International Science Council
The global voice for science

POLICY BRIEF: UN 2023 WATER CONFERENCE

Author: Frank Winde

Contributors: Antonio Lo Porto, Shabana Khan, Stella Tsani, Lahcen El Youssfi, Yunzhong Jiang, Jan Polcher, Jonathan Tonkin, Suzanne Hulscher, Piet Kenabatho, Christophe Cudennec, Daniel Olago, Eduardo Planos Gutierrez, Shreya Chakraborty, Suad Sulaiman, Hugo Hidalgo León, Euloge Kossi Agbossou, Ovie Augustine Edegbene, Heather O'Leary, Paweł Rowiński, Apostolos Apostolou, Pulane Mswela, Ismail Koyuncu, Ramia Al Bakain, Samia Benabbas Kaghouche, Joao Porto de Albuquerque, Mahesh W. Jayaweera, Shameen Jinadasa, Mehmet Emin Aydin

Reviewers: Tom Soo, Peter Bridgewater

Coordination: Anne-Sophie Stevance and Anda Popovici, ISC secretariat

This policy brief of the International Science Council (ISC) for the UN 2023 Water Conference highlights the importance of science and the importance of actionable knowledge in responding to current global water crises as well as emerging and future challenges. The brief groups the numerous water challenges into four main categories with associated examples and focal areas that each demand different scientific responses. Together with concluding advice, this policy brief aims to efficiently engage with policy- and decision-makers and other stakeholders at UN- and Member States-level to translate scientific insights into tangible improvements and support the water-related Sustainable Development Goals (SDGs) and the achievement of the 2030 Agenda. Drawing on the expertise of its broad-based membership in the natural and social sciences as well as technology, the ISC is prepared to provide integrated, independent and evidence-based advisory support to UN-Water, to the relevant organizations of the UN system, and to Member States as needed to achieve SDG 6 and other relevant SDGs.

Photo: Qanat in Shahdad, Kerman, Iran. Ninara/Flickr.

KEY MESSAGES

1

The world is not on track to meet global targets related to water as defined in SDG 6 and other relevant SDGs. Water crises across the globe threaten the achievement of key development and environmental goals and ultimately all the SDGs, given the centrality of water in social, political and economic affairs across all scales.

2

The ISC has identified four categories of water challenges that require different science–policy–practice strategies to address them. These challenges range from well-understood issues that only lack implementation of proven solutions to new and emerging issues that require additional research and innovative thinking. This brief describes such issues and opportunities to translate knowledge into solutions and improvements on the ground.

3

Science is indispensable for generating knowledge to address the complex interplay of natural and human factors that still hinder progress in resolving current water challenges. This requires a more systematic dialogue between policy-makers and scientists on evidence-based policy options to support tangible action and anticipate future water-related risks.

4

Drawing on its broad-based global membership, the ISC stands ready to provide policy-makers at the global and national level with the required independent and evidence-based guidance, including anticipative research addressing future water risks.

I. PROBLEM STATEMENT AND ROLE OF THE ISC

Despite various UN-led efforts to improve the global water situation, there is still insufficient progress in addressing key water issues outlined in SDG 6 – issues which affect billions of people, especially in low- and middle-income countries. Challenges include a lack of access to safe drinking water and hygienic sanitation facilities, leading to an increased burden of disease and economic hardship; heightened vulnerability to hydrological extremes such as flood and droughts, and their impacts on livelihoods and food security; rising water pollution levels; and latent conflict potential in shared watersheds and aquifers. Ensuring access to fit-for-purpose water is also a key enabler of many SDGs, and a critical ingredient across many sectors such as food, health, energy, environment, economy, industry and education. While many of these challenges are not new, their magnitude and frequency have recently increased in response to rapidly changing natural and environmental conditions, including altered land use, weather and climate patterns as well as mass migration and uncontrolled urbanization.

Approaching the mid-point of the current UN Water Action Decade, and with only seven years left to achieve the SDGs, the UN 2023 Water Conference aims to accelerate delivery of the agreed water-related goals, calling for game-changing solutions and their rapid and effective implementation.

Against this backdrop, the ISC sees its main role as providing evidence-based and independent scientific options to policy- and decision-makers by drawing on its diverse global membership of science academies, unions and scientific associations of natural and social sciences across and beyond the water sector.

II. TRANSLATING SCIENCE INTO ACTION

The nature of water-related challenges differs profoundly across the five priority themes of the UN 2023 Water Conference, ranging from longstanding problems which are well-understood but lack implementation of known solutions, to new and emerging challenges that still require research, theoretical advances and innovative scientific approaches. Consequently, the many individual water issues identified by the UN through global consultations ahead of the conference are here grouped into four categories for which science and ensuing actionable knowledge can provide different responses (Figure 1).

By reducing the prohibitively large number of individual water problems, this approach aims to prioritize scientific responses to focal areas where successful implementation is likely to yield the largest benefits for people. The following examples are by no means exhaustive but serve to illustrate the nature of the contribution of science to elucidate and tackle water issues in each category.

Category I: Persistent water problems with known solutions

This category encompasses regional or local water problems for which proven solutions are already known and routinely practised in some places but are not implemented.

Example – waterborne diseases: There is a well-established link between a lack of access to safe drinking water and sanitation facilities and the spread of waterborne diseases. Waterborne diseases account for most premature child deaths in developing countries and, in addition to human suffering, cause significant costs to public health care systems as well as losses of productivity and income. While plenty of safe and often simple technologies exist to ensure adequate water supply and sanitation, their implementation in many parts of the world is still lacking.

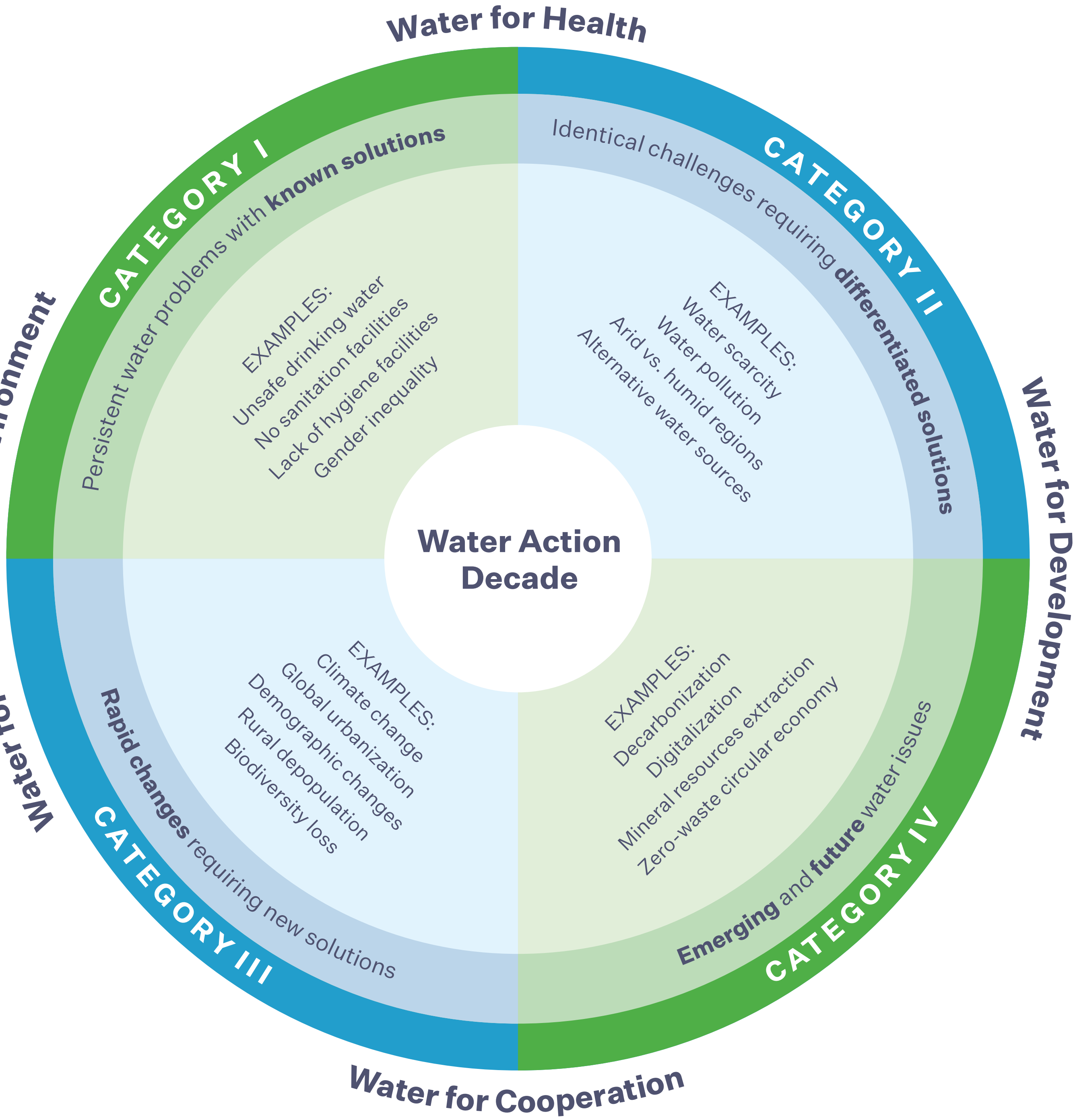

Figure 1: Actionable knowledge across four categories and selected examples of associated water issues (the five main themes of the UN 2023 Water Conference are in dark blue).

Associated science-to-action focus: The main challenge here is to disentangle the complex systems of interconnected socio-economic, cultural and political causes of waterborne diseases, and translate this knowledge into implementing appropriate solutions on the ground. This requires a stronger integration of social and economic sciences as well as indigenous and ancient knowledge of communities in a non-patronizing and empowering manner. It also includes acknowledging safe water and sanitation as basic human rights as well as employing innovative economic concepts like full-cost and natural capital accounting that help to illustrate the economic viability of water-related investments. A key focus will be on overcoming the fragmentation of national water governance structures, identified as a major stumbling block by national water leaders.

Category II: Identical challenges requiring differentiated solutions

Water issues in this category, like water scarcity or water pollution, appear to be similar in nature across different parts of the world but, in fact, often have very different causes requiring differentiated solutions.

Example – water scarcity: Although the number of people affected by water scarcity is rapidly rising across the globe, there are distinct regional differences in the underlying causes. In dry (arid or semi-arid) regions of the subtropical high-pressure belts, below-average rainfall sets tight natural boundaries that are frequently overstepped by disproportionate human consumption, exacerbating natural deficits. Termed ‘physical’ water scarcity, this is different from ‘economic’ water scarcity as experienced by many people in high-rainfall tropical regions with an abundance of freshwater resources (Figure 2). There, the term ‘scarcity’ relates not to water itself but to the funds and infrastructure needed to access it. This scarcity is often rooted in highly complex interplays of economic, social, technological, cultural, behavioural and political factors requiring holistic research to be disentangled.

Climate change may worsen this situation by increasing water supply where it is already plentiful and reducing it where there is a dire need for more. Both scenarios have the potential to result in human migration and civil unrest, both domestically and internationally. Exports of large amounts of embedded (virtual) water from arid regions (such

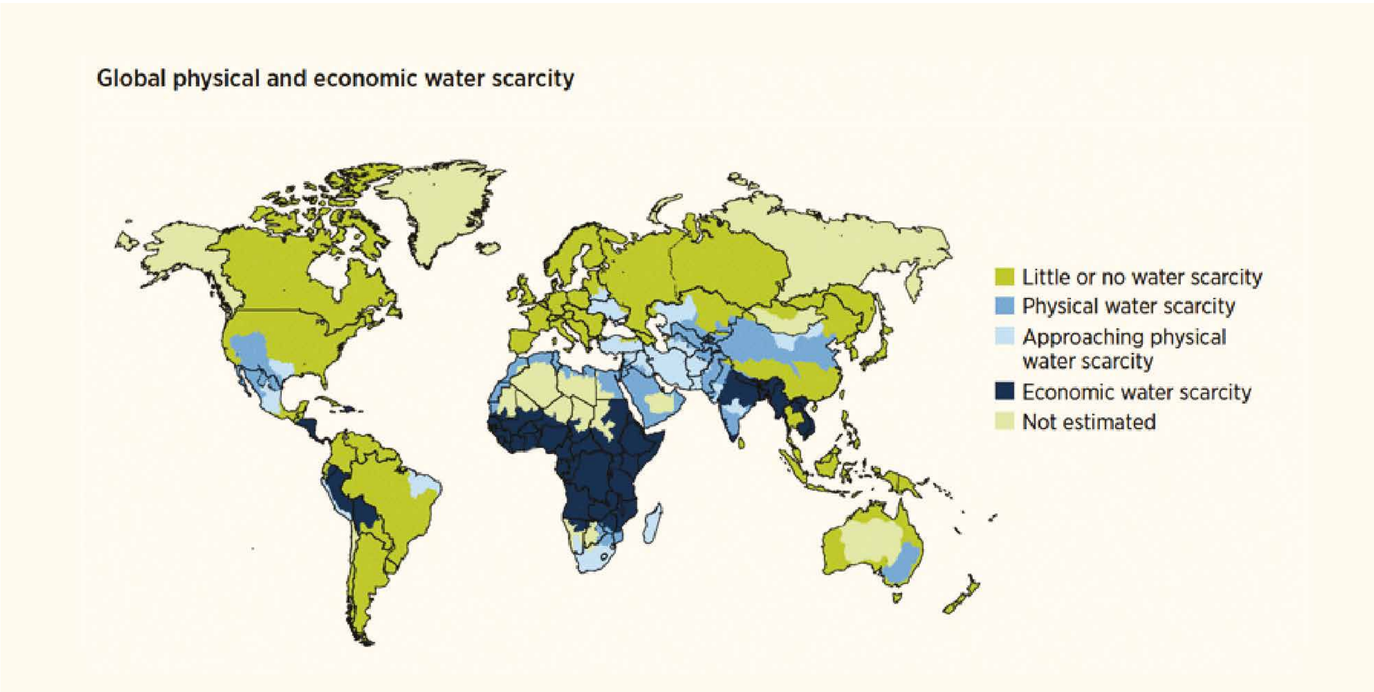

Figure 2: Despite abundant natural freshwater supply in the tropics, a large proportion of the population in these regions lacks access to potable water (‘economic water scarcity’). At the same time, physical water scarcity is increasing in arid areas of the subtropical high-pressure belts (UNDESA, 2014).

as irrigated fruits, crops, meat and water-intensive industrial products) to water-rich countries exacerbate water stress.

Associated science-to-action focus: One area to focus on is improving water-use efficiency. In agriculture – by far the largest global water user – water-use efficiency can be improved with smart irrigation and drought-resilient crops, for example. In industry, benchmarking of water efficiency for products may also help. These efforts should be paired with more general drives to curb water losses, such as reducing evaporation losses through managed aquifer recharge.

Another focus area is tapping into alternative water resources, including seawater (desalination), atmospheric water vapour (renewable-powered condensation schemes in coastal areas, reversible hygroscopic uptake by chemical compounds), frozen water (use of icebergs) as well as recently discovered submarine freshwater aquifers. It also includes low-cost, low-tech solutions for harvesting fog and rainwater, including drawing on indigenous and traditional knowledge, such as *foggaras* in the Maghreb, *qanats* in Iran and Aboriginal water use in arid Australia. Of crucial future importance is the application of circular-economy principles to water, including the reuse of wastewater, water recycling and zero-discharge concepts. In terms of economic water scarcity, a stronger emphasis on transdisciplinary approaches is required, including the development of innovative funding mechanisms for accelerating investments while avoiding a commodification of water.

Category III: Rapid changes requiring new solutions

This category comprises current and emerging water issues related to rapidly changing environmental conditions, such as weather and climate, and socio-economic conditions, including urbanization, demographic change and the expanding global middle class. While underlying causes are generally understood by science, new and more effective solutions are still required.

Example – urbanization under changing climates: With over half of humankind living in cities and urbanization continuing at unprecedented rates, especially in megacities, new ways need to be found for coping with the associated water challenges that are increasingly affecting urban areas around the world and across all income levels. This includes an increased vulnerability to floods, droughts and prolonged heat periods that recently made headlines in Europe as much as in Africa. It also relates to overflowing wastewater drainage systems due to cloudbursts – one of the most significant sources of diffuse stream pollution in Europe. Combined with prolonged low-flow periods and rising rainfall intensities, wastewater overflows pose significant future risks to aquatic ecosystems as well as human health. In megacities that suffer from uncontrolled growth of informal settlements, additional health risks arise from untreated sewage and the consumption of unsafe water. Additionally, since water consumption rates per capita multiply as rural dwellers move into cities, ever larger outside catchments are required to meet urban water demand, often at the expense of disempowered communities in affected source areas.

Associated science-to-action focus: One approach applicable to a wide range of urban water problems is the sponge city concept. A sponge city aims to reduce excessive urban runoff by increasing water storage and natural groundwater recharge in cities, thereby reconnecting the components of the hydrological cycle. Other measures, including increased rainwater harvesting, reuse of grey water and decentralized sewage treatment, should also be explored, especially in the context of informal settlements. It is important to consider perceptions and acceptability of solutions such as reusing treated wastewater, which may depend on cultural, religious and other preferences.

Other actions include technological advances in the detection and fixing of leaks from pressurized water reticulation systems – which account for enormous water losses around the world – and in the removal of emerging contaminants like endocrine-disrupting compounds and microplastics from municipal wastewater. For settlements in coastal areas, where some 40 percent of the global population live, the risk of seawater intrusions into local aquifers due to over-abstraction of groundwater and/or sea level rise is to be mapped and assessed.

Category IV: Addressing emerging and future water issues

This category relates to emerging or future water issues that are not yet sufficiently understood or known, respectively, and for which practical solutions are still to be developed.

Example – green energy transition: Decarbonization is central to the global strategy of combating climate change. With water and energy being inextricably linked, this transformation has profound implications for water. As green technologies like wind turbines, solar panels and electric cars require significantly more rare-earth metals per output unit than their technological predecessors, global mineral extraction and processing activities are expanding substantially. In the past two decades, mineral extraction doubled. If this rate continues, more minerals will have been mined between 2018 and 2030 than in all preceding human history. As 90 percent of global mining today takes place in water-stressed areas, this is bound to worsen the already fierce competition for scarce land, water and energy resources in the Global South, where most of the minerals needed for green technologies are extracted. Moreover, the need to mine ever lower-grades of ore at greater depths, and in increasingly remote locations, is expected to drastically increase associated water and energy consumption, the latter of which already accounts for 10 percent of the global energy use. It will further exacerbate mine waste-related problems like long-term water pollution, already regarded as one of the largest global environmental problems.

Increasing hydropower generation from large dams, as well as the growing use of pumped storage hydropower facilities to store intermittent wind and solar energy, have impacts on aquatic ecosystems, natural water balances and net-greenhouse gas emissions that need to be assessed. Following the emergency shut down of major thermal power plants (including nuclear) due to persistent low-flow conditions and the resulting shortage of cooling water in Central Europe in 2022, drought-proofing the energy sector should also be prioritized.

Associated science-to-action focus: Quantifying water implications of a shifting water–energy–food nexus is but one issue that needs anticipative research to assess and avert future water risks. For example, in order to increase the storage capacity for renewable energy without large dams impacting pristine environments, the repurposing of mined-out underground voids is currently being explored. Similar attention should also be paid to the implications of the large-scale use of green hydrogen and rising water temperatures on aquatic biodiversity and pathogen survival, for example.

Photo: Solar-powered sprinkler system in Klashar, Haryana, India. Prashanth Vishwanathan/Flickr.

III. SCIENCE ADVICE IN SUPPORT OF THE UN WATER ACTION DECADE

Addressing water challenges is imperative to achieving sustainable development and will require concerted and ambitious actions on the drivers and pressures governing water availability and quality. The following three priority areas and interventions have been identified:

Science policy development

- Strengthen independent and holistic scientific input into relevant UN structures and multilateral environmental agreements (such as the envisaged Special Envoy on Water, the Protocol on Water and Health, and UN-Water and related authorities) to support a wider science–policy interface, including a critical review of decisions and actions.
- Organize, and appropriately resource, mission-oriented science – science that engages with society to co-produce actionable knowledge to promote long-term sustainability, locally and globally – to address key areas where progress is lagging and transformative change is urgently needed.
- Strengthen the integration of natural and social sciences as well as indigenous and local knowledge with transdisciplinary approaches, including the protection of water-related cultural heritage and its material, conceptual, political and spiritual aspects.
- Develop a broader representation of water scientists, including underrepresented linguistic, gender and ethnic groups.

Capacity building and education

- Promote dedicated nation-level water research and education programmes (including support for citizen science), especially in water-stressed countries. Support the interlinking of these programmes to form a global water knowledge and capacity building network.
- Promote the open science paradigm, including cost-free access to publications, data, models and other scientific resources.
- Enhance water-related education and capacity development at all levels, ranging from schools to universities.
- Maintain the ability of science for critical self-reflection and proactively address any tendency of water science to become stagnant, repetitive, overly technical or less grounded in real world data. Underlying causes requiring attention include undue publication pressure, funding bias for short-term, predictable research and inadequate evaluation procedures.
- Stop the ongoing decline of water monitoring networks to ensure adequate data continues to be gathered to inform future water management (65 percent of World Meteorological Organization member countries have reported a decline in the density and frequency of hydrological monitoring systems capturing basic water flow and quality data). Promote the use of innovative sensing techniques to improve data capture. In the age of big data and rapidly expanding analytical capabilities, including artificial intelligence, there is also significant potential to improve data generation and interpretation beyond traditional water monitoring systems.

Communication and implementation

- Close the science–policy gap by improving communication and close collaboration among experts, policy-makers and practitioners to arrive at co-designed solutions acceptable to all.
- Develop approaches, tools and solutions that can be easily implemented by non-experts.
- Promote the sustainable use of water, in particular by large water users like agriculture, cities and industry, while strengthening local communities, especially marginalized groups, by forming genuine partnerships with scientists, planners and other experts.

KEY REFERENCES

The Global Commission on Science Missions for Sustainability, forthcoming. *A model for implementing mission science for sustainability*. Paris, International Science Council.

International Science Council. 2021. *Unleashing Science: Delivering Missions for Sustainability*. Paris, International Science Council. DOI: 10.24948/2021.04

Nature Sustainability. 2021. 'Too much and not enough.' *Nature Sustainability*, Vol. 4, 659, DOI: 10.1038/s41893-021-00766-8

UNDESA. 2014. *International Decade for Action 'WATER FOR LIFE' 2005–2015*. New York City, United Nations Department of Economic and Social Affairs. https://www.un.org/waterforlifedecade/scarcity.shtml (Accessed 07 March 2023).

United Nations. 2003–2022. *The United Nation's World Water Development Report Series*. Paris, UNESCO. https://www.unwater.org/publications/un-world-water-development-report (Accessed 07 March 2023).

Photo: Flooding in Bradford, UK. Chris Gallagher/Flickr.

Cover image
Students get water, Bangladesh.
Scott Wallace/World Bank.

International Science Council
The global voice for science

The International Science Council (ISC) works at the global level to catalyse and convene scientific expertise, advice and influence on issues of major concern to both science and society. The ISC has a growing global membership that brings together over 230 organizations, including international scientific unions and associations from the natural and social sciences, and national and regional scientific organizations such as academies and research councils. It is the largest international non-governmental science organization of its kind.

Citation: International Science Council, 2023. *UN 2023 Water Conference: ISC Policy Brief*. Paris, International Science Council. https://council.science/publications/water-policy-brief/

For more information, kindly contact Anne-Sophie Stevance, Senior Science Officer, at: anne-sophie.stevance@council.science or Anda Popovici, Science Officer, at: anda.popovici@council.science

Work with the ISC to advance science as a global public good.

Connect with us at:
www.council.science
secretariat@council.science

International Science Council
5 rue Auguste Vacquerie
75116 Paris, France
+33 1 45 25 03 29