water–society relations because of dichotomies, ahistorical models and the complex social and ritual webs of meaning. Water shapes and is shaped by political, cultural and ritual relations. Hence, water distribution reinforces social differentiation from local to state levels, and traditions continue to impede the establishment of new water management practices.

Petri S. Juuti, Henry Nygård and Tapio S. Katko analyse water supply and sanitation, sewerage and waste management in a comparative, historic perspective with a special focus on Finland. They emphasise the motivations, expectations and experiences of the development of the early water supply and sanitation services. Managing water supply and sanitation has been central in prehistoric urban settlements from the first cities in the Middle East, but it was from the early 1800s that major water supply and sanitation schemes were implemented in Europe. These developments took place parallel to and as a consequence of the appearance of new ideas regarding water, health and hygiene. It has been said that 'water is life; sanitation is dignity', and thus the history of water and sanitation services is also social and environmental history as well as the history of industrialisation and urbanisation, linking together cultural values, health, development processes and new ideas for solving future problems.

Susan C. Anderson analyses the role of water in culture and recreation in modern Western Europe. Cultural uses of water have reflected, questioned and helped shape social and cultural values and identities. In the early modern period few Europeans swam or bathed. The Church opposed bathing as 'immoral' and water was

regarded as a bearer of disease, the beach as an unclean place. Late seventeenth-century medical discoveries and ideas about the benefits of hardening the body attracted educated Europeans to cold bathing. The Romantics saw swimming as a way of regaining innocence and liberating themselves from the constraints of urban life. Bathing for hygienic reasons came into fashion during the eighteenth century, where the idea of bathing as part of a cure in spas formed one form of water recreation. In the nineteenth century spas and seaside resorts became social arenas first for the European elite and later for a broad array of people. Thus, water in culture relates to the displacement of hydrophobia and to the changing notions of nature, the human body and purity.

The third part of this volume explores the roles and ideas about water in different religious belief systems and cultural practices, from the monotheistic so-called 'Desert religions' of Judaism, Christianity and Islam, to water-mythologies in China, Aboriginal Australia and the Maya culture, and from rain-making in Africa to the almost universal theme of the flood. Francesca de Châtel compares ideas of water and purity in Judaism and Islam in both the scriptures and ritual practices. Both religions originated in arid, desert environments where water's absence underscored its importance in society and religion. In the Hebrew scriptures, rain is seen as more precious than the Torah and creation itself, whereas in Islam water symbolises God's benevolence and the most sacred qualities are ascribed to it. In Judaism, purifying water rituals revolve around the *mikvah* – the Jewish ritual bath. Immersion in its waters is a purely spiritual ritual, and symbolises rebirth. In Islam, the minor and major ablutions that are conducted before the prayer or after illness, for instance, purify the believers both physically and spiritually; they form an integral part of the religion.

Terje Oestigaard analyses the qualities of fire and water as metaphors in Heaven and Hell in Christianity. The Otherworldly spheres are to a large extent represented by various types of fire and water, which have been used in purification and purgation, and as a penalty in hell. Baptism, the deluge and hell's torments have all been described through various combined ideas of water and/or fire. Completely different processes and spheres have been visualised and materialised with water and fire because it is possible to attribute opposite qualities to these two elements. God and Satan may employ the same water and fire, just different forms of it; God's are benevolent and life-giving whereas Satan's are malevolent, destructive and evil both in hell and on earth. Hence, ideas of fire and water play a fundamental role in the conceptualisation of cosmic principles in Christianity.

Dieter Gerten examines hydrolatry and practices of water worship in early pre-Christian religions in Europe and looks at whether, and in what form, these practices were continued in Christianity. The Christian syncretism – in which earlier Greek, Roman, Celtic and Germanic types of water worship were incorporated despite theological differences – highlights how the idea of water as a sacred element transcends religions. The author also traces pre-Christian ideas and myths of water in European folklore, literature and the arts until the nineteenth century, when the religious importance of water in culture diminished. A conclusion is that the current mechanistic and reductionist worldview is only a quite recent, and Western, phenomenon that may be too narrow a perspective for overcoming the looming global water crisis.

Veronica Strang analyses water in Aboriginal Australia. Situated in 'the Dreamtime', Aboriginal engagements with water are holistic, with the land and waterscape shaping social, political, economic and religious institutions. Ancestral stories describe how the flow of water across the continent 'holds' the ancestral forces which generate life. Often represented as a serpent, 'The Rainbow' conceptually links all of the waters that provide the ancestral pool from which human spiritual being emerges, and to which it returns at the end of life. Water and other fluids are imbued with powerful energies, and the exchange of these is a crucial element in rituals that affirm people's clan membership and identity, and maintain their relationships with place.

Tore Sætersdal analyses rain-making in a comparative context with a particular focus on African practices in Central Mozambique and Eastern Zimbabwe, where rain-making is related to ancestral spirits of the land and special sites, often archaeological sites and rock art sites. Traditionally, rain-makers were both divine kings and sorcerers, and rain was seen as a sacred phenomenon, thus including the divine realms. The ideas of rain and the procurement of it through rituals are closely associated with other symbols and transformations. Rain-making is part of fertility rites with an emphasis on sex and continuity of life. Rain is seen as semen bringing forth the natural transformation and there is also a social transformation that brings health and wealth to individuals and society. Hence, the ideas of rain-making pervade all parts of society, relating to land and consequently to religion and cosmos.

Zheng Xiao Yun analyses water-related myths in China with a particular emphasis on ethnic groups in the province of Yunnan in the south-west of China. In China, there are three levels of water myths. First, in general, human history evolved from water. A central feature is how heroes harnessed the flood – one such hero who

fought evil deities and controlled the water became the first Chinese emperor. Second, at a regional level there are water myths with regards to particular deities, rivers, lakes, springs, wells, and so on. Third, at the level of ethnic groups there are numerous myths about the origin of the world prior to the flood. Water myths have significant importance for the origin and constitution of social systems such as marriage, family relations, man–nature interaction, and ideas about good and evil. Ideas about water have therefore deeply influenced culture and identity up to the present day.

Wendy Doniger makes a cross-cultural analysis of flood myths with an emphasis on myths in India. The almost universal theme of the flood as a cause of human devastation has led scholars from numerous disciplines ranging from psychology to ecology to try to explain this phenomenon. The flood myths take several forms, including the doomsday flood, the sinking of the earth, the flooding of cities, the Tsunami and the myth of survival. Many of these myths have common themes despite significant difference in place, time and culture. The similarities in the various myths may be explained through shared experiences of real floods, since this myth theme is prevalent in early cultures along major rivers such as the Nile, the Tigris, the Euphrates, the Indus and the Yangtze, and may have spread from there to other cultures.

José Luis Martínez Ruiz, Daniel Murillo Licea and Jorge Martínez Ruiz analyse the water cosmoview and symbolism in the Mesoamerican and Peruvian area in the pre-Hispanic period. Water has had a fundamental role in the civilisations of the Olmec, the Maya, the Mexica and the Andean peoples. The mythology and cosmology are structured around different perceptions of water and the water cult is one of the most ancient cults in Mesoamerica. Perceptions of water are found in all parts of society, mythology and religion. From architecture to rituals and the divine Parthenon, water is intrinsic in the cultural construction and religious perceptions of cosmos. Moreover, the ideas of water show a huge similarity in both form and meaning across the different civilisations in time and space in Mesoamerica and the Andes.

## NOTE

1. The way the distinction between culture and nature was drawn by the 'father of sociology', Émile Durkheim (1858–1917) has been criticised as unfruitful by a number of authors (e.g. Ingold 1986; Godelier 1988; Latour 1993, 2003; see also Tvedt and Oestigaard 2006). By arguing that 'a social fact' could and should be explained by another social fact only

(Durkheim 1904: 145), natural variables or the physical world were left out as a relevant topic to study for social scientists or for students of the history of ideas.

## REFERENCES


Allen, D. C. 1963. *The Legend of Noah. Renaissance, Rationalism in Art, Science, and Letters*. University of Illinois Press. Urbana.

Anthes, R. 1959. Egyptian Theology in the Third Millennium B.C. *Journal of Near Eastern Studies.* Vol. 18, No. 3: 169–212.

Assmann, J. 1995. *Egyptian Solar Religion in the New Kingdom. Re, Amun and the Crisis of Polytheism*. Kegan Paul International. London.

Bachelard, G. 1994. *Water and Dreams. An Essay on the Imagination of Matter*. The Dallas Institute of Humanities and Culture. Dallas.

Baird Callicott, J. and Palmer, C. (eds) 2005. *Environmental Philosophy: Critical Concepts in the Environment.* Routledge. London.

Beasley-Murray, G. R. 1962. *Baptism in the New Testament*. Macmillian & Co Ltd. London.

Beck, U. 1998. *Risk Society: Towards a New Modernity* (translated by Mark Ritter). Sage. London.

Bell, B. 1970. The Oldest Records of the Nile Floods. *The Geographical Journal.* Vol. 136, No. 4: 569–73.

Bell, B. 1971. The Dark Ages in Ancient History. I. The First Dark Age in Egypt. *American Journal of Archaeology* Vol. 75, No 1: 1–26.

Blackman, A. M. 1925. Osiris or the Sun-God? *The Journal of Egyptian Archaeology*. Vol. 11, No. 3/4: 201–9.

Bord, J. and Bord, C. 1985. *Sacred Waters: Holy Wells and Water Lore in Britain and Ireland.* Granada. London.

Brundtland, G. H., et al. 1987. *Our Common Future: Report of the World Commission on Environment and Development*. Oxford University Press. Oxford.

Buttimer, A. and Wallin, L. 1999. *Nature and Identity in Cross-Cultural Perspective.* Kluwer Academic Press. Dodrecht/Boston/London.

Butzer, K. W. 1976. *Early Hydraulic Civilization in Egypt. A Study in Cultural Ecology*. University of Chicago Press. Chicago.

Coates, P. 1998. *Nature. Western Attitudes since Ancient Times.* Polity Press. Cambridge.

Cohn, N. 1996. *Noah's Flood. The Genesis Story in Western Thought*. Yale University Press. New Haven and London.

Darian, S. G. 1978. *The Ganges in Myth and History*. The University Press of Hawaii. Honolulu.

Devall, W. and Session, G. 1985. *Deep Ecology: Living as if Nature Mattered*. Gibbs M. Smith. Salt Lake City, Utah.

Douglas, M. 1994. *Purity and Danger*. Routledge. London.

Dundes, A. (ed.) 1988. *The Flood Myth*. University of California Press. Berkeley.

Durkheim, E. 1904. *The Rules of Sociological Method.* Free Press. New York. 3rd ed. 1966.
Eck, D. E. 1983. *Banaras – City of Light*. Penguin Books. New Delhi.
Eliade, M. 1979. *The Sacred and the Profane*. Harcourt Brace Jovanovich. New York.
Engel, J. R. and Engel, J. G. (eds) 1990. *Ethics of Environment and Development: Global Challenge and the International Response*. Belhaven. London.
Fagan, B. 2000. *The Little Ice Age. How Climate Made History 1300–1800*. Basic Books. New York.
Faulkner, R. O. 1969. *The Ancient Egyptian Pyramid Texts*. Clarendon Press. Oxford.
Faulkner, R. O. 2007. *The Ancient Egyptian Coffin Texts. Spells 1–1185 & Indexes*. Aris & Phillips. Oxford.
Feldhaus, A. 1995. *Water and Womanhood. Religious Meanings of Rivers in Maharashtra*. Oxford University Press. Oxford.
Frankfort, H. 1948. *Kingship and the Gods. A Study of Ancient Near Eastern Religion as the Integration of Society & Nature.* The University of Chicago Press. Chicago.
Geertz, C. 1973. *The Interpretation of Cultures*. HarperCollins Publishers. New York.
Giddens, A. 1989. *Sociology.* Polity Press. Cambridge.
Giddens, A. 1999. Risk and Responsibility. *The Modern Law Review*. Vol. 62, No. 1: 1–10.
Glacken, C. 1967. *Traces on the Rhodian Shore.* University of California Press. Berkeley.
Godelier, M. 1988. *The Mental and the Material: Thought Economy and Society*. Verso. London.
Gordon, S. 1996. *The Book of Miracles: from Lazarus to Lourdes.* Headline Book Publishing. London.
Gottlieb, R. S. (ed.) 2003. *This Sacred Earth: Religion, Nature, Environment.* Routledge. London.
Gribben, A. 1992. *Holy Wells and Sacred Water Sources in Britain and England. An Annotated Bibliography*. Garland Publishing Inc. London.
Griffiths, J. G. 1960. *The Conflict of Horus and Seth. From Egyptian and Classical Sources.* Liverpool University Press. Liverpool.
Haleem, M. A. 1999. *Understanding the Qur'an. Themes and Styles*. I.B.Tauris. London.
Harper, M. 1970. *The Baptism of Fire*. Fountain Trust. London.
Harpur, J. 1994. *The Atlas of Sacred Places. Meeting Points of Heaven and Earth.* Cassell. London.
Harris, R. 1999. *Lourdes: Body and Spirit in the Secular Age.* Viking. New York.
Hertz, R. 1996. *Sin and Expiation in Primitive Societies.* Occasional papers No. 2. British Centre for Durkheimian Studies. Oxford.
Hirsch, E. 1995. Introduction – Landscape: Between Place and Space. In Hirsch, E. and O'Hanlon, M. (eds), *The Anthropology of Landscape. Perspectives on Place and Space*: 1–30. Clarendon Press. Oxford.

Ingold, T. 1986. *The Appropriation of Nature. Essays on Human Ecology and Social Relations*. Manchester University Press. Manchester.
Issar, A. S. 1990. *Water Shall Flow from the Rock. Hydrogeology and Climate in the Lands of the Bible*. Springer-Verlag. Berlin.
Jamieson, Dale (ed.) 2001. *A Companion to Environmental Philosophy*. Blackwell Publishing. London.
Kramer, S. N. and Maier, J. 1989. *Myths of Enki, the Crafty God.* Oxford University Press. Oxford.
Lakoff, G. and Johnson, M. 1981. *Metaphors We Live By*. The University of Chicago Press. Chicago.
Lakoff, G. and Johnson, M. 1999. *Philosophy on the Flesh. The Embodied Mind and Its Challenge to Western Thought*. Basic Books. New York.
Latour, B. 1993. *We Have Never Been Modern*. Prentice Hall. London.
Latour, B. 1997. The Trouble with Actor-Network Theory. *Philosophia*. Vol. 25, No. 3–4: 47–64.
Latour, B. 1999. *Pandora's Hope. Essays on the Reality of Science Studies*. Harvard University Press. Cambridge, MA.
Latour, B. 2003. Revolution. In Pepper, D., et al. (eds), *Environmentalism. Critical Concepts.* Vol. V: 287–327. Routledge. London.
Leach, E. 1969. *Genesis as Myth and Other Essays*. Jonathan Cape. London.
Lehner, M. 1997. *The Complete Pyramids*. Thames and Hudson. London.
Lehtonen, T. 1999. *Punishment, Atonement and Merit in Modern Philosophy of Religion*. Luther-Agricola-Society. Helsinki.
Lhalungpa, L. P. 1979. *The Life of Milarepa.* Arkana. New York.
MacCulloch, J. A. 1911. *The Religion of Ancient Celts*. T. & T. Clark. Edinburgh.
MacQuitty, W. 1976. *Island of Isis: Philae, Temple of the Nile.* Macdonald and Jane's. London.
Marriott, M. 1976. Hindu Transactions: Diversity Without Dualism. In Kapferer, B. (ed.), *Transaction and Meaning*: 109–42. Institute for the Study of Human Issues. Philadelphia, PA.
Marriott, M. and Inden, R. B. 1974. Caste Systems. *Encyclopedia Britannica.* 15th ed, 3: 982–91.
Marriott, M. and Inden, R. B. 1977. Toward an Ethnosociology of South Asian Caste Systems. In David, K. (ed.), *The New Wind: Changing Identities in South Asia*. Mouton. The Hague and Paris.
McKittrick, M. 2006. 'The Wealth of These Nations': Rain, Rulers and Religion on the Cuvelai Floodplain. In Tvedt, T. and Oestigaard, T. (eds), *A History of Water: The World of Water.* Vol. 3: 449–69. I.B.Tauris. London.
Merleau-Ponty, M. 1995 [1962]. *Phenomenology of Perception*. Routledge. London.
Messerschmidt, D. 1982. *Muktinath: Himalayan Pilgrimage, A Cultural & Historical Guide*. Sahayogi Press. Kathmandu. Nepal.
Næss, A. 1973. The Shallow and the Deep, Long-range Ecology Movement: A Summary. *Inquiry*. Vol. 16: 95–100.

Oestigaard, T. 2005a. *Death and Life-giving Waters – Cremation, Caste, and Cosmogony in Karmic Traditions.* BAR International Series 1353. Oxford.
Oestigaard, T. 2005b. *Water and World Religions. An Introduction*. SFU & SMR. Bergen.
Parry, J. 1985. Death and Digestion: The Symbolism of Food and Eating in North Indian Mortuary Rites. *Man*, Vol. 20, No. 4: 612–30.
Parry, J. 1994. *Death in Banaras*. The Lewis Henry Morgan Lectures 1988. Cambridge University Press. Cambridge.
Pepper, D. 1996. *Modern Environmentalism. An Introduction*. Routledge. London.
Pepper, D. with Webster, F. and Revill, G. 2003. *Environmentalism, Critical Concepts*. 5 vols. Routledge. London.
Pratt, V., Howarth, J. and Brady, E. 2000. *Environment and Philosophy*. Routledge. London.
Radkau, J. 2008. *Nature and Power: A Global History of the Environment.* Cambridge University Press. Cambridge.
Redford, D. B. 1995. The Concept of Kingship during the Eighteenth Dynasty. In O'Connor, D. and Silverman, D. P. (eds), *Ancient Egyptian Kingship*: 157–84. Brill. Leiden.
Said, R. 1993. *The River Nile. Geology, Hydrology and Utilizatio*n. Pergamon Press. Oxford.
Schwarz, M. and Thompson, M. 1990. *Divided we Stand: Redefining Politics, Technology and Social Choice*. Harvester Wheatsheaf. London.
Seligman, C. G. 1934. *Egypt and Negro Africa. A Study in Divine Kingship.* George Routledge and Sons. London.
Seligman, C. G. 1965. *Pagan Tribes of the Nilotic Sudan.* Routledge & Kegan Paul. London.
Selin, H. and Kalland, A. (eds) 2003. *Nature Across Cultures: Views of Nature and the Environment in Non-Western Cultures*. Kluwer Academic Publishers. Dordrecht.
Snellgrove, D. 1979. Place of Pilgrimage in Thag (Thakkhola). *Kailash*. Vol. VII, No. 2: 75–170.
Te Velde, H. 1967. *Seth, God of Confusion. A Study of His Role in Egyptian Mythology and Religion*. E. J. Brill. Leiden.
Tokar, B. 1987. *The Green Alternative: Creating an Ecological Future.* R. and E. Miles. San Pedro, CA.
Trigger, B. 2003. *Understanding Early Civilizations. A Comparative Study*. Cambridge University Press. Cambridge.
Tucker, M. E. and Grim, J. A. (eds) 1993. *Worldviews and Ecology*. Bucknell University Press. Lewisburg, PA.
Turner, N. J. 2005. *The Earth's Blanket: Traditional Teachings for Sustainable Living.* University of Washington Press. Seattle.
Turner, V. 1991. *The Forest of Symbols.* Cornell University Press. New York.
Tvedt, T. 1997. *En reise i vannets historie – fra regnkysten til Muscat*. Cappelens Forlag AS. Oslo.
Tvedt, T. 2007. *En resie i vannets fremtid.* Kagge forlag. Oslo.

Tvedt, T. and Oestigaard, T. 2006. Introduction. In Tvedt, T. and Oestigaard, T. (eds), *A History of Water: The World of Water.* Vol. 3: ix–xxii. I.B.Tauris. London.

Wainwright, G. A. 1935. Some Celestial Associations of Min. *The Journal of Egyptian Archaeology*, Vol. 21, No. 2: 152–70.

Wainwright, G. A. 1938. *The Sky-Religion in Egypt. Its Antiquity and Effects.* Cambridge University Press. Cambridge.

Wainwright, G. A. 1963. The Origin of Storm-Gods in Egypt. *The Journal of Egyptian Archaeology*, Vol. 49: 13–20.

Worster, D. 1977. *Nature's Economy. A History of Ecological Ideas.* Cambridge University Press. New York.