

The United Nations World Water Development Report 2021

VALUING WATER

Executive summary



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There are several different views and perspectives of what ‘value’ specifically means to various user groups and stakeholders

Perspectives, challenges and opportunities

The current status of water resources highlights the need for improved water resources management. Recognizing, measuring and expressing water's worth, and incorporating it into decision-making, are fundamental to achieving sustainable and equitable water resources management and the Sustainable Development Goals (SDGs) of the United Nations' 2030 Agenda for Sustainable Development.

Those who control how water is valued control how it is used. Values are a central aspect of power and equity in water resources governance. The failure to fully value water in all its different uses is considered a root cause, or a symptom, of the political neglect of water and its mismanagement. All too often, the value of water, or its full suite of multiple values, is not prominent in decision-making at all.

Whilst the term 'value' and the process of 'valuation' are well defined, there are several different views and perspectives of what 'value' specifically means to various user groups and stakeholders. There are also different methods for calculating value and different metrics to express it.

Differences in the way water is valued occur not only between stakeholder groups but are widespread within them. These divergent perspectives on water value and the best ways to calculate and express it, coupled with limited knowledge of the actual resource, present a challenging landscape for rapid improvements in valuing water. It is, for example, futile to attempt to quantitatively compare the value of water for domestic use, the human right to water, customary or religious beliefs, and the value of maintaining flows to preserve biodiversity. None of these should be sacrificed for the sake of achieving consistent valuation methodologies.

Traditional economic accounting, often a key means of informing policy decisions, tends to limit water values to the way that most other products are valued – using the recorded price or costs of water when economic transactions occur. However, in the case of water, there is no clear relationship between its price and its value. Where water is priced, meaning consumers are charged for using it, the price often reflects attempts for cost recovery and not value delivered. Yet, regarding valuation, economics remains a highly relevant, powerful and influential science, even though its application needs to be made more comprehensive.

Nevertheless, the different values of water need to be reconciled, and the trade-offs between them resolved and incorporated into systematic and inclusive planning and decision-making processes. The way forward, therefore, will be to further develop common approaches to valuation where feasible, but also to prioritize improved approaches to compare, contrast and merge different values, and to incorporate fair and equitable conclusions into improved policy and planning.

This report groups current methodologies and approaches to the valuation of water into five interrelated perspectives: valuing **water sources**, *in situ* water resources and ecosystems; valuing **water infrastructure** for water storage, use, reuse or supply augmentation; valuing **water services**, mainly drinking water, sanitation and related human health aspects; valuing **water as an input to production and socio-economic activity**, such as food and agriculture, energy and industry, business and employment; and other **sociocultural values of water**, including recreational, cultural and spiritual attributes. These are complemented with experiences from different global regions; opportunities to reconcile multiple values of water through more integrated and holistic approaches to governance; approaches to financing; and methods to address knowledge, research and capacity needs.

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Valuing the environment

The source of all water is the environment and all water abstracted by humans eventually returns there, together with any impurities added to it. The environment–water interface can be proactively managed in order to address water-related challenges through what has become known as ‘nature-based solutions’.

But the status and trends of the environment–water interactions clearly indicate the need for much better incorporation of the value of the environment in water resources management. In most studies, water-related ecosystem services are not treated as a distinct or separate category, and clusters or bundles of services must often be combined from the underlying results to obtain relevant analyses and conclusions regarding water.

Significant values can also be attributed to ecosystem services that relate to supporting resilience, or reducing risks. Many disaster risks are exacerbated by the loss of relevant ecosystem services, as these services played a role in preventing disasters in the first place. The values of these services can be calculated, but they are often not recognized or adequately included in economic planning, which tends to favour short-term gains over longer-term sustainability.

Expressing the values of ecosystem services in monetary terms enables values to be more easily compared with other economic assessments, which often use monetary-based units. However, the environment can have important values that cannot, or should not, be constrained or defined by monetary-based approaches.

The existence of different value systems infers that it would be problematic to develop a unified system of, and metrics for, valuing water and/or the environment. What is feasible is to develop a common approach under which different environmental values or value systems can be compared, contrasted and used.

Valuing hydraulic infrastructure

The value of water to society is underpinned by hydraulic infrastructure, which serves to store or move water, thus delivering substantial social and economic benefits. Socio-economic development is curtailed in countries that have insufficient infrastructure to manage water. While more infrastructure is needed, past experience shows that the valuation of hydraulic infrastructure has been seriously flawed.

In spite of the large sums of money invested in water infrastructure, the valuation of costs and benefits are not well developed, standardized or widely applied. Societal benefits delivered are often unquantified, costs (particularly external costs) are not adequately accounted for, options are often not appropriately valued and compared, and hydrological data are often poor and outdated.

The valuation of hydraulic infrastructure is beset with conceptual and methodological difficulties, particularly regarding non-consumptive use, and indirect and non-use values. Most methods of valuing water infrastructure centre on a cost–benefit approach, but there is a tendency to overestimate benefits and underestimate costs, and in particular to not include all costs.

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One of the most critical questions is 'value to whom'. Valuations tend to excessively focus on target beneficiaries while other stakeholders may benefit less or even be negatively impacted. A major shortcoming in many approaches is that they focus mainly on financial costs (cash flows, and capital and operational expenditure) and financial returns. They often omit indirect costs, and in particular social and environmental costs, which are treated as externalities.

A key question in valuation is whether large capital and operational and maintenance (O&M) costs are included in subsequent valuations of end uses. Full-cost charging for water services is the exception rather than the rule. In many countries, only part or all of the operational costs are recovered, and capital investments are covered by public funds.

Valuation is only of use if the decision-making process in question is based on a fair assessment of values. Too many projects, particularly for high-profile water infrastructure such as dams, remain essentially vanity projects, politically motivated and/or potentially subject to corruption. Under such circumstances, values, if assessed, are opaque, selective, manipulated or ignored. No amount of guidance on valuation will change that. Fundamentally, valuation of water infrastructure is about good governance. At least, the attempt to govern well must be in place for proper valuations to play their part.

Valuing water supply, sanitation and hygiene (WASH) services

The role of water within households, schools, workplaces and health care facilities is often overlooked or not assigned a value comparable with other uses. Water is a basic human need, required for drinking and to support sanitation and hygiene, sustaining life and health. Access to both water and sanitation are human rights. A direct extension of access to WASH services not only improves educational opportunities and workforce productivity, but also contributes to a life of dignity and equality. WASH services also indirectly add value in the form of a healthier environment.

It has been estimated that achieving universal access to safe drinking water and sanitation (SDG Targets 6.1 and 6.2) in 140 low- and middle-income countries would cost approximately US\$1.7 trillion from 2016 to 2030, or US\$114 billion per year. The benefit–cost ratio of such investments has been shown to provide a significant positive return in most regions. Returns on hygiene are even higher, as they can greatly improve health outcomes in many cases with little need for additional expensive infrastructure.

The year 2020 saw the rise of the COVID-19 pandemic, which hit the world's most vulnerable people the hardest – many of them living in informal settlements and urban slums. Hand hygiene is extremely important to prevent the spread of COVID-19. Globally, over three billion people and two out of five health care facilities lack adequate access to hand hygiene facilities.

Because access to WASH is so fundamental to life and public health, in many countries WASH services are considered the realm of governments and therefore often subsidized, even in high-income countries.

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Improving water security for food production in both rainfed and irrigated systems can contribute to reducing poverty and closing the gender gap

However, subsidies do not necessarily ensure that the poor are able to access basic services. Water subsidies can end up benefiting those with existing connections to sewerage or water networks, many of whom are non-poor. As a result, the poor do not benefit from the subsidy and the water service provider loses the tariff revenue it could have collected from wealthier households. Value is lost in terms of revenue to the provider, while the negative impacts of not having access to WASH services, such as school and work absenteeism, are not mitigated.

It is important to examine affordability from the perspective of disadvantaged groups, based on their income, their location and the socio-economic challenges they face.

Valuing water for food and agriculture

Agriculture uses the major share (69%) of global freshwater resources. However, water use for food production is being questioned as intersectoral competition for water intensifies and water scarcity increases. Moreover, in many regions of the world, water for food production is used inefficiently. This is a major driver of environmental degradation, including depletion of aquifers, reduction of river flows, degradation of wildlife habitats, and pollution.

The value assigned to water in food production is generally low compared to other uses. It is usually very low (typically less than US\$0.05/m³) where water is used for irrigating food grains and fodder, while it can be relatively high (of the same order of magnitude as values in domestic and industrial uses) for high-value crops such as vegetables, fruits and flowers.

Estimates of values of water for food production normally only consider the direct economically beneficial use of water (i.e. value to users of water), while many of the other direct and indirect benefits associated with water, which may be economic, sociocultural or environmental, remain unaccounted for or only partially quantified. Some of those benefits include improving nutrition, accommodating shifts in consumption patterns, generating employment and providing livelihood resilience especially for smallholder farmers, contributing to alleviating poverty and revitalizing rural economies, and supporting climate change mitigation and adaptation. The food security value of water is high but rarely quantified – and it is often a political imperative irrespective of other values.

Several management strategies that could maximize the multiple values of water for food production could be implemented, including improving water management in rainfed areas; transitioning to sustainable intensification; sourcing water for irrigated agriculture, especially from nature-based and non-conventional sources; improving water use efficiency; reducing demand for food and its consequent water use; and improving knowledge and understanding of water use for food production.

Improving water security for food production in both rainfed and irrigated systems can contribute to reducing poverty and closing the gender gap directly and indirectly. Direct effects include higher yields; reduced risk of crop failure and increased diversity of cropping; higher wages from enhanced employment opportunities; and stable local food production and prices. Indirect effects include income and employment multipliers beyond the farm, and reduction of migration. Enhanced and more stable incomes could help improve education and the skillsets of women, and thus foster their active participation in decision-making. Although increasing water productivity can have substantial positive impacts, care should be taken to account for possible perverse effects and implications on poverty alleviation (i.e. land grabbing and increasing inequality).

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Energy, industry and business

In the energy, industry and business (EIB) sector, water is seen as both a resource with withdrawal and consumption costs determined by prices, and a liability involving treatment costs and regulatory penalties, leading to a perception that water is a cost or risk to sales and compliance. Business tends to focus on operational savings and short-term revenue impacts, and tends to pay less attention to water value in administrative costs, natural capital, financial risk, future growth and operations, and innovation.

There are drivers that push and others that pull businesses towards valuing water. The former are trends, both global and regulatory, involving natural capital accounting, water valuation and water pricing. The latter is the growing business case for prospective benefits including better decision-making, higher revenues, lower costs, improved risk management and a better reputation.

The higher costs, lower earnings and financial losses related to water risks are significant. The risks associated with increased water scarcity, flooding and climate change include higher operating costs, supply chain disruption, water supply disruption, constraints to growth and brand damage.

Due to its character, the EIB sector is highly focused on monetization. This provides a predisposition towards certain aspects of value (e.g. price of a cubic metre of water) and sometimes an indifference to others (e.g. the tangible and intangible value of water to other stakeholders). The most straightforward monetary valuation is volumetric – price per cubic metre, multiplied by the volume of water used, plus the cost to treat and dispose of wastewater. The metrics for the commercial performance of water use in EIB are relatively simple. They include water productivity, defined as profit or value of production per volume ($\$/\text{m}^3$); water use intensity, defined as volume to produce a unit of value added ($\text{m}^3/\$$); water use efficiency, defined as value added per volume ($\$/\text{m}^3$); and the change in water use efficiency over time (SDG Indicator 6.4.1).

The overall economic productivity of water (GDP/m^3) in the EIB sector also leads at local, regional and national levels to various co-benefits, such as job creation and new enterprises. These are not easy to quantify, as many factors come into play, of which water is only one.

A better understanding of the motivations behind corporate interests in water management should align with those of water management agencies pursuing Integrated Water Resources Management (IWRM) planning approaches. The circular economy will value water to the extent that each litre is reused again and again, making water itself almost become part of the infrastructure rather than a consumable resource.

Cultural values of water

Culture directly influences how the values of water are perceived, derived and used. Every society, group or individual exists in their own cultural setting that is moulded by a varying mix of heritage, tradition, history, education, life experience, exposure to information and media, social status, and gender, among many other factors.

Some cultures can hold values that are difficult to quantify or indeed, in some cases, to articulate. Water can appeal to people for spiritual reasons, or through scenic beauty, because of its importance for wildlife or recreation, among others, or combinations of these. These



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values can be problematic to compare with values derived through other formal means, such as economics, and are therefore often excluded from value assessments that favour those. Moreover, culture changes and evolves over time, sometimes rapidly.

There is a close relationship between religion, or faith, and ethics. For example, narratives originating from regions characterized by water scarcity often feature illustrations of lawful and morally correct living beings, often as characterized by the local religion, rewarded with rainfall and access to water. By contrast, the modern economic conception of water can be characterized by its abstraction from social, cultural and religious contexts. Water in the global economic development context is often considered a resource at the disposal of society and is therefore distinct from water as it may be recognized by religions or the belief systems of many indigenous peoples, creating quite diverse, and potentially contradictory, perspectives of values.

The values of water in the context of conflict, peace and security are paradoxical. Whilst much has been written about the positive value of water in promoting peace, in many cases water itself was a contributing factor to the conflict in the first place. It has been argued that a spirit of dialogue helps to transform water-related conflicts into cooperation.

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After understanding, categorizing or codifying cultural values, there is a need to identify ways and means of incorporating these values into decision-making. These tools, such as cultural mapping, can help to better understand cultural values of water, reconcile antagonistic values, and build resilience with regard to current and future challenges, such as climate change. A fundamental need is the full and effective gender-sensitive participation of all stakeholders in decision-making, allowing everyone to express their own values in their own way.

Regional perspectives

Sub-Saharan Africa

Africa's freshwater resources are estimated to be nearly 9% of the world's total. However, these resources are unevenly distributed, with the six most water-rich countries in Central and Western Africa holding 54% of the continent's total resources and the 27 most water-poor countries holding only 7%.

The *Africa Water Vision 2025* offers a context within which water security and sustainable management of water resources could be achieved. However, rapid population growth, inappropriate water governance and institutional arrangements, depletion of water resources through pollution, environmental degradation, deforestation, and low and unsustainable financing of investments in water supply and sanitation are some of the main challenges to the achievement of SDG 6 on the continent.

In Sub-Saharan Africa, valuing water has been a challenging task for many researchers and development experts, due at least in part to limited baseline historical data. Researchers studying the value of water have focused mainly on using the actual price paid or the willingness to pay from the consumer's point of view by adopting the contingent valuation method. Studies valuing water in Sub-Saharan Africa have mostly focused on domestic water use.

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Pan-European region

Valuing water is a challenging task within any single jurisdiction, hence doing so across borders presents even greater challenges. While increasing significance is being placed on valuing water within the Pan-European region, efforts to value water, especially in a transboundary basin context, remain limited in scope and often use different approaches. The discernable approaches to valuing water quantitatively in transboundary basins are more targeted on flood management, disaster risk reduction, early-warning systems and ecosystem services. The collective economic benefits of transboundary cooperation on these aspects outweigh the collective investment costs of unilateral action by several times.

Quantitatively valuing water is significantly more challenging within transboundary contexts as the data required to base calculations are often lacking. The countries that share a water resource often put different emphases on values, needs and priorities attached to water-related sectors. Many elements that can be valued, are done so on the basis of approximations and thus often undervalued, especially due to the lack of data and the inability to quantify indirect benefits. However, several broad-based approaches exist for identifying the intersectoral benefits of transboundary water cooperation on a case-by-case basis. These benefits, when strengthened, can consequently help increase the value of transboundary water management by reducing the economic and other costs of 'inaction' or insufficient cooperation in shared basins.

Latin America and the Caribbean

Water stress in the region has fuelled a number of conflicts, as various sectors, including agriculture, hydroelectricity, mining, and even drinking water and sanitation, are competing over scarce resources.

Some of the major obstacles in securing effective allocation processes are connected to poor regulation, missing incentives and/or lack of investment. All these factors ultimately reflect the low value that is largely attributed to water resources in the region. The costs of water use or maintenance (once the concession or right of use is granted), are usually nil or insignificant for hydroelectric plants, mining companies and even farmers; and sometimes these costs are not even included in their economic balances. The latter represents an implicit subsidy that does not reflect the strategic value of water in the multiple production processes and under a context of climate change.

Most countries in the region have not assigned sufficient funds for proper law enforcement in cases of pollution or overexploitation. While legal precepts are of extreme relevance, regulation and monitoring as well as well-aligned incentives are essential in the region, not only to ensure a better appreciation of the role and value of water but also to prevent its overexploitation and pollution, particularly given the increasing climate instability.

Asia and the Pacific

Due to population growth, urbanization and increased industrialization, water competition among sectors has become more severe in the region, threatening agricultural production and food security while also affecting water quality. Water is often a relatively scarce and valuable resource in the region, and water scarcity is likely to worsen due to the impacts of climate change.

Unsustainable water withdrawals are a major concern in the region, as some countries withdraw unsustainable proportions of their freshwater supply – exceeding half of the total water availability – and seven of the world's 15 biggest abstractors of groundwater are in Asia and the Pacific.

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The use of multi-value approaches to water governance entails acknowledging the role of values in driving key water resources management decisions as well as a call for active participation of a more diverse set of actors

Wastewater remains an underutilized resource in the region. There is therefore an urgent need in Asia and the Pacific to tap into wastewater, as well as to tackle water pollution and promote water efficiency, including from the industrial sector. This is particularly urgent in the region's least developed countries, on islands and in countries where water resources are particularly scarce.

The region has seen the emergence of diverse positive water-valuing initiatives that leverage new financial, governance and partnership models, notably in Australia, China, Japan and Malaysia.

The Arab region

Few other regions value water as much as the water-scarce Arab region, where over 85% of the population live under conditions of water scarcity. This scarcity has increased dependency on transboundary waters, non-renewable groundwater resources and non-conventional water resources. The quantity of freshwater that can be abstracted in a sustainable way would probably even be lower if water quality considerations were included.

Water is so highly valued in the region that it is considered a topic of security in bilateral and multilateral discussions among states. This is amplified by the fact that over two thirds of freshwater resources available in Arab States cross one or more international boundaries. However, joint methodologies for the economic valuation of transboundary waters have not yet been incorporated into cooperation arrangements, and funding to inform joint management efforts remains limited. Furthermore, national security considerations and a water rights perspective tend to dominate the discourse among riparian states, although nascent initiatives exist to value transboundary water cooperation and analysis focused on climate security and risk mitigation in transboundary water contexts in the Middle East and North Africa.

For the full value of water to be captured and considered by all to be a human right, there is a need for considerable investment in infrastructure, appropriate technologies and the use of non-conventional water resources to improve productivity, sustainability and access for all.

Governance

Global momentum is evolving towards an understanding that a diverse set of values drives the economic and financial considerations in water-related decision-making. Coupled with a recognition of water's multiple values, there is also a call for more robust measurement and valuation methods to help resolve trade-offs. The use of multi-value approaches to water governance entails acknowledging the role of values in driving key water resources management decisions as well as a call for active participation of a more diverse set of actors, thereby also incorporating a more diverse set of values into water governance. Including the intrinsic or relational values of diverse groups to better inform and legitimize water and related land resources management decisions would typically involve the direct participation of groups or interests that are often excluded from water-related decision-making. It may bring greater emphasis on ecological and environmental processes, and refocus efforts on sharing water resource benefits, rather than allocating water quantities for highest-value economic priorities.

Transitioning to a system of water governance that recognizes multiple values and the active participation of a varied set of actors presents a set of challenges. The first relates to acknowledging that the governance of water is driven by a set of implicit or explicit values.

The second involves the value or worth of using water in different ways, which is fraught not only with measurement issues, including what can – and should – be measured, and by whom. The third relates to the common disconnect between public decision-making processes and actions on the ground, including the risk of agendas being controlled by vested interests.

Nations can transition into multi-value governance by building on existing governance frameworks such as IWRM, which integrates interests of diverse stakeholder groups operating at various political levels and policy sectors. IWRM is most often represented as cutting across water for people, food, nature, industry and other uses, and aims to encompass all social, economic and environmental considerations. It is essential to broaden and strengthen multi-stakeholder processes that recognize and reconcile a comprehensive mix of values, including benefit-sharing in water governance, as well as integrating ecological and environmental values into climate-resilient water management.



In cases where benefits cannot be monetized, other valuation tools can be used, such as cost–effectiveness analyses

Financing and funding water services

Maximizing the value of water in investment decisions requires careful valuation of the costs and benefits that a project provides. For this, all benefits need to be taken into account, including those that are economic, social or environmental. Many of the unintended consequences of these investments, both negative and positive, must also be considered. Aggregating these types of benefits can be difficult, as they are not all easily converted into monetary amounts. In cases where benefits cannot be monetized, other valuation tools can be used, such as cost–effectiveness analyses, which compare costs with non-pecuniary outcomes such as lives saved, people served or environmental metrics achieved. Another critical factor for determining benefits of a project is comparing it to what would happen if the project were not undertaken.

How a project will be funded is another critical component to the valuation analysis, as a project that does not have a means for funding will eventually see a service disruption when operations and maintenance are unfunded and capital costs cannot be repaid. Similarly, the dynamics of the funding type will impact the net benefits of the investment itself, and who receives them.

For investments in water supply, sanitation or irrigation services, designing an appropriate water tariff structure is a challenge, as there are multiple, often competing, policy goals that need to be taken into consideration. When supplying these services, care should also be taken to ensure affordability for the poor, expansion to the widest number of individuals, and funding to ensure reliability and network improvements. The water tariff (i.e. price) must be carefully designed to accomplish as many of these goals as possible – the price of water, its cost of delivery and its value are not synonymous, and price is merely one tool for aligning water's use with its values.

Large subsidies for WASH service provision are justifiable from an economic as well as a social and moral standpoint; however, they are often poorly targeted, resulting in poor outcomes. In fact, large, untargeted WASH subsidies can be counterproductive, reducing the benefits of water services, and thus the valuations of WASH investments. Indeed, in countries where piped water is deemed to be very low-cost or free, the poor are often unserved or underserved, and are compelled to pay a much higher price for their water than the rich.

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Knowledge, research and capacity development

As a core component of knowledge building and sharing, water-related data and information are central to understanding and valuing the resource. Water-related data and information can also be generated by other sources such as earth observations, sensor networks and citizen data, including on social media. But data and information relating to social, economic and environmental demands and uses for water are also needed to complete the picture for potential value generation from water. Further efforts and investments are required to sustain the supply chain of data and information from its collection, analysis, sharing and application across sectors and scales.

To promote inclusive and transformative change in valuing water, it is strategically important to recognize the unique role of local and indigenous knowledge, in addition to the mainstream or traditional scientific or academic knowledge. Another part of the solution is to expand citizen science. The involvement of representative local stakeholders in ground-truthing data and information is also important.

Within the context of valuing water, capacity development concerns the establishment of know-how to inclusively and properly value water and to effectively manage it on the basis of those values, applied at different levels and under diverse conditions, leading to variable outcomes.

Conclusions

Unlike most other natural resources, it has proven extremely difficult to determine water's 'true' value. As such, the overall importance of this vital resource is not appropriately reflected in political attention and financial investment in many parts of the world. This not only leads to inequalities in access to water resources and water-related services, but also to inefficient and unsustainable use and degradation of water supplies themselves, affecting the fulfilment of nearly all the SDGs, as well as basic human rights.

Consolidating the different approaches and methods for valuing water across multiple dimensions and perspectives will likely remain challenging. Even within a specific water use sector, different approaches can lead to strikingly different valuations. Trying to reconcile valuations across sectors would normally increase the overall level of difficulty, as would taking account of some of the more intangible values attributed to water in different sociocultural contexts. While there may be scope to reduce complexities and standardize metrics in some circumstances, the reality is the need for better means to recognize, maintain and accommodate different values.

Coda

Even though it is not always recognized by all, water clearly has value. In some perspectives the value of water is infinite, since life does not exist without it and there is no replacement for it. This is perhaps best exemplified by the efforts and investments made in the search for extra-terrestrial water and the recent elation in finding it on the Moon and Mars. It is a shame that all too often, it is taken for granted here on Earth. The risks of undervaluing water are far too great to ignore.

Prepared by WWAP | Richard Connor

This publication is produced by WWAP on behalf of UN-Water.

Cover artwork by Davide Bonazzi



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UNESCO World Water Assessment Programme
Programme Office for Global Water Assessment
Division of Water Sciences, UNESCO
06134 Colombella, Perugia, Italy
Email: wwap@unesco.org
www.unesco.org/water/wwap

We acknowledge with gratitude the financial support provided by the Government of Italy and Regione Umbria.



Regione Umbria

