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A Tale of Two UN Water Conferences - Mar del Plata (1977) to New York City (2023): Goals, Progress and Priorities

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Abstract

The United Nations (UN) 1977 Water Conference at Mar del Plata (MDP) sought to avoid a water crisis of global dimensions by 2000 and to ensure an adequate supply of good quality water to meet socio-economic needs. While much has been achieved, the MDP goals are not yet realised. Unsafe, or perceived to be unsafe, drinking water still affects at least 2 billion people, unsafe sanitation affects more than 4 billion people, and billions face severe water scarcity for at least part of the year. At the mid-point of the 2018-2028 International Decade for Action, 'Water for Sustainable Development', the UN 2023 Water Conference in New York City (NYC) in March 2023 offers a unique opportunity to review progress on global water goals, including the Sustainable Development Goals (SDGs), especially SDG 6 and its targets. Here, we document the global goals and progress from MDP to NYC and highlight priorities to deliver on the MDP goals and beyond.

Keywords: SDGs, justice, WASH, pollution, water quality, water pricing, safe water, water-use efficiency.

1 Introduction

Despite a 5000-year history of water governance[1], the world's first global conference on water[2] was not held until 1977 in Mar del Plata (MDP), Argentina - the United Nations (UN) Water Conference (Fig. 1). This was the first gathering of governments at a high political level to respond comprehensively to multiple global water agendas[3]. Its focus was to ensure that all people, irrespective of their state of development and social and economic condition, had access to water in the appropriate quantity and quality to cover their basic needs[4].

The MDP water agenda was carried forward in the International Conference on Water and the Environment (ICWE) in Dublin (1992) and the World Summit on Sustainable Development (WSSD) in Johannesburg (2002). Multiple UN initiatives have focused on global actions and outcomes, including the Millennium Development Goals (MDGs, 2000–2015); Sustainable Development Goals (SDGs, 2015–2030); and the High-Level Panel on Water (HLPW, 2015-18) (Fig. 1). Many parallel local, regional (e.g., Arab Water Forum), and global (e.g., World Water Forum) water-related forums have emerged since 1977. Here, we review the goals and progress up to the UN 2023 Water Conference in New York City (NYC) and our priorities for consideration and action.

2 Goals: Then and now

Between 1977 and 2023, the world's human population doubled to 8 billion. Urbanisation, agricultural expansion, industrial development, pollution, and climate change have placed enormous pressure on water resources. Since MDP, water has become scarcer per person and more polluted, and its availability in sufficient volumes and for essential uses, including ecosystem integrity, is threatened by climate change[5,6]. Increasing global water insecurity[7,8] imposes high environmental and economic costs[9–12] and increases risks[13].

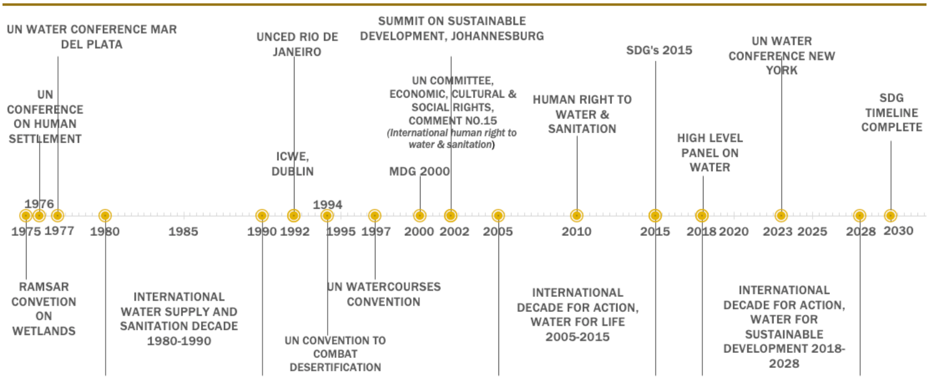

Fig. 1 Timeline of key UN Water-related Initiatives 1975-2030

A crucial ongoing global goal is to provide clean water and adequate sanitation services for all. Many other water goals that began at MDP have been retained and are part of multiple SDG targets (Fig. 2A). Some ongoing goals include access to improved sources of water and better sanitation services for all; better water data for improved decision-making; increased cooperation from the transboundary to the community level; reduced water pollution; and investment and innovation in water-related (primarily grey) infrastructure; these are within SDG 6 (Clean Water and Sanitation) and SDG 11 (Housing). Other water-related issues such as gender (highlighted at ICWE, 1992), agricultural water use, conflict zones, and desertification (highlighted at MDP, 1977) have, respectively, been subsumed into SDG 5 (Gender Equality), SDG 2 (Zero Hunger), SDG 16 (Peace, Justice, and Strong Institutions) and SDG 15 (Desertification).

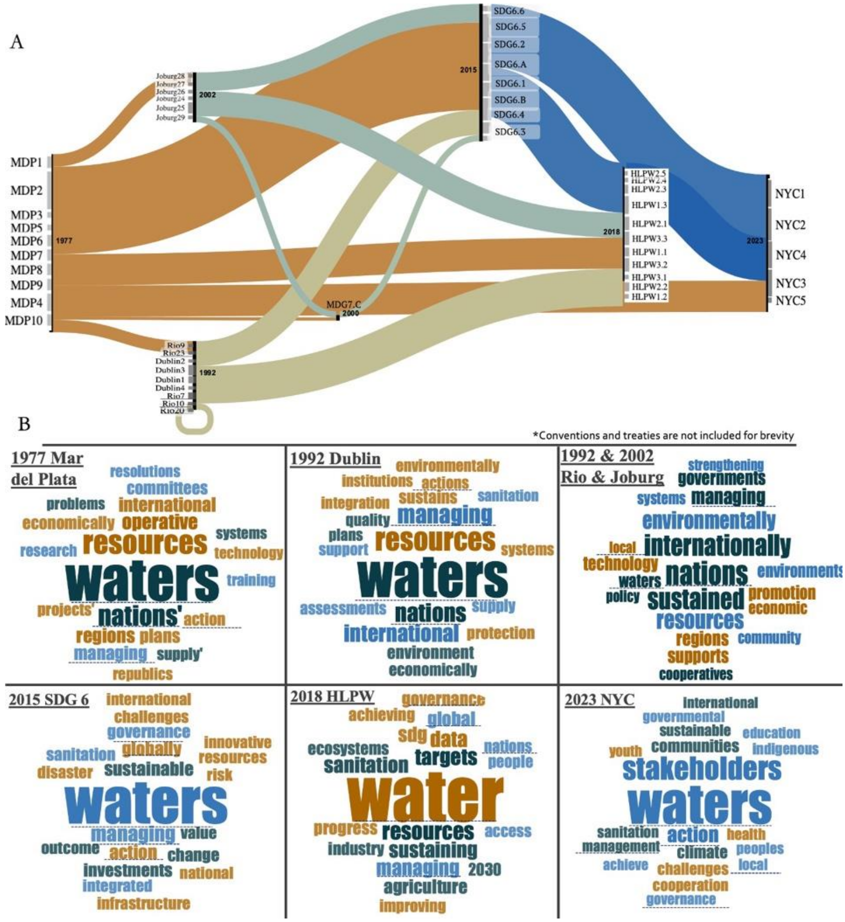

Fig. 2A. Connecting the goals of UN-Water Initiatives: Mar del Plata to New York City (Goals detailed in supplementary materials); **2B.** Word clouds representing the often-used words with conference reports (Data extracted from conference reports listed in supplementary materials).

In 1997, the UN member states adopted the Watercourses Convention to highlight the need to share water equitably and optimally between riparian nations to counter the prevalent notions of absolute territorial sovereignty and absolute integrity of state territory. Notably, the convention did not include the human right to water. The international human right to water and sanitation was recognised in 2002 by the United Nations Committee on Economic, Cultural and Social Rights (General Comment No. 15)[14] and, in 2010, in Resolution 64/292, the UN

General Assembly declared water and sanitation as a human right. These recognitions have not yet been sufficient to ensure clean water for all at an affordable price including the impoverished, marginalised, many Indigenous peoples[15] and those in remote locations in both the global North and South[16,17].

Colonisation legacies within law and practices have left many low-income countries with water 'ownership' patterns tied to land ownership[18] that impede water sharing. For example, while the South African Constitution acknowledges customary law, it is not mentioned in the National Water Act (1998). Thus, customary water rights are frequently overlooked, and apartheid-era water rights continue under the Existing Lawful Use water entitlements[19.] Regulatory patterns in former colonial states have also promoted a preference for 'full permanent sovereignty' over natural resources, thus reinforcing competing interests between countries[19].

Since MDP, water priorities have broadened from a focus on finance and grey infrastructure for water access to a greater emphasis on the environment[20], especially climate change (Fig. 2B). Other vital priorities include: responding to sovereignty and water sharing between nations; the water-energy-food nexus[8]; water governance challenges from the local to the global [21]; freshwater ecosystems losses[22,23]; conservation of green infrastructure[24]; water's gender and social dimensions [25]; private sector provision of water services; water pricing[26,27]; adaptation[28]; civil society's participation in decision-making processes[29], and the multiple values of water[30].

3 Progress

Progress on delivery of global water goals is mixed. For example, Water, Sanitation and Hygiene (WASH), was targeted in: MDP (1977) as 'Provision of drinking water and sanitation for all in 1990'; in MDG Target 7.C (2000) 'Reduce by half the proportion of people who were not able to reach or afford safe drinking water compared to 1990', and 'Halve by 2015 the proportion of people without access to improved sources of drinking water and improved sources of sanitation'; in WSSD (2002) 'To halve by 2015 the proportion of people without access to basic sanitation compared to 1990'; and in SDG 6 (2015) 'Ensure availability and sustainable management of water and sanitation for all by 2030'. Yet, none of these WASH goals has been achieved[31]. Failure to meet global water goals goes beyond WASH and their progress is detailed below.

3.1 Water supply and sanitation

In 2020, some 5.8 billion people had access to safely managed drinking water services, about 70% of the world's population, a 2 billion increase since 2000[32]. Yet, less than 30% of Africans have access to safely managed drinking water services compared to more than 90% of North Americans and Europeans (Table 1). At the current rate of progress (Fig. 3), no region in the global North or South will achieve SDG target 6.1: "By 2030, achieve universal and equitable access to safe and affordable drinking water for all"[32].

Table 1 Access to safely managed water supply and sanitation: average vs weighted average by population (Data Source: WHO/UNICEF JMP.)

Region	Details	Safe Water Supply			Safe Sanitation		
		2000	2010	2020	2000	2010	2020
Europe (53 Countries)	Countries reporting	50	51	51	46	48	46
	Average	84.35	88.62	91.32	67.48	72.03	79.94
	Weighted average	75.43	88.94	90.43	73.28	76.65	82.20
Africa (47 Countries)	Countries reporting	19	19	19	20	20	20
	Average	17.1	21.8	26.5	13.19	16.58	16.58
	Weighted average	16.21	19.78	23.76	14.12	16.69	16.69
Western Pacific (27 Countries)	Countries reporting	14	14	14	13	14	12
	Average	53.64	60.65	63.56	50.45	54.51	66.10
	Weighted average	71.9	77.12	76.92	23.06	42.14	65.12
America (36 Countries)	Countries reporting	13	14	13	15	16	15
	Average	63.72	69.7	71.29	40.93	44.56	50.52
	Weighted average	65.11	67.78	81.43	59.50	60.44	67.75
Eastern Mediterranean (22 Countries)	Countries reporting	13	13	13	15	16	16
	Average	66.66	70.19	75.01	44.59	51.60	59.44
	Weighted average	51.87	53.23	55.81	41.60	47.51	54.40
South-East Asia (11 Countries)	Countries reporting	5	5	5	6	6	6
	Average	41.38	45.86	47.59	28.97	38.14	47.51
	Weighted average	47.76	51.13	54.94	10.16	26.74	44.89
Global (197 countries)	**Countries reporting**	**113**	**116**	**115**	**115**	**120**	**115**
	Average	**63.19**	**68.11**	**71.22**	**58.77**	**51.63**	**62.70**
	Weighted average	**60.99**	**66.05**	**66.55**	**47.65**	**52.66**	**59.67**

About 60% of the world's population in 2020 had access to safely managed sanitation services. Yet some 1.7 billion people still lack basic sanitation services, and at least half a billion people are forced to defecate in the open. Further, within countries access is inequitable with rural regions having 26% lower coverage than urban[32,33]. At the current rate of progress (Fig. 3), the world will not achieve SDG target 6.2[33]: “By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations”.

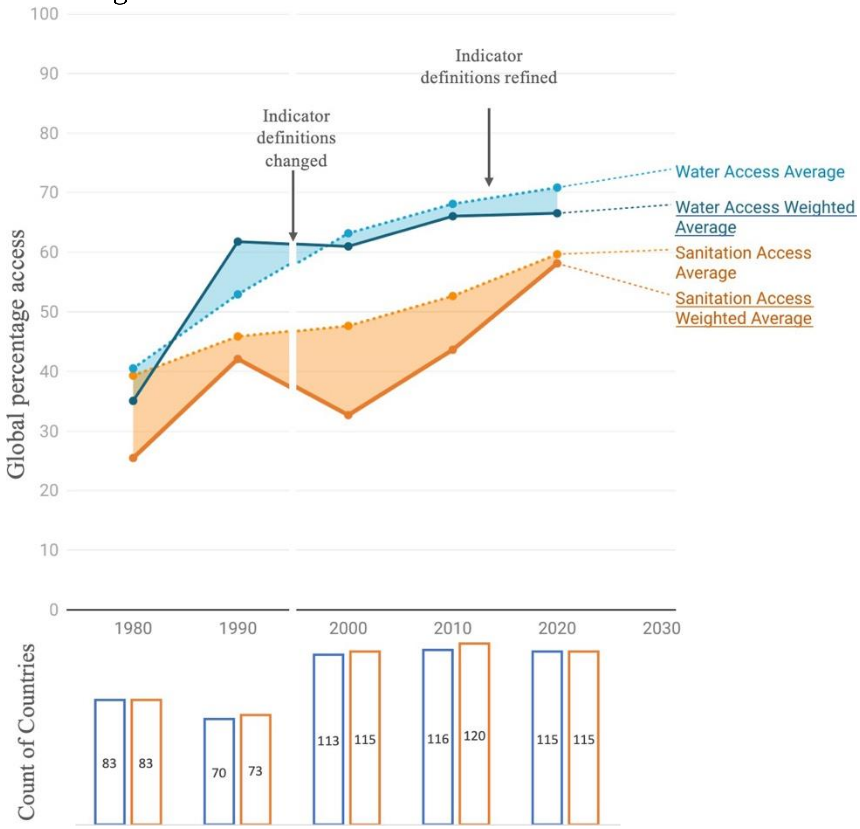

Fig. 3 Worldwide progress towards access to safely managed drinking water and sanitation. Figure includes average and weighted average by population (Data Source: WHO/UNICEF Joint Monitoring Programme (JMP))

3.2 Water Quality

Water quality contributes to water scarcity and is a critical concern for water security[34], noting that water pollution arises from multiple anthropogenic and natural sources[35,36].

Global water quality data is limited, particularly in Africa and parts of Asia and Latin America[34].Thus, it is difficult to determine, at a global scale, progress towards SDG target 6.3: “By 2030, improve water quality by reducing pollution, eliminating dumping and minimising release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally”. Notwithstanding data limitations, the UN Environment Programme concludes that surface water quality has declined from pollution in many of the rivers of Latin America, Africa, and Asia[34].

In some regions, there have been notable improvements in water quality especially in the global North and, most recently, in China[37]. The water quality of the Rhine River improved substantially between 1945 and 2008[38] and had ‘more or less’ stable water quality from 2008-2020[39]. Despite this progress, some freshwater ecosystems in the European Union continue to degrade, with pollution from chemicals and nutrients exacerbated by water withdrawals[40].

The Ganges River (Ganga) supports more than 600 million people and many bio-diverse ecosystems, yet it is one of the world’s most polluted rivers. The Government of India’s Ganga Action Plan (GAP) highlights the challenge of effectively responding to water pollution at scale. The GAP was launched in 1986 and became the National Mission for Clean Ganga, currently supported with USD one billion from the World Bank to build institutional capacity and undertake infrastructure investments[41,42]. Yet, multiple long-standing challenges exist for a clean Ganga[43,44] that include implementation delays; irregular release of funds; confusion over the roles of different government institutions; and irregular monitoring while claims of improvement in Ganga’s water quality are contested[43,44]

3.3 Water use efficiency

The HLPW highlighted the need for: “efficient use of water through a national policy framework that creates incentives for water users, including irrigators, to not waste or pollute water, and promote its reuse”[45]. This idea is frequently applied to irrigated agriculture with the goal to increase irrigation efficiency[45] (i.e., the ratio of water supporting plant growth to the total water available). Water efficiency has been prioritised because irrigation accounts for about 70% of blue water (e.g., freshwater lakes, rivers, and aquifers) withdrawals and more than 80% of blue water consumption[46].

Increased irrigation efficiency has been promoted to increase crop yields and to respond to a more than doubling of global irrigated areas over the past 60 years[47]. Higher irrigation efficiency helps farmers to increase production. However, this increase is frequently associated with reduced water availability elsewhere[48] because increased beneficial water consumption promotes a 'rebound effect' increasing irrigation water demand[49] and, reducing the return flow of water from farmers' fields to streams, rivers, and aquifers. Consequently, without additional actions such as limits on water consumption[50], increasing water use-efficiency alone will not achieve SDG target 6.4: "By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity."

3.4 Transboundary water treaties

Bilateral water treaties have existed since the 25th century BCE; today, they number some 600. These treaties have been critical in shaping principles of water law at a global level, that is, absolute territorial sovereignty (countries have absolute rights to use the water flowing in their territory, empowering upstream states); and the absolute integrity of state territory (countries have the right to receive the same quality and quantity of flows through time, benefitting downstream states)[1].

Amending existing water laws is critical to ensure sustainable governance of water. At the global scale, three water conventions relate to transboundary waters, although none adequately responds to the hydrological impacts of climate change. First, the Ramsar Agreement on Wetlands (1971) had 172 contracting parties and entered into force in 1975 with the intent to stem the loss and degradation of wetlands of international importance. Second, the UN Economic Commission for Europe (UNECE) 1992 Water Convention had 46 contracting parties and was later opened for ratification by non-UNECE members. Third, the 1997 Watercourses Convention has 37 contracting parties and entered into force in 2014[1].

The 1992 Water Convention is notable for its focus on water pollution, and its follow-up protocol responds to concerns over human health related to drinking water and sanitation. The 1997 Watercourses Convention is important because it shifted long-standing notions of national sovereignty towards ‘do no harm’ to other states and equitable water sharing based on specified criteria and weights agreed to by riparian countries[51.] While hundreds of treaties govern transboundary waters, many countries are reluctant to ratify the Watercourses Convention, which specifies the need for equitable sharing. Further, transboundary cooperation, as envisaged by the UN and UNECE Water Conventions, has only progressed to a limited extent and is limited to specific water issues[51]. Thus, much remains to be accomplished to achieve SDG target 6.5: “By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate.”[1].

3.5 Protect and restore water-related ecosystems

About 35 percent of the world’s wetlands were lost between 1970 and 2015. This loss severely impacts ecosystems, biodiversity, and human welfare (Convention on Wetlands 2021). While some regions, such as North America, have performed relatively well in reducing recent losses, others, such as Africa and Latin America, have not[52]. Nevertheless, more wetlands are currently characterised as in a ‘fair or good’ ecological character state than previously, and only 23% of all wetlands are reported as being in a ‘poor’ state[53]. Further, Ramsar wetlands of international importance are said to be in better condition than wetlands in general[52].

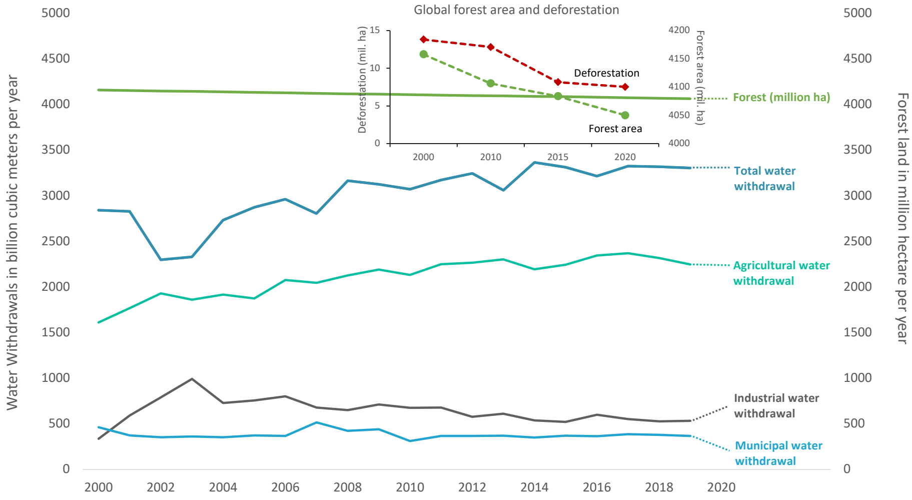

Fig. 4 Global Water Withdrawals (bill Cu. M/year), and Global Forest Area and deforestation (mill. Ha.) (Data Source: FAO stat, 2022)

About 70% of the global wetland losses happened in the 20th century, with the highest loss rates in inland and coastal wetlands areas occurring from 1950[54]. The current estimated total area of wetlands is 15–16 million km^2 and loss rates are 0.2% per year[55]. Much of this loss is associated with land-use change, but inappropriate water regulation (drainage, water withdrawals, salinisation, river regulation) has also been a contributing factor.

An important contributor to the degradation of water-related ecosystems is reduced forest cover. Deforestation contributes to changes in water availability, soil erosion that can increase sedimentation and reduces water storage capacity, degrades water quality, and increases flooding risks. While forest cover has recently increased in some regions, such as North America and Northern Europe[56], the global forested area continues to decline (Fig. 4). Another critical pressure on water ecosystems is global blue water withdrawals which have almost doubled since MDP (1977)[57,58].

Consequently, SDG target 6.6 has not been achieved: "By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes". Nor will SDG target 15.1: "[c]onservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands..." be realised without a change in business-as-usual.

3.6 Data gaps

Eight of the 11 water-related indicators for SDG6 are regularly assessed by at least half of all countries. These indicators include access to safe and affordable drinking water; increased water-use efficiency; implementation of integrated water resources management; protection of water-related ecosystems; and international cooperation and participation of local communities in improving water and sanitation management. Three indicators - access to sanitation, discharge of safely treated domestic and industrial wastewater, and bodies of water with good ambient water quality - are not regularly produced by most countries[10]. Further, only 115 countries report data on total water access, and some (e.g., Australia and China) only report urban water access but not rural water access (See Fig. 5).

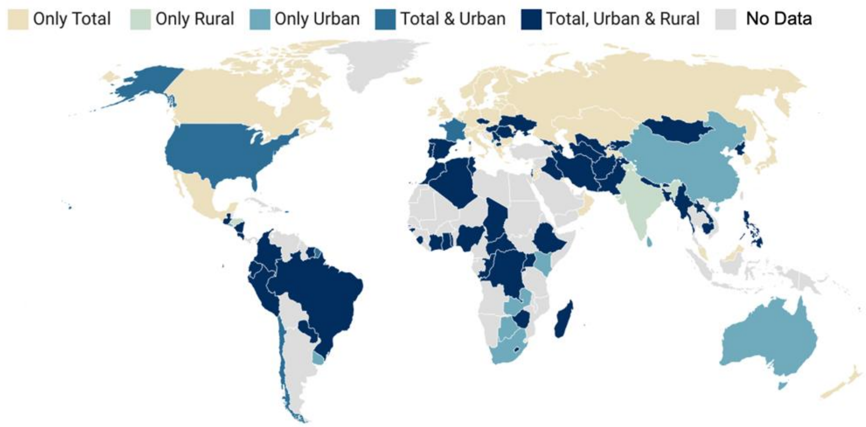

Fig. 5 Countries reporting data on access to safely managed water supply (Data Source: JMP, UNICEF/WHO database)

Thus, despite substantial progress, data constraints identified at MDP, the MDGs[59], and highlighted in the High-level Panel on Water (2018) remain an impediment to determining progress, identifying gaps, allocating funding, and delivering actions linked to human development[60]. Nevertheless, we contend there are sufficient data to define priorities and act.

4 Priorities

Progress since MDP shows that there is no single approach to achieve sustainable and equitable goals of 'water for all'. This is because the burdens of water insecurity are primarily realised at a local level (e.g., droughts, floods, pollution, access and affordability, the distribution of property rights to water in society), yet the drivers range from local to global (e.g., trade in virtual water, climate change, income and wealth inequalities, power imbalances within and across countries, failure to internalise costs and historical injustice, and more)[61.] In contrast to MDP, delivery on global water goals while responding to injustice in both the global North[16] and global South[62] is constrained by planetary limits[63] and tipping points[64]. Among the many priorities available, here we highlight three for consideration at the second UN Water Conference: improved WASH[42]; investments in infrastructure (grey, green, and soft); and a shift in values, behaviours, and incentives.

4.1 Towards safe drinking water and sanitation

Realising any of the SDG goals ranging from health to gender equality require transformational change in access to safe water supply and sanitation for all[32]. A bespoke example in urban WASH services is Cambodia's Phnom Penh Water Supply Authority that began reforms in 1993 that subsequently resulted in a ten-fold increase in its water distribution network. This change was accomplished by a 'Swiss cheese model' of cumulative actions to ensure WASH access[65], rather than any single action. These actions included: inspired leadership and institutional reform; a good understanding of water customers; a focus on reduced water losses; removal of illegal connections; metering of all connections; a billing system that ensures all who receive water pay for it; and donor-financed infrastructure upgrades[66].

Similarly for potable purposes, we highlight innovations as Windhoek, Namibia, a pioneer in directly providing reclaimed water[67]. Similarly, in other cities such as Singapore; Orange County, United States; Wulpen, Belgium; Essex, United Kingdom; and Perth, Australia, reclaimed and/or recycled water is an essential part of water supply[66]. While much can be learnt from these examples, unfortunately, these cities remain an exception. For many urban residents, bespoke water reforms are required to overcome shortfalls. In cities like Jakarta[68] New Delhi[69] and Flint, Michigan US[70], unsafe tap water, incomplete sanitation and wastewater treatment services are a norm for those who cannot afford to pay for safe water access.

In contrast to urban experiences, enabling water and sanitation in rural areas is more difficult due to scale, demand, and dispersed infrastructure, institution (formal and informal), and finance[14]. Rural water supply experiences from African and Asian countries suggest a need to go beyond single source supply and to 'think beyond pipes' to encompass diversified sources ranging from private water vendors to rainfall. Enhancing access to safe water in rural areas is also linked to strengthening cultural water values and the conservation of blue water sources (e.g., springs, lakes, and wetlands)[14,32].

4.2 Investing in the three infrastructures

Much of the focus on delivering water infrastructure since MDP has been on grey infrastructure (e.g., pipes, channels, treatment, buildings). While grey infrastructure is needed in both the global South and North, we contend that green (e.g., floodplains, wetlands, river channels, lakes and estuaries, soil, aquifers) and soft infrastructure (e.g., governance, regulation, education, incentives, and communication) are equally important priorities.

4.2.1 Grey infrastructure for WASH

Annual global subsidies of some US$ 320 billion are provided for delivering WASH services. Much of this expenditure goes to existing water services. Thus, the poorest with the least (or no) access to a centralised water system receive the minimal support. Around 56% of subsidies go to the highest quintile households by income, and 6% go to the lowest quintile households[71]. Multiple informal markets and decentralised system of water provision are frequently ignored by regulated and centralised pricing and infrastructure systems[32]

By 2030, approximately US$ 1.5 trillion per year capital investments are required for grey infrastructure, with the most needed in the global South[30]. Hutton and Varughese[72] estimated that the total annual capital costs to achieve SDG targets 6.1 and 6.2 range from US$74–166 billion, comprised of 37.6 billion for safe water, 19.5 billion for basic sanitation, and 49 billion for safe faecal waste management.

The investments required to deliver SDG 6 will need multiple forms of financing. Yet, global private sector investments in greywater infrastructure in 2020 were only US$ 17 billion[73]. To overcome this challenge, the OECD recommends several financing pathways: improved soft infrastructure around the delivery of WASH services, such as an enabling environment (e.g., decrease in non-revenue water); strategic investment planning; mobilising additional investment by governments; restructuring risks and returns; and public-private partnerships leveraged by larger public investments[73].

4.2.2 Green infrastructure for WASH and more

Green infrastructure has long been practised in the water sector, especially in conserving water catchments. For decades, cities such as Tokyo and New York[74] have invested in protecting their watersheds to maintain high-quality water supply sources[75]. The financial pay-off has been a reduction in treatment, operation, and maintenance costs[23]. A review of 309 large cities, showed how degraded catchments increased operations and maintenance costs by 53 ± 5%, and replacement capital costs by 44 ± 14%[76]. Further, these benefits are not just measured in dollars; examples from Kenya show that conserving green infrastructure such as natural springs can reduce child mortality by one-quarter[14].

Green infrastructure is increasingly acknowledged for its importance in delivering important ecosystem services (e.g., freshwater provision, sediment regulation, flood mitigation and hydropower production)[77,78]. In addition, such infrastructure also supports cultural, recreational, and amenity values while enabling flood management, groundwater recharge and more[79]. Nature-based investments in rain gardens, green roofs, and urban constructed wetlands can also offset some of the negative impacts of built infrastructure[77,80]. The benefits of maintaining and conserving green infrastructure are estimated to be worth US$3 trillion by 2050 in avoided replacement costs for grey infrastructure[61].

4.2.3 Soft infrastructure for collective action

As synthesised by the World Bank[42] and highlighted by the OECD[73], soft infrastructure reform is critical to progressing SDG 6 and other SDG targets. According to the Water Policy Group, and others [42,81], three important and general failures that need to be overcome include: fragmented water institutions; inadequate and inaccessible data and information; and conflicts between water user groups. In response to these challenges, the World Bank has proposed a Policy, Institutions and Regulations framework that connects data to WASH performance, reviews existing laws and the incentives they provide, builds institutional capacity, and establishes effective planning to respond to stresses and shocks [42]. The lessons from this framework are applicable beyond WASH but can be difficult to implement because of regulatory capture, rent seeking, and corruption[82].

Regulatory capture[83] occurs when state actors are 'captured' through a process of mediated corruption[84]. Such capture is not necessarily illegal and is facilitated by political donations, lobbying, 'tit for tat' favours and 'revolving doors' for decision-makers. This may be exacerbated by rigid decision hierarchies[85], but Singapore is an example where a top-down corruption control has been highly effective. Singapore's approach has been supported by; laws (*Prevention of Corruption Act*, and *Corruption, Drug Trafficking and Other Serious Crimes* (Confiscation of Benefits) *Act*), an independent judiciary, strict and timely enforcement through the Corrupt Practice Investigation Bureau under the Prime Minister's Office, and a strict code of conduct for the public servants with severe penalties for infringements.

Regulatory capture and rent-seeking influence how money is spent and how decisions are prioritised[82], noting that in some water sectors, corruption is widespread[86] and occurs in both the global North and global South [82]. Responding to corruption requires bottom-up citizen vigilance plus international and national civil society support [82].

Anti-corruption measures must be fit for purpose. Nevertheless, we highlight some priorities: promoting decision-making at the scale where it is most effective and least vulnerable to manipulation; meaningful deliberations with all relevant stakeholders; transparency in process and decisions; and independent regulatory oversight.

4.3 Values, Behaviours, and Incentives

Water has multiple use values (e.g., WASH, agriculture, industry, ecological flows, etc.) observable from people's behaviours and non-use or passive values (e.g., aesthetic, spiritual, and bequest), which are not often valued[30]. Measurement of these multiple values is essential because without estimates of non-market values (e.g., water in rivers and lakes left in situ) and cultural values of water, decision-makers will, typically, only consider and/or prioritise market values (e.g., water used to produce commercial crops) [30].

Failure to fully value water in all uses, including *in situ* uses, has contributed to the degradation of green infrastructure that is critically important to deliver SDG 6, among other goals. Not or only partially valuing water[87] and not accounting for the external costs imposed on others from water use, such as increased salinity, reduced stream flows from irrigation, or water-related health problems, contributes to water misallocation. That is, too much water is allocated for purposes that generate market values (e.g., cotton production), and too little water is allocated for non-market needs (e.g., maintaining ecosystem services). This problem is most transparent with formal water markets (e.g., in Australia, Chile, China, Spain, USA) which have been effective, when there is adequate monitoring and compliance, at reallocating water based on the marginal willingness to pay among competing market uses. Nevertheless, if the overall cap on water withdrawals in water markets fails to adequately consider non-market values, total water withdrawals are economically inefficient[88]. Failure to ensure an appropriate initial allocation of water rights, especially for Indigenous custodians of land[89] and to prioritise drinking water needs for communities located on or nearby rivers where water rights are traded, undermines the social licence of water markets, and increases inequities[90.]

Water regulators influence water conservation behaviours in multiple ways. For example, rationing constrains water availability or type of use and modifies household water conservation behaviours by requiring users to use less water. An alternative approach is to price non-essential water uses and to provide a free allocation for essential uses and subsidies for low-income water users. Higher volumetric prices for those who can afford it can provide an incentive, but not an obligation, to conserve water[91,92] where water use is metered. More equitable water outcomes can be supported by ensuring additional revenues from higher water prices are directed to water suppliers to improve services and/or to reduce the fixed charges of poorer households. Non-market values and future water scarcity may also be included in regulated water prices. For example, in Canberra, Australia a water abstraction charge[93] proxies the external costs of household water consumption on downstream water users while in Sydney, Australia the volumetric price increases by 35% when water storages fall below 60%.

In many cities in the global South there is inadequate household coverage of centralised water services, and this is frequently accompanied by supply interruptions[94]. Consequently, a proportion of urban households–as much as 50% in some cities, either supplement or completely obtain water independently (e.g., wells, rivers) and/or through private water vendors. While the volumetric price from water vendors can be much greater than centralised water systems[95,96], they do offer a valuable service in cities as diverse as Dhaka, Bangladesh[97] to Dar es Salaam, Tanzania[96].

5 Conclusions

Progress on achieving the goals at MDP, the MDGs, and SDGs is mixed. Substantial progress has occurred on WASH, important transboundary agreements and conventions have come into force (e.g., RAMSAR, Watercourses Convention) and some measures of water quality have improved, mostly in the global North, since MDP. Nevertheless, none of the SDG 6 targets will be delivered by 2030, increases in water-use efficiency (SDG Target 6.4) alone will not ensure either sustainable water withdrawals or reduce the number of people suffering from water scarcity, and key data gaps remain.

Decades-long trends of reductions in the global area of wetlands and forests, coupled with ever increasing global blue water withdrawals, pose increasing risks for human welfare and planetary health. A failure to achieve the key goals at the first UN Water Conference after almost five decades and an increasing risk the world will cross a critical tipping point demands transformational change. At the second UN Water Conference, and beyond, we highlight the importance of: improved WASH; much greater and better prioritised infrastructure (grey, green, and soft) investments; and a shift in values, behaviours, and incentives.

Without these and other changes that are bespoke to the bio-physical and socio-economic contexts where they are applied, we will fail to deliver 'water for all'.

Supplementary information. Data sources, detailed tables and calculations applied in this paper are listed in the supplementary information.

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