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Executive summary

A. SDG 6 in the 2030 Agenda for Sustainable Development

All 193 Member States of the United Nations General Assembly unanimously agreed to *Transforming our world: the 2030 Agenda for Sustainable Development* (the 2030 Agenda) in September 2015. The 2030 Agenda is a plan of action for people, the planet and prosperity. Member States resolved to "end poverty in all its forms", to take bold and transformative steps to "shift the world on to a sustainable and resilient path" and to ensure that "no one will be left behind". The 2030 Agenda established 17 Sustainable Development Goals (SDGs) and 169 global targets, relating to development outcomes and means of implementation (MoI), for the period 2015–2030. These were designed to be integrated and indivisible and to balance the social, economic and environmental dimensions of sustainable development. The 2030 Agenda further seeks to realize the human rights of all, and to achieve gender equality and empowerment of all women and girls. This ambitious universal agenda is intended to be implemented by all countries and all stakeholders, acting in collaborative partnership.

The establishment of SDG 6, *Ensure availability and sustainable management of water and sanitation for all*, reflects the increased attention on water and sanitation issues in the global political agenda. The 2030 Agenda lists rising inequalities, natural resource depletion, environmental degradation and climate change among the greatest challenges of our time. It recognizes that social development and economic prosperity depend on the sustainable management of freshwater resources and ecosystems and highlights the integrated nature of SDGs.

This first synthesis report on SDG 6 seeks to inform discussions among Member States during the High-level Political Forum on Sustainable Development. It is an in-depth review and includes data on the global baseline status of SDG 6, the current situation and trends at global and regional levels, and what more needs to be done to achieve this goal by 2030. The report is based on the latest data available for the 11 SDG 6 global indicators[1] selected by Member States to track progress towards the eight global targets, plus complementary data and evidence from a wide range of sources.

B. Sustainable water and sanitation for all

Fresh water, in sufficient quantity and quality, is essential for all aspects of life and sustainable development. The human right to water and sanitation are widely recognized by Member States. Water resources are embedded in all forms of development (e.g. food security, health and poverty reduction), in sustaining economic growth in agriculture, industry and energy generation, and in maintaining healthy ecosystems.

Water-related ecosystems and the environment have always provided natural sites for human settlements and civilizations, bringing benefits suchas transportation, natural purification, irrigation, flood protection and habitats for biodiversity. However, population growth, agricultural intensification, urbanization, industrial production and pollution, and climate change are beginning to overwhelm and undermine nature's ability to provide key functions and services. Estimates suggest that if the natural environment continues to be degraded and unsustainable pressures put on global water resources, 45 per cent of the global gross domestic product,

[1] Data relating to targets are based on the latest data drives from 2015 (WASH data, and most MoI data) and 2017 or previously collected data.

52 per cent of the world's population and 40 per cent of global grain production will be put at risk by 2050. Poor and marginalized populations will be disproportionately affected, further exacerbating rising inequalities.

Agriculture (including irrigation, livestock and aquaculture) is by far the largest water consumer, accounting for 69 per cent of annual water withdrawals globally. Industry (including power generation) accounts for 19 per cent and households for 12 per cent. All these water uses can pollute freshwater resources. Most wastewater from municipal, industrial and agricultural sources is discharged back into water bodies without treatment. If not treated, this pollution further reduces the availability of fresh water for drinking and other uses, and also degrades ecosystems.

There is a growing consensus that the challenges can be met by adopting a more integrated approach to managing and allocating water resources, including the protection of ecosystems upon which societies and economies depend. The concept of integrated water resources management (IWRM) is embedded in the 2030 Agenda and requires governments to consider how water resources link different parts of society and how decisions in one sector may affect water users in other sectors. It is an approach that must involve all actors and stakeholders, from all levels, who use and potentially pollute water so that it is managed equitably and sustainably.

C. Achieving the SDG 6 targets

SDG 6 includes eight global targets that are universally applicable and aspirational. However, each government must decide how to incorporate them into national planning processes, policies and strategies based on national realities, capacities, levels of development and priorities. They cover the entire water cycle including: provision of drinking water (target 6.1) and sanitation and hygiene services (6.2), treatment and reuse of wastewater and ambient water quality (6.3), water-use efficiency and scarcity (6.4), IWRM including through transboundary cooperation (6.5), protecting and restoring water-related ecosystems (6.6), international cooperation and capacity-building (6.a) and participation in water and sanitation management (6.b).

This report recognizes that monitoring progress towards achieving SDG 6 is a learning process of review and improvement, that the selection of indicators, data collection and methodologies represent work in progress, and that countries are at different stages in developing their monitoring and reporting mechanisms. Less than half of Member States have comparable data available on progress towards meeting each of the global SDG 6 targets. Almost 60 per cent of countries do not have data available for more than four global SDG 6 indicators, and only 6 per cent reported on more than eight global indicators, representing a major knowledge gap. Water, sanitation and hygiene (WASH) targets have accumulated data since 2000 during the Millennium Development Goal period, whereas most other targets have a much shorter history of data acquisition.

1. Target 6.1: Safe and affordable drinking water

Achieving universal access to safe and affordable drinking water by 2030 presents a huge challenge for all countries, not just those with low incomes. The global population using at least a basic drinking water service increased from 81 per cent in 2000 to 89 per cent in 2015. However, only one in five countries below 95 per cent coverage is on track to achieve universal basic water services by 2030. Achieving target 6.1 means addressing the "unfinished business" of extending services to 844 million people who still lack even a basic water service, and progressively improving the quality of services to 2.1 billion people who lack water accessible on premises, available when needed and free from contamination (safely managed drinking water). It also implies going beyond households and providing access to services in schools, health-care facilities and other institutional settings.

The commitment to "leave no one behind" will require increased attention on disadvantaged groups and efforts to monitor elimination of inequalities in drinking water services. Disaggregated data on basic services are available for a growing number of countries (80), by rural and urban area, wealth group and subnational region. . This enables governments to better identify and target disadvantaged groups, but further work is required to disaggregate estimates for safely managed services.

In those countries where a large proportion of the population still lacks even a basic drinking water service, the initial focus must remain on ensuring that everyone has access to an improved drinking water source and reducing the time spent (primarily by women and girls) collecting water. Further work is also needed to establish a commonly agreed method for assessing affordability, as payment for services should not be a barrier to accessing services.

2. Target 6.2: Access to sanitation and hygiene and end open defecation

Achieving universal access to adequate and equitable sanitation and hygiene by 2030 is a major challenge in many parts of the world. Target 6.2 calls for countries to end open defecation, to ensure that everyone has access to a basic toilet and to put in place systems for safe management of excreta. The global population using at least a basic sanitation service increased from 59 per cent in 2000 to 68 per cent between 2000 and 2015. However, 2.3 billion people still lacked basic services, 70 per cent were in rural areas, and just 1 in 10 countries below 95 per cent coverage is on track to achieve universal coverage by 2030. Furthermore, 4.5 billion people worldwide lacked a safely managed sanitation service in 2015, where excreta were safely disposed of in-situ or treated off-site.

Target 6.2 also highlights the importance of hygiene and calls for special attention to the needs of women and girls. Handwashing with soap and water is widely recognized as a top priority for reducing disease transmission. The global status is not yet known, but least developed countries (LDCs) had the lowest coverage: only 27 per cent had basic handwashing facilities, though coverage was higher in urban areas at 39 per cent.

Some 892 million still practise open defecation. Between 2000 and 2015, the total fell from just over 1.2 billion. Of those who still practise open defecation, 90 per cent lived in rural areas, and the vast majority lived in just two regions with 558 million in Central Asia and Southern Asia and 220 million in sub-Saharan Africa. A substantial effort will be needed to end this practice by 2030.

Substantial investment will be required, particularly in rapidly growing urban areas, although solutions will vary depending on the relative importance of sewerage networks and on-site sanitation systems. Strengthening the capacity of local and national authorities to manage and regulate sanitation systems will be a high priority, including the development of information management systems, especially in low- and middle-income countries.

3. Target 6.3: Improve water quality, wastewater treatment and safe reuse

Collecting, treating and reusing wastewater from households and industry, reducing diffuse pollution and improving water quality are major challenges for the water sector. Ambient freshwater quality is at risk globally. Freshwater pollution is prevalent and increasing in many regions worldwide. Preliminary estimates of household wastewater flows, from 79 mostly high and high middle-income countries, show that 59% are safely treated. For these countries it is further estimated that safe treatment level of household wastewater flows with sewer connections and on-site facilities are 76% and 18% respectively.

Although water quality problems are largely associated with developing countries, they also persist in developed countries and include the loss of pristine quality water bodies, impacts associated with changes in hydromorphology, the rise in emerging pollutants and the spread of invasive species.

The extent of industrial pollution is not known, as discharges are poorly monitored and seldom aggregated at national level. Although some domestic and industrial wastewater is treated on site, few data are available and aggregated for national and regions assessments. Many countries lack the capacity to collect and analyse the data needed for a full assessment. Reliable water quality monitoring is essential to guide priorities for investment. It is also important for assessing the status of aquatic ecosystems and the need for protection and restoration.

Increasing political will to tackle pollution at its source and to treat wastewater will protect public health and the environment, mitigate the costly impact of pollution and increase the availability of water resources. Wastewater is an undervalued source of water, energy, nutrients and other recoverable by-products. Recycling, reusing and recovering what is normally seen as waste can alleviate water stress and provide many social, economic and environmental benefits.

4. Target 6.4: Increase water-use efficiency and ensure freshwater supplies

Few countries have the natural and financial resources to continue increasing water supplies. The alternative is to make better use of available resources. This target addresses the issue of water scarcity and the importance of increasing water-use efficiency, with the latter being a measure of the value of water to the economy and society in units of United States dollars per cubic metre (US$/$m^3$) of water used.

More than 2 billion people live in countries experiencing high water stress. It affects every continent, hinders sustainability, and limits social and economic development. Although the global average water stress is only 11 per cent, 31 countries experience water stress between 25 per cent (when stress begins) and 70 per cent, and 22 countries are above 70 per cent and are seriously stressed. The highest stress levels occur in Northern Africa and in Western, Central and Southern Asia. Sub-Saharan Africa, has a stress level of only 3 per cent, but this regional figure hides the large differences between the wetter and drier parts of this region. Levels of stress are likely to increase as populations and the demand for water grow and the effects of climate change intensify.

Agriculture is by far the largest water consumer, accounting for nearly 70 per cent of all withdrawals globally and as much as 90 per cent in some arid countries. Saving just a fraction of this can significantly alleviate water stress in other sectors. Alternative water sources, such as wastewater, storm runoff and desalination, can also relieve water stress. Safe wastewater reuse and recycling is a significant untapped resource for industry and agriculture, but its use must overcome political and cultural barriers. Another option is to import food grown in water-rich countries, but this may conflict with political sensitivities as countries seek food security in terms of self-sufficiency.

The water-use efficiency is 15 US$/$m^3$ globally, but values range from as little as 2 US$/$m^3$ for countries whose economy largely depends on agriculture, to 1,000 US$/$m^3$ in highly industrialized, service-based or other economies that are dependent on natural resources. This information is not sufficient to define detailed policies and to take specific operational decisions to improve the grass-roots efficiency of various water users. Additional indicators reflecting those uses would therefore be most helpful. Indicators that reflect improvements in water productivity and irrigation in agriculture, and reduced losses in municipal distribution networks, industrial and energy cooling processes, are among the main issues that such indicators should monitor.

5. Target 6.5: Implement integrated water resources management

The 2030 Agenda fully commits Member States to IWRM and transboundary cooperation over shared water resources. Putting this into practice will be the most comprehensive step that countries make towards achieving SDG 6. Some 80 per cent of countries reported from all regions and on all levels of development. The global average degree of implementation of IWRM was 48 per cent (medium-low), but there were great variations among countries. Only 25 per cent of countries in the three lower human development index groups reached the medium-low classification. Modest progress is being made, but most countries will not meet the target by 2030 at current rates of implementation. If the components of IWRM are broken down, most progress towards implementation is found in cross-sectoral coordination and public participation at national level (62 per cent), but financing (33 per cent), gender issues (33 per cent) and aquifer management (41 per cent) are areas of concern. There is no universal approach to implementing IWRM, and each country must develop its own pathway based on political, social, environmental and economic circumstances.

Implementing IWRM at the transboundary level demonstrates the critical need to strengthen cooperation over shared water resources. The average of the national percentage of transboundary basins covered by an operational arrangement is 59% (based on 2017-18 data from 61 out of 153 countries sharing transboundary waters. However, the operational agreements and the joint bodies established were diverse and demonstrated that, while based on principles of customary law, there is no 'one size fits all' solution for what these should look like. Countries reported barriers to reaching agreement. These included: lack of political will and power asymmetries among riparian countries; fragmented national legal, institutional and administrative frameworks; lack of financial, human and technical capacity; and poor data availability, especially in relation to transboundary aquifers and their boundaries.

6. Target 6.6: Protect and restore water-related ecosystems

Historically, the drive for economic and social development has largely depended on exploiting natural resources, including water-related ecosystems. Today, as the demand for fresh water increases, awareness is focusing on ensuring that the limited capacity of the natural environment to sustain the multiple services that society has come to rely on is maintained. Water-related ecosystems underpin other SDGs, and yet they also depend on them, particularly those relating to food and energy production, biodiversity, and land and sea ecosystems. Protecting and restoring water-related ecosystems cannot be achieved without progress on these other goals and vice versa.

The world has lost 70 per cent of its natural wetland over the last century, including significant loss of freshwater species. Artificial water bodies such as reservoirs, dams and rice paddies have been increasing in most regions, but current data-collection systems do not differentiate between natural and artificial water bodies. Reports suggest that the global data currently collected through the SDG process do not reflect the general state or trends known about freshwater ecosystems from other data sources. The global indicator is helpful but broad. Insufficient data are generated by countries to adequately measure progress. More detailed data will be essential for accurate understanding of water-related ecosystems and the benefits they provide. Earth observations can complement local ground data and support the national burden of data acquisition and reporting.

Member States will need to strengthen capacity, increase financial resources, and implement clear roles and responsibilities for data collection and processing. Monitoring at the ecosystem level and at the basin scale is important. Local level monitoring provides evidence for practical action, and larger basin level monitoring provides an overall perspective.

7. Target 6.a: Expand international cooperation and capacity building

Expanding international cooperation and support for capacity development is fundamental and contributes to achieving many goals including SDG 6. Over 80 per cent of participating countries in the 2016/2017 cycle of the UN-Water Global Analysis and Assessment of Sanitation and Drinking-Water (GLAAS) reported insufficient financing to meet national WASH targets. The need for increased financial resources to reach SDG targets 6.1–6.6 is clear.

Funding has increased across the water sector since 2005, as aid for agricultural water resources has nearly tripled. However, water sector official development assistance (ODA) has remained constant at around 5 per cent as a proportion of the total ODA disbursements. Total water sector ODA disbursements increased from US$7.2 billion in 2011 to US$8.8 billion in 2016.

Current data are not sufficient to assess the extent to which ODA is included in government-coordinated spending plans. It is expected that the monitoring framework for this target will develop over time. There is a need to better understand the extent and value of international cooperation, particularly support for capacity development, as this is currently not part of the indicator. Both the target and the indicator are strongly focused on external support and refer to the potential and need for stronger domestic engagement. Defining additional indicators or modifying indicators to take account of this should be considered.

8. Target 6.b: Support stakeholder participation

Effective and sustainable water management depends on the participation of a range of stakeholders, including local communities. Over 75 per cent of countries reported having clearly defined policies and procedures in place for service users and communities to participate in planning programmes for drinking water supply (urban: 79 per cent, rural: 85 per cent) and sanitation (urban: 79 per cent, rural: 81 per cent). For water resources planning and management, 83 per cent of 82 reporting countries had policies and procedures in place.

Monitoring participation was limited prior to approval of the SDGs and the monitoring framework for this target is still under development. The target needs to recognise that participation cannot be measured by quantity alone. A clearer set of indicators is needed that includes the quality of participation, such as its nature, effectiveness and value.

Progress monitoring is dominated by information from the WASH sector, because of the extensive availability of GLAAS data. However, data from other areas such as IWRM were included in the latest cycle of data collection (2016/2017), although trend data are still lacking. Refined monitoring is needed to give a voice to groups in other sectors, particularly in agriculture where there is a long tradition of farmer participation in water user associations.

D. Enabling and accelerating progress towards SDG 6

The main challenge across the water sector is to enable and accelerate progress towards achieving SDG 6, based on the findings from the assessment of progress on SDG 6 targets. The water sector is struggling to improve water resources management and to increase the coverage and quality of water and sanitation services. Some of the many challenges are practical actions that provide the “visible” side of water, such as installing taps and toilets, building reservoirs, drilling boreholes, and treating and reusing/recycling wastewater. However, some actions are much “less visible”. They are far more challenging and highly complex, and yet they underpin the visible side of water. They include the need for good water governance, which is crucial for implementing IWRM, resolving the challenges of sharing water and the benefits it provides across national boundaries, and tackling the thorny issue of inequality where the rich have better water services than the poor and wealthy land owners control water that reduce the productivity of smallholders.

TSDG 17 offers a framework for enabling and accelerating progress in all aspects of SDG 6, including the challenging issues of IWRM and eliminating inequalities, which will be essential for achieving SDG 6 and leaving no one behind. MoI for water and sanitation include governance, finance, capacity development and data acquisition and monitoring These are interlinked, and effective policies in each activity are mutually reinforcing. They are all essential elements in meeting the SDG 6 targets.

1. Governance

Good water governance is an essential pillar for implementing SDG 6. Yet governance structures tend to be weak and fragmented in many countries. Good water governance provides the political, institutional and administrative rules, practices and processes for taking decisions and implementing them.

Many governance functions fall on governments, such as formulating policy, developing legal frameworks, planning, coordination, funding and financing, capacity development, data acquisition and monitoring, and regulation. However, governance is increasingly going beyond government and takes account of cooperation with other stakeholders including the private sector. Good water governance comprises many elements, but principally it includes: effective, responsive and accountable state institutions that respond to change; openness and transparency providing stakeholders with information; and giving citizens and communities a say and role in decision-making.

Participation and multi-stakeholder engagement are important parts of policy processes, although measuring their effectiveness is still in its infancy. The importance of having a transparent, universal and neutral platform for government and citizen groups in place to mobilize available resources and seek alternative means of ensuring improved water services has proven to be essential and complementary to local government support. The importance of capacity becomes an important element in how policy is created and carried out in practice.

(a) IWRM

Good water governance is the key to implementing IWRM. As pressure on water resources has increased over the past 25 years, the demand for greater cooperation across the water sector has grown. The concept of IWRM has gradually been accepted and is embedded in the 2030 Agenda (target 6.5). IWRM defines the enabling environment for integration, the need for a strong institutional framework (including participation), the need for management instruments for effectively managing water resources (including those shared across national boundaries), and financing requirements for water resources development and management.

IWRM is a relatively simple concept but putting it into practice is complex. There is no 'one size fits all' solution, and each country must seek its own unique approach. Guidance can come from experiences in other countries pursuing integration. Progress is linked with the state of the national economy and the level of effective governance, though low HDI should not necessarily be a barrier.

Implementing IWRM at the transboundary level provides further justification for the critical need to strengthen cooperation over shared water resources and the benefits they provide. Countries need to cooperate to ensure that transboundary rivers, lakes and aquifers are managed in an equitable and sustainable manner.

(b) Eliminating inequalities

Good water governance underpins the elimination of inequalities. Equal access to sufficient safe and affordable water and adequate and equitable sanitation and hygiene can mean the difference between prosperity and poverty, well-being and ill-health, and even living and dying. Poverty has significantly decreased and access to WASH services has increased over the past 20 years. But inequalities have continued to increase; they are at an all-time high and affect almost every country. Rich people generally have better WASH access than poor people, and wealthy landowners often control water resources in ways that reduce the productivity of smallholder farmers. However, economic influence is only part of the picture. Inequalities in societies exist between urban and rural communities, within urban communities, and among different cultures and genders.

Only 62 per cent of people in LDCs have access to a basic drinking water service compared to 89 per cent of the global population. The disparity in basic sanitation services is even greater where coverage in LDCs (32 per cent) is less than half the global average (68 per cent). Only 27 per cent of the population in LDCs had a basic handwashing facility at home. There are marked differences between fragile and non-fragile states, and rural communities lag behind those in the urban sector. Urban populations are growing rapidly, and slums can proliferate when growth is not well managed. Ethnicity is important in determining access to water and sanitation. Indigenous and tribal people comprise more than 15 per cent of the world's poor, although they account for less than 5 per cent of the world's population. They care for an estimated 22 per cent of the Earth's surface and protect nearly 80 per cent of the remaining biodiversity on the planet. Many countries are failing to implement policies that sufficiently target the most vulnerable. Only 27 per cent of countries are consistently applying financial measures to target resources to poor populations for drinking water and 19 per cent of countries for sanitation services.[2]

2. Finance

Financial needs in the water sector remain high. More funding is required, ranging from more effective use of existing resources through to providing new financing paradigms to create greater opportunities for making rapid progress in future years. Current financial resources are inadequate to achieve SDG 6. The World Bank estimated the annual capital costs of meeting SDG targets 6.1 and 6.2 as US$114 billion per year. This does not include other SDG 6 targets. Nor does it include operation and maintenance, monitoring, institutional support, sector strengthening and human resources.

Investments in WASH bring social and environmental benefits, as do investments in other water and water-using sectors. Estimates of the annual costs of damage from flooding, inadequate WASH and water scarcity amount to US$500 billion. This figure would be much higher if environmental costs could be valued and considered. The benefits of investing in water security should reduce these costs and promote growth, which can then provide revenue supporting further investment, thus creating a virtuous circle.

Development partners in the WASH sector identified three financial challenges: (1) a lack of finance for strengthening the enabling environment and service delivery, (2) untapped use of repayable finance, including microfinance and blended finance, and (3) resources inadequately targeted towards the poor and vulnerable who are unable to access services.

Bridging the finance gap necessitates improving the efficiency of existing financial resources, while increasing innovative sources of financing, such as commercial and blended finance, including the private sector. An

[2] http://www.who.int/water_sanitation_health/publications/glaas-report-2017/en/.

enabling environment is therefore needed that considers the specialities of water investments (e.g. large upfront capital needs, long terms or associated risk management). ODA is crucial, but it needs targeting where it can be most effective and used to catalyse other funding sources.

The World Bank has stated that these actions are self-reinforcing in the WASH sector. Improving the use of existing resources, when coupled with reforms, should lead to increased efficiencies, improved services and increased creditworthiness. This can lead to increased access to repayable and commercial financing, which can then be invested in further service improvements, thus continuing the cycle.

3. Capacity development

Strong formal and informal institutions and human resources underpin good water governance. However, an acute lack of capacity is constraining water resources development and management in all its facets, across most developing countries, particularly in Sub-Saharan Africa and South and South-eastern Asia. Human resource shortages are reported in all key areas, including: agriculture and irrigated farming; water-related risks management; water and sanitation services; wastewater treatment, recycling and reuse technologies; and desalination. This is not a new phenomenon and has been a leading concern and constraint on water-related development for many decades. Too little capacity has been developed.

Several countries are now producing national capacity development strategies for the water sector. However, the big challenge is implementation. There are means of rapidly increasing vocational skills to meet specific shortages using short-term programmes of two to four years. But it takes many years to strengthen institutional capacity with a cadre of experienced and effective professionals and technicians that can plan and enable progress towards SDG 6. The answer lies in long-term commitment and support for knowledge and capacity development.

4. Data acquisition and monitoring

Data underpin the governance elements of accountability, transparency and participation. They enable progress to be monitored and service providers, governments and development partners to be held accountable. Many countries lack the financial, institutional and human resources to acquire and analyse data to support governance. Less than half of Member States have comparable data available on progress towards meeting each of the global SDG 6 targets.

Stakeholders have no basis for challenging factually incorrect or biased positions without available data. Reliable, consistent and, whenever possible, disaggregated data are essential to stimulate political commitment, inform policy-making and decision-making, and trigger well-placed investments towards health, environment and economic gains. Data acquisition and monitoring requires political commitment to transparency that includes efforts related to accessibility and sharing of data. Increased utilization of the latest Earth observations, citizen science and private sector data should be incorporated into data monitoring systems at all levels to complement existing data-collection efforts.

E. Beyond SDG 6: Connections across the 2030 Agenda

The integrated approach to the 2030 Agenda recognizes that most aspects of society, development, sustainable growth and the environment are symbiotic. Accepting this can make development more cost-effective, help to maximize synergies and reduce the risks that actions taken to meet one goal will undermine other goals. It will also ensure appropriate timing and sequencing of policy and institutional reforms and related investments so that limited resources are used efficiently and sustainably. An integrated approach has important implications. It means that progress towards SDG 6 can enable and drive progress in most other SDGs; equally, the success of SDG 6 will also depend on most other SDGs meeting their targets.

1. Water and society

The transformative vision and ambition of Member States to end poverty and hunger everywhere, to combat inequalities within and among countries, to build peaceful, just and inclusive societies, and to protect human rights everywhere is at the heart of the 2030 Agenda. Water is central to achieving this vision and ambition. It is essential for society's health and well-being, ending hunger, achieving food security and improving nutrition.

Safe drinking water, and adequate sanitation and hygiene are fundamental to protecting health, and directly contribute to achieving good health and well-being. Water-related diseases are closely linked to poverty and disproportionately affect vulnerable communities that do not have access even to basic water, sanitation and hygiene services. Universal access to WASH is essential for ending preventable deaths from diarrhoea and other water-related diseases, and for improving nutrition, health service delivery, social well-being and economic productivity. Estimates suggest that every US$1 invested in WASH yields a US$5 return, considering all social and economic benefits. Inequalities must be eliminated and rates of progress increased for those furthest behind, if WASH targets are to be met by 2030. This includes people in rural areas, and communities where neglected tropical diseases are endemic and hotspots where outbreak of diseases such as cholera recur.

Schools have an important role to play. Improving access to WASH in schools can improve pupil and teacher health, school attendance and welfare, which benefits educational outcomes for all. This is particularly beneficial for girls and young women with regard to menstrual hygiene management. Primary and secondary pupils are well placed to learn about safe water and sanitation, both in practice and in the classroom, so that they and their families can understand the links among water, health and nutrition.

Access to WASH, together with food security, can reduce infections that exacerbate undernutrition. Poor WASH contributes to undernutrition, which is both a rural and an urban health issue but is worse in rural communities. It is endemic among the poor in sub-Saharan Africa and Asia, where many people live in insanitary conditions and do not get enough calories, protein and micronutrients in their diet. Almost 25 per cent of children under the age of five was stunted and 10 per cent was wasted in 2016.

Women are predominantly caretakers of domestic water, collecting it for household use and irrigating crops. Many women in poor households bear the burden of retrieving water from distant sources and often have little option but to use polluted wastewater for domestic purposes. Their role in societies and within their families means that they are often critically exposed to unsafe water and are most affected by the lack of adequate sanitation facilities and/or sufficient wastewater management.

Women need much greater engagement in decision-making about WASH infrastructure and services, they need to be asked about location, design and management of water points and toilet facilities. Women and men need to be equally represented on WASH committees, service providers and water user associations, and a concerted effort is required to promote more women in leadership positions. National and local governments therefore need to integrate gender issues into their policymaking and decision-making and enable women to have an effective "voice" and engage in meaningful participation.

Water is an essential ingredient in agriculture and food production, and is intrinsic to ending hunger, achieving food security, improving nutrition and promoting sustainable agriculture. Most water withdrawals are in the agriculture sector. Therefore, water shortages and scarcity can seriously affect agriculture and food production, particularly in vulnerable developing countries, where the demand for food is increasing and undernutrition is endemic. World hunger is rising again now, following a prolonged period of decline, as more people suffer food insecurity. This is especially noticeable in sub-Saharan Africa, which experiences the highest level of food insecurity, affecting almost 30 per cent of the population. Conflict and fragility have also worsened food security and are often compounded by floods and droughts, both of which can devastate crops and harvests.

2. Water and the environment

Ecosystems and their inhabitants, including humans, are water users. Water-related ecosystems include wetlands, rivers, aquifers and lakes, and sustain a high level of biodiversity and life. They are vital for providing benefits and services such as drinking water, water for food and energy, humidity, habitats for aquatic life, and natural solutions for water purification and climate resilience. They contribute to addressing competing demands, mitigating risks and promoting stability and trust-building measures, if they are managed well. They are therefore essential for sustainable development, peace, security and human well-being.

Water-related ecosystems are increasingly under threat, as the demand grows for fresh water for agriculture, energy and human settlements. They endure effects from pollution, infrastructure development and resource extraction. Degrading ecosystems can also lead to conflict, displacement and migration.

Water quality is diminishing as pollution from pathogens, organic matter, nutrients and salinity increase due to lack of properly managed sanitation, and industrial and agricultural runoff. Land and freshwater ecosystems are totally interdependent. Land-based ecosystems depend on freshwater resources in sufficient quantity and quality; in turn, activities on land, including land use, influence water availability and quality for people, industry and ecosystems. Poor water quality degrades freshwater habitats and coastal areas, and affects fishers, influencing both biodiversity and food security.

Nature-based, rather than engineered, solutions are on the rise. They use or mimic natural processes to increase water availability (e.g. soil moisture retention and groundwater recharge), improve water quality (e.g. natural and constructed wetlands and riparian buffer strips), and reduce water-related risks by restoring flood plains and constructing decentralized water retention such as green roofs.

Agriculture is both a leading cause and a victim of water pollution. Agricultural water withdrawals are consumed by crops, but some water is returned to water bodies, resulting in pollution. The lack of water treatment from domestic and industrial sources also makes agriculture a victim, as polluted water contaminates crops and transmits disease to consumers and the people involved in food production and processing.

Much of the pollution affecting oceans and coastal zones comes from human activities and poorly managed land-use practices. This also applies to solid waste dumped at or near coastal areas, which eventually ends up in the sea. Reducing pollution and minimizing dumping of hazardous materials into upstream ecosystems will benefit marine environments and reduce the impact on coastal ecosystems.

Climate change has a significant impact on freshwater systems and their management. Indeed, most effects due to climate change will be experienced through changes in the hydrological cycle, such as overall water availability, water quality and frequency of extreme weather events (e.g. floods and droughts). Floods are immediate and visible and receive much attention. In contrast, droughts are a creeping phenomenon, like climate change. They contribute to overall water scarcity, stress water supplies, and affect agriculture and aquatic ecosystems. Proactive drought policies and drought risk management can build greater societal resilience to the effects of drought and reduce the need for an emergency response. But this requires a fundamental shift in the way droughts are perceived and managed.

Water stress (scarcity) is linked to hunger and food insecurity. Countries need to improve water productivity and water-use efficiency to overcome water shortage and scarcity, especially those facing high water stress. An important option for water savings is to reduce high levels of food loss and waste, which could save the resources used to produce them for other productive purposes.

Cities and towns present a special and major water challenge, as they are expected to be home for some 66 per cent of the world's population by 2050. Increasing urbanization and deteriorating infrastructure inhibit progress, as does the growth in peri-urban slum populations where there is only limited access to safe water and sanitation and which are linked to poverty, gender equality, and health and nutrition problems. Cities also do not function in isolation, they exist within river basins and as such what happens in cities affects others downstream and vice versa.

Migration (often partly caused by environmental degradation and water insecurity) adds to water pressure. Unemployment across many Arab States has worsened in recent years as rural incomes have fallen due to drought, land degradation and groundwater depletion, resulting in low agricultural productivity. This has fuelled rural to urban migration, expanded informal settlements and increased social unrest. The loss of agricultural jobs jeopardizes agricultural livelihoods and economic opportunities, which particularly affect younger generations and vulnerable members of society. Migrants can place great burdens in countries where existing resources are often limited, poorly managed and overexploited.

3. Water and the economy

Economic growth is still the priority for most countries. SDGs cannot be met without growth, which tends to overshadow other issues. But unsustainable use of water and land resources will not help to meet these targets. Climate change is focusing minds on sustainability and the fact that the natural resources of future generations are being consumed to satisfy the economic demands of today.

Water is accepted as being important to economic growth. But recent studies have helped to quantify and confirm this relationship. However, determining how water-related investments affect growth is fraught with difficulties because of the many pathways that lead to growth and the pervasive way in which water is an input into so many economic activities. The findings confirm that water insecurity acts as a major constraint to global economic growth.

About 1.4 billion livelihoods globally are directly dependent on water, including jobs in the food and beverage industry, the energy industry and the water industry. Millions of smallholder farmers in LDCs rely on water for irrigation and livestock farming for their livelihoods.

Agriculture is a major industry, employing about 30 per cent of the global workforce. Agriculture is treated like any other industrial business in developed countries. Only 1.5 per cent of the nation's workforce is employed in agriculture in the UK. But the wider agrifood industry, which relies on agriculture for its raw materials, employs 14 per cent of the nation's workforce and is worth US$145 billion to the national economy. However, uncertainty over future water supplies for agriculture is leading to greater uncertainty among agrifood businesses and may act as a disincentive to future growth and investment. These issues are reflected across many similar industrialized countries.

Agriculture is the mainstay of economic growth in most LDCs and is the main consumer of water. Millions of smallholder producer farmers, more than 60 per cent of the workforce in sub-Saharan Africa, are involved in agriculture-related activities. Agricultural production and the economy in sub-Saharan Africa largely depend on the vagaries of sparse and unreliable seasonal rainfall. Most countries face a combination of high hydrological variability, a lack of investment in water infrastructure and weak water governance. Irrigated agriculture is an option for only some.

Water quality is of equal concern as water quantity for the manufacturing industry. Most industrial processes degrade water quality. Industries in modern economies have statutory duties to clean up their effluents to national and international standards before discharging into receiving water bodies such as lakes, rivers or the sea. Most industries in developing countries still discharge untreated or partially treated effluent, which raises concerns about pollution from toxic metals and organic compounds. Those pollutants that are harmful to people and the environment in places where regulatory systems are ill-equipped to deal with them are of concern.

Industrial water demand in Europe is decreasing; it has levelled in North America, although demand is much higher than in other regions. Demand continues to rise in Australia and Oceania, Asia, South America and Africa. The challenge is for developed nations to lower industrial water use and for developing countries to industrialize without substantially increasing water demand and water pollution.

Water and energy go hand-in-hand. WASH services, agriculture and industry all need energy for pumping water, treating wastewater, irrigating crops and desalination. The energy sector also needs water to cool thermal power plants, provide hydropower and grow biofuels. A 48 per cent increase in global energy consumption is expected by 2040 (above 2012 levels), mostly in China, India, South-east Asia, parts of Africa, Latin America and the Middle East. Energy demands in the water sector are increasing as more farmers exploit groundwater for irrigation, and substantial increases in water treatment are expected in order to meet SDG 6 targets. Most wastewater in developing countries is untreated. If this is to be halved by 2030 to meet SDG 6 targets, substantial amounts of additional energy will be needed if traditional methods of treatment are applied. A potential bonus is that the energy contained in wastewater is about 5–10 times greater than the energy needed to treat it. Innovative methods are needed to extract and use it.

F. Key messages

1. Integrating SDG 6 in the 2030 Agenda

- **Achieving SDG 6 is essential for progress on all other SDGs and vice versa.** Sustainable management of water and sanitation underpins wider efforts to end poverty and advance sustainable development.
- **The time to act on SDG 6 is now.** The world is not on track to achieve the global SDG 6 targets by 2030 at the current rate of progress.
- **Global SDG 6 targets must be localized and adapted to the country context.** National governments must decide how to incorporate SDG 6 targets into national planning processes, policies and strategies, and set their own targets, taking into account local circumstances.
- **Effective water resources management needs more and better data.** Data underpin good water governance. Less than half of Member States have comparable data available on progress towards SDG 6 targets.

2. Understanding the baseline status and trends of the global indicators of SDG 6

- **Extending access to safe drinking water presents a huge challenge.** Achieving universal access to safe and affordable drinking water means providing basic water services to 844 million people and improving service quality to 2.1 billion people who lack safely managed drinking water services.

- **Billions of people still need access to basic toilet and handwashing facilities.** Over 2.3 billion people lack basic sanitation services, 892 million still practice open defecation and 4.5 billion people lack safely managed sanitation services. These will not be eradicated by 2030 with current trends. Only 27 per cent of the population in LDCs has access to soap and water for handwashing on premises.
- **Improving water quality can increase water availability.** Worsening water pollution must be tackled at source and treated to protect public health and the environment and increase water availability.
- **Agriculture offers opportunities for significant water savings.** The agricultural sector accounts for nearly 70 per cent of global freshwater withdrawals. Saving just a fraction of this would significantly alleviate water stress in other sectors.
- **Implementing IWRM is the most comprehensive step towards achieving SDG 6.** Integration across the water and water-using sectors is essential for ensuring that limited water resources are shared effectively among many competing demands.
- **Sustaining water-related ecosystems is crucial to societies and economies.** The world has lost 70 per cent of its natural wetlands over the last century. Sustaining and recovering water-related ecosystems are vital for societal well-being and economic growth.
- **Improved international cooperation and more and better use of funding is needed.** Over 80 per cent of countries report insufficient financing to meet national WASH targets. ODA funding is important, but so too is stronger domestic financial engagement, including the private sector, and better use of existing resources.
- **Public participation is critical to water management.** Community participation in decision-making can yield many benefits, but better means of measuring quality and effectiveness of such participation are needed rather than just relying on quantity of engagement.

3. Enabling and accelerating progress towards SDG 6

- **Good water governance is essential.** Good water governance provides the political, institutional and administrative rules, practices and processes for taking decisions and implementing them. It is key to implementing IWRM.
- **Inequalities must be eliminated.** Effective policies, strategies and subsidies must be developed to ensure that no one is left behind. The 2030 Agenda will not succeed if governments fail to support the most vulnerable people.
- **Water and sanitation require a new financing paradigm.** This means increasing the efficiency of existing financial resources and mobilizing additional and innovative forms of domestic and international finance.
- **Capacity must be developed.** A serious lack of institutional and human capacity across the water sector is constraining progress, particularly in LDCs. Investing in capacity development requires a long-term view as well as quick fixes.
- **Smart technologies can improve management and service delivery.** Smart technologies supported by information technology can effectively improve all aspects of water resources and WASH management.
- **Multi-stakeholder partnerships can unlock potential.** Sharing, accessing and adapting new solutions needs cooperation. SDG 6 provides the ideal platform for multi-stakeholder partnerships to ensure more effective and efficient progress on poverty reduction and sustainable development.

I. Introduction

All 193 Member States of the United Nations General Assembly (UNGA) unanimously agreed to *Transforming our world: the 2030 Agenda for Sustainable Development* (the 2030 Agenda) in September 2015. The 2030 Agenda is a plan of action for people, the planet and prosperity. Member States of the UNGA resolved to "end poverty in all its forms", to take bold and transformative steps to "shift the world onto a sustainable and resilient path" and to ensure that "no one will be left behind". The 2030 Agenda established 17 Sustainable Development Goals (SDGs) and 169 global targets, relating to development outcomes and means of implementation (MoI), for the period 2015–2030. These were designed to be integrated and indivisible and to balance the social, economic and environmental dimensions of sustainable development. The 2030 Agenda further seeks to realize the human rights of all, and to achieve gender equality and empowerment of all women and girls. This ambitious universal agenda is intended to be implemented by all countries and all stakeholders, acting in collaborative partnership (United Nations, General Assembly, 2015a).

The 2030 Agenda emphasizes that governments have primary responsibility for "follow up and review" of progress towards SDGs and their targets at national, regional and global levels. It encourages Member States to establish regular and inclusive review processes and highlights the need for "high quality, accessible, timely and reliable disaggregated data" to measure progress. The High-level Political Forum on Sustainable Development (HLPF) is the main global platform on sustainable development and has a central role in follow-up and review of the 2030 Agenda. The HLPF meets annually under the auspices of the United Nations Economic and Social Council and every four years under the auspices of the United Nations General Assembly. The theme of each HLPF, and a subset of goals to be reviewed, is agreed in advance. Member States present national reports, which are reviewed together with reports and contributions from other major stakeholders (United Nations, United Nations, Department of Economic and Social Affairs, n.d.).

The purpose of this report is to synthesize the latest available data and evidence on the global status of efforts to achieve the dedicated SDG on water and sanitation (SDG 6). It presents the global baseline status of SDG 6 and what more needs to be done to achieve the goal by 2030. The information presented will be used to inform decision-making at the 2018 HLPF.

A. Sustainable Development Goal 6 in the 2030 Agenda

The establishment of SDG 6, *Ensure availability and sustainable management of water and sanitation for all*, reflects the increased attention on water and sanitation issues in the global political agenda. The 2030 Agenda lists rising inequalities, natural resource depletion, environmental degradation and climate change among the greatest challenges of our time. It recognizes that social development and economic prosperity depends on the sustainable management of freshwater resources and ecosystems and highlights the integrated nature of SDGs.

SDG 6 will be reviewed for the first time in July 2018, under the theme *Transformation towards sustainable and resilient societies*, along with a pre-selected set of SDGs comprising those on affordable and clean energy (SDG 7), sustainable cities and communities (SDG 11), responsible consumption and production (SDG 12) and life on land (SDG 15). The goal on Partnerships for the Goals (SDG 17) is reviewed annually at each HLPF. Linkages among SDG 6 and this set of goals will be examined in this report, as well as the linkages with other SDGs.

This first synthesis report of SDG 6 seeks to inform discussions among Member States during the HLPF and the in-depth review of SDG 6. It provides an overview of the current situation and trends at global and regional levels. It also brings together the latest data available for the 11 SDG 6 global indicators selected by Member States to track progress towards the eight global targets, plus complementary data and evidence from a wide range of different sources. The report presents data on the global baseline status of SDG 6 and, importantly, what more needs to be done to achieve the goal by 2030 (Box 1).

Box 1 What does this synthesis report offer to policymakers?

This report presents data collected through the Integrated Monitoring Initiative for SDG 6 coordinated by UN-Water and uses complementary sources of data and information to analyse policy linkages among different SDG targets and indicators in an integrated fashion. By assessing the global baseline status of SDG 6, it provides Member States with an overview of water and sanitation issues in the context of the wider 2030 Agenda, and outlines what needs to be done to accelerate progress towards this goal. It provides the basis upon which a road map towards more sustainable development can be established.

B. Sustainable water and sanitation for all

Fresh water, in sufficient quantity and quality, is essential for all aspects of life and sustainable development. The human rights to water and sanitation is widely recognized by Member States (Box 2). Water resources are embedded in all forms of development (food security, health and poverty reduction), in sustaining economic growth in agriculture, industry and energy generation, and in maintaining healthy ecosystems. It is no coincidence that the World Economic Forum has consistently ranked the water crisis as a top global risk since 2012 (WEF, 2018).

Box 2 Human rights to water and sanitation

Access to water and sanitation is required for the realization of other human rights, including the right to adequate housing, the right to the highest attainable standard of health and the right to life (United Nations, Office of the High Commissioner for Human Rights, 2003; United Nations, Economic and Social Council, 2010). The United Nations General Assembly and the Human Rights Council reaffirmed the human rights to safe drinking water and sanitation in 2015 (United Nations, General Assembly, 2015b; United Nations, Human Rights Council, 2016). All States have an obligation to move as quickly as possible towards full realization, using the maximum available resources, and to take active measures to reduce and eliminate existing inequalities, without discrimination. The criteria of accessibility, availability, quality, acceptability and affordability are increasingly reflected in the frameworks used for monitoring water and sanitation at national and global levels. A human rights approach requires that individuals have a right to adequate water and sanitation services. It also requires services to be provided in a way that respects the environment and does not negatively affect downstream communities or future generations (de Albuquerque, 2014).

Water-related ecosystems and the environment have always provided natural sites for human settlements and civilizations, bringing benefits such as transportation, natural purification, irrigation, flood protection and habitats for biodiversity. Major global trends (such as population growth, agricultural intensification, urbanization, industrial production and pollution, and climate change) are beginning to overwhelm and undermine nature's ability to provide key functions and services (WWAP, 2009; WWAP and UN-Water, 2018). Estimates suggest that if the natural environment continues to be degraded and unsustainable pressures put on global water resources, by 2050 this will put at risk 45 per cent of the global gross domestic product (GDP), 52 per cent of the world's population and 40 per cent of global grain production (IFPRI, n.d.). Poor and marginalized populations will be disproportionately affected, further exacerbating rising inequalities.

Agriculture (including irrigation, livestock and aquaculture) is by far the largest water consumer globally, accounting for 69 per cent of annual water withdrawals. Industry (including power generation) accounts for 19 per cent and households for 12 per cent (FAO, 2016). All these water uses can pollute freshwater resources.

Most of all wastewater from domestic, industrial and agricultural sources is discharged back into water bodies without treatment. If not treated, this pollution further reduces the availability of fresh water for drinking and other uses and degrades ecosystems.

The challenge of meeting future demands and achieving sustainable water and sanitation for all is significant. Strong political will and commitment are required. However, there is no standard approach for sequencing the policies and institutional developments and investments required for effective management of water resources and provision of services that will be valid for all countries and under all circumstances. Finding sustainable development pathways will be challenging for water-insecure countries, 90 per cent of which are least developed countries (LDCs). This is because many of the countries have limited water available per capita, inadequate professional and institutional capacity, and experience extremes of droughts and floods that require costly water infrastructure (Ait-Kadi, 2016).

However, there is a growing consensus that these challenges can be met by adopting a more integrated approach to the management and allocation of water resources for different purposes, including the protection of ecosystems upon which societies and economies depend. The concept of integrated water resources management (IWRM) is now reflected in the 2030 Agenda and requires governments to consider how water resources link different parts of society and how decisions in one sector may affect water users in other sectors. It is an approach that must involve all actors and stakeholders, from all levels, who use and potentially pollute water so that water is managed in an equitable and sustainable manner (Box 3).

Box 3 IWRM

"IWRM is a process which promotes the co-ordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems." (GWP, 2000)

IWRM is a process; therefore, it does not offer a universal approach to water management. Water resources, development priorities, and social and economic issues are all location- and context-specific. Country or water basin planning may differ, but IWRM provides a common approach, and experience shows that there are common features to all. These include: a strong enabling environment; sound investments in infrastructure; clear, robust and comprehensive institutional roles and responsibilities; and effective use of available management and technical instruments. These are the practical elements of implementing IWRM (Lenton and Muller, 2009).

C. Monitoring SDG 6

SDG 6 includes eight separate targets that aim to address the entire water cycle including: provision of drinking water (6.1) and sanitation and hygiene services (6.2), treatment and reuse of wastewater and ambient water quality (6.3), water-use efficiency (6.4), IWRM including through transboundary cooperation (6.5), protecting and restoring water-related ecosystems (6.6), international cooperation and capacity-building (6.a) and local participation in water and sanitation management (6.b) (Table 1).

The 2030 Agenda states that the SDG targets are "global in nature and universally applicable, taking into account different national realities, capacities and levels of development and respecting national policies and priorities" (United Nations, General Assembly, 2015, para. 55). Global targets are therefore considered aspirational, and each government must decide how to incorporate SDG 6 targets into national planning processes, policies and strategies. Governments are expected to set their own targets guided by the global level of ambition but taking into account national circumstances. National targets should also build on existing international agreements related to water and sanitation, including the human right to water and sanitation.

The United Nations Statistical Commission has established an Inter-agency and Expert Group on SDG Indicators (IAEG-SDGs) to develop and implement a global indicator framework for the goals and targets of the 2030 Agenda. This group selected one or two indicators for each of the 169 global SDG targets, recognizing that these may not fully reflect all aspects of the targets, for the purpose of global monitoring.

The Statistical Commission approved the official list of global SDG indicators[3] in March 2017. The General Assembly subsequently adopted this list in July 2017. The resolution adopted states that the indicator framework will be refined annually and reviewed comprehensively by the Statistical Commission in 2020 and 2025.[4] It also notes that the global indicators may be complemented by additional national, regional and thematic indicators, which can be further developed by Member States (United Nations, General Assembly, 2017).

[3] https://unstats.un.org/sdgs/indicators/indicators-list/.

[4] The 2030 Agenda recognizes that data for several of the global targets remain unavailable. It calls for increased support for data collection and capacity-building in Member States to establish national and global baselines. IAEG-SDGs has classified the 232 global indicators based on methodological development and data availability. Tier I indicators have established methods, standards and data available for at least 50 per cent of the global population and 50 per cent of countries. Tier II indicators have established methods and standards, but data are not regularly produced by countries. Tier III indicators are those for which methods and standards are still being developed.

Table 1 Targets and indicators of SDG 6

Target	Indicator (custodian agencies)
6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all	6.1.1 Proportion of population using safely managed drinking water services (World Health Organization (WHO)/United Nations Children's Fund (UNICEF))
6.2 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	6.2.1 a Proportion of population using safely managed sanitation services (WHO/UNICEF) 6.2.1 b Proportion of population using a handwashing facility with soap and water available (WHO/UNICEF)
6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally	6.3.1 Proportion of wastewater safely treated (WHO/United Nations Human Settlement Programme (UN-Habitat)/United Nations Statistics Division (UNSD)) 6.3.2 Proportion of bodies of water with good ambient water quality (UN Environment (UNSD))
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	6.4.1 Change in water-use efficiency over time (Food and Agriculture Organization of the United Nations (FAO)) 6.4.2 Level of water stress: freshwater withdrawal as a proportion of available freshwater resources (FAO)
6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate	6.5.1 Degree of integrated water resources management implementation (0–100) (UN Environment) 6.5.2 Proportion of transboundary basin area with an operational arrangement for water cooperation (United Nations Educational, Scientific and Cultural Organization (UNESCO)/United Nations Economic Commission for Europe (UNECE))
6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes	6.6.1 Change in the extent of water-related ecosystems over time (UN Environment/Ramsar Convention)
6.a By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies	6.a.1 Amount of water- and sanitation-related official development assistance that is part of a government-coordinated spending plan (WHO/UN Environment/Organisation for Economic Co-operation and Development (OECD))
6.b Support and strengthen the participation of local communities in improving water and sanitation management	6.b.1 Proportion of local administrative units with established and operational policies and procedures for participation of local communities in water and sanitation management (WHO/UN Environment/OECD)

Source: United Nations, Department of Economic and Social Affairs (2017).

IAEG-SDGs has identified "custodian agencies" for each of the 232 global SDG indicators. These agencies are expected to lead the development of methods and standards for data collection, contribute to statistical capacity-building and data collection, establish mechanisms for compilation and verification of national data, maintain global databases and provide internationally comparable estimates for the purposes of global monitoring and reporting.

Reflecting the integrated nature of water, SDG 6 is matched by a coordinated response from the United Nations system, including the United Nations agencies that deal with water, health, food, development, vulnerable people, the environment, disasters, and human peace and security. The UN-Water Integrated Monitoring Initiative for SDG 6 brings together eight United Nations agencies. These are custodians of the 11 SDG 6 global indicators and comprise the following monitoring programmes:

- The WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (JMP) tracks progress on drinking water, sanitation and hygiene (SDG targets 6.1 and 6.2) and was established in 1990.
- Integrated Monitoring of Water and Sanitation Related SDG Targets (Global Environmental Management Initiative (GEMI))[5] tracks progress on wastewater, water quality, water resources management and water-related ecosystems (SDG targets 6.3–6.6) and was established in 2014.
- UN-Water Global Analysis and Assessment of Sanitation and Drinking-Water (GLAAS) tracks finance, capacity and the enabling environment (SDG targets 6.a and 6.b) and was established in 2008.

This report provides an overview of data collected under the UN-Water Integrated Monitoring Initiative for SDG 6.[6] The custodian agencies will also produce reports with more detailed analysis and disaggregation of SDG 6 global indicators and other indicators relevant for national and global monitoring.

D. Structure of this report

Chapter I provides an overview of SDG 6 in the context of the 2030 Agenda and the emerging framework for national and global monitoring under the UN-Water Integrated Monitoring Initiative for SDG 6.

Chapter II reviews current SDG 6 data resulting from the most-recent data drive at the indicator level. It includes baseline data on the indicators and identifies gaps in knowledge, capacity and resource availability. Information comes from the Integrated Monitoring Initiative, complemented by data from other sources.

Chapter III is based on the findings from chapter II and examines the enablers for progress, challenges and obstacles facing the sector. It targets water management and sanitation priorities that can accelerate progress towards achieving SDG 6 by 2030.

Chapter IV looks beyond SDG 6, explores how it connects with other SDGs and reviews the evidence available to establish those key connections. The interconnected nature of all 17 SDGs and their 169 targets suggests a mutual interdependence and that other SDGs will only be achieved if SDG 6 is realized. Likewise, SDG 6 will only be achieved if the other SDGs are accomplished.

Chapter V provides key messages on how more coherent policies and strategies for the integrated and successful implementation of SDG 6 might be achieved.

This report includes all SDG 6 indicators agreed upon by IAEG-SDGs in 2017, which comprised Member States, and regional and international organizations as observers. Data collection and monitoring progress towards the achievement of SDG 6 are part of a learning process of review and improvement by the United Nations Statistical Commission, Member States, United Nations agencies and other stakeholders. The report recognizes that the selection of indicators, data collection and methodologies represent work in progress, and countries are at different stages in developing their monitoring and reporting mechanisms.

[5] GEMI was established as an inter-agency initiative comprising: FAO, UNECE, UN Environment, UNESCO, UN-Habitat, UNICEF, WHO and the World Meteorological Organization. The first phase of GEMI implementation (2015–2018) focused on developing and testing monitoring methodologies and other support tools for countries, global implementation of SDG 6 monitoring and the start of a long-term process to build monitoring capacity in countries, as well as establishing a global baseline for SDG targets.

[6] For further details, see www.sdg6monitoring.org.

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Abbreviations and acronyms used in chapter I

FAO	Food and Agriculture Organization of the United Nations
GDP	gross domestic product
GEMI	Global Environmental Management Initiative
GLAAS	Global Analysis and Assessment of Sanitation and Drinking-Water
HLPF	High-level Political Forum on Sustainable Development
IAEG-SDGs	Inter-agency and Expert Group on SDG Indicators
IWRM	integrated water resources management
JMP	Joint Monitoring Programme for Water Supply, Sanitation and Hygiene
LDC	least developed country
MoI	means of implementation
OECD	Organisation for Economic Co-operation and Development
SDG	Sustainable Development Goal
UNECE	United Nations Economic Commission for Europe
UNESCO	United Nations Educational, Scientific and Cultural Organization
UN-Habitat	United Nations Human Settlement Programme
UNICEF	United Nations Children’s Fund
UNSD	United Nations Statistics Division
WHO	World Health Organization

II. Global baseline status of targets and indicators of SDG 6

A. Introduction

This chapter provides a global baseline status for SDG 6 targets and indicators. It compiles data from the United Nations agencies contributing to the UN-Water Integrated Monitoring Initiative for SDG 6 and provides Member States with key information and an overview of the current state of water management and sanitation within SDG 6. Current rates of change and trajectories towards 2030 targets are established where sufficient data (such as those from previous monitoring during the Millennium Development Goal (MDG) period 2000–2015) are available. The chapter also highlights specific challenges associated with measuring and monitoring progress and identifies opportunities for improvement.

IAEG-SDGs developed an indicator framework for tracking progress towards the global targets set by the 2030 Agenda.[7] This framework comprises 232 SDG global indicators, which focus on specific measurable issues and aim to reflect the spirit and ambition of the targets (United Nations, General Assembly, 2017). However, the official list of indicators does not fully reflect all aspects and ambitions of the SDG targets. Additional complementary information sources are therefore used in this report where needed. Further indicators may be added in the future to meet specific national and regional monitoring purposes and for in-depth reporting, particularly on cross-cutting themes.

The 2030 Agenda states that SDG indicators should be disaggregated, where relevant, by income, sex, age, race, ethnicity, migratory status, disability, geographic location or other characteristics in accordance with the Fundamental Principles of Official Statistics (United Nations, General Assembly, 2014). Disaggregating data is challenging in many parts of the world. While almost all countries can disaggregate estimates of basic drinking water, sanitation and hygiene for urban and rural populations, doing the same for environmental indicators is particularly challenging given the lack of commonly agreed methods and standards for stratification. IAEG-SDGs has established a working group to develop further guidance on disaggregation of global SDG indicators.

All SDG 6 indicators are new since the MDG period. They incorporate many new elements that reflect the increased ambition of the 2030 Agenda, although some are based on information collected by national governments during the MDG period. For example, indicators used for monitoring targets 6.1 and 6.2 on drinking water, sanitation and hygiene go beyond simply measuring access to infrastructure and also take into account the quality of services provided. Several significant data gaps were identified in some countries, mainly because of introducing these new elements.

Table 2 summarizes the status of indicators for SDG 6 targets and highlights common challenges to and opportunities for enhancing monitoring during the SDG period.

[7] Official metadata summaries for global indicators are available from https://unstats.un.org/sdgs/metadata/.

Table 2 Current status of indicators for global targets under SDG6

Indicators	Current status	Progress	Challenges of tracking progress	Opportunities for improving monitoring and tracking progress	Disaggregation (relevance)	Global database/data source
All SDG 6 global indicators	Less than 50 per cent of countries have comparable baseline estimates for the majority of SDG 6 global indicators	Many SDG 6 global indicators are new, and most have only limited time series, making it difficult to determine rates of progress	Data quality and reliability vary across countries and data sources Data availability, frequency and coverage vary widely; Disaggregation is a challenge for all indicators	Further standardization and harmonization of all indicators and monitoring to improve comparability of data across countries Establish common understanding of how to assess MoI across SDG 6; build capacity throughout	High relevance for all indicators (though in different dimensions), but some lack commonly agreed stratifiers and few are routinely produced by national data providers	Variable for each indicator
6.1.1 Proportion of population using safely managed drinking water services	Estimates available for 96 countries and four out of eight SDG regions[a]	Limited availability of time series makes it difficult to determine rates of progress	Good data on accessibility but limited data on availability and quality, especially in rural areas; no commonly agreed approach to monitor affordability	Strengthen regulatory data and expand coverage of regulatory data, i.e. expand beyond urban areas to rural areas; integrate new questions on availability and quality into household surveys	Urban/rural, subnational region, wealth quintile, specific geographic areas (slums) and other locally disadvantaged groups	WHO/UNICEF Joint Monitoring Programme (JMP) global database
6.2.1a Proportion of population using safely managed sanitation services	Estimates available for 84 countries and five SDG regions	Limited availability of time series makes it difficult to determine rates of progress	Good data on access and treatment of wastewater from sewers but relatively little data on treatment and disposal of excreta from on-site sanitation facilities such as septic tanks and latrines	Strengthen regulatory data and expand coverage of regulatory data, i.e. expand beyond urban areas; integrate new questions on management of on-site sanitation in household surveys	Estimates for basic services can be disaggregated by rural/urban, by wealth and by subnational region, but few countries have disaggregated data for safely managed services	WHO/UNICEF Joint Monitoring Programme (JMP) global database
6.2.1b Proportion of population using a handwashing facility with soap and	Comparable data available for 70 countries and two SDG regions, but these are insufficient to generate a global estimate; few high-income countries	Limited availability of time series makes it difficult to determine	Observations of handwashing facilities and soap and water during household surveys are more reliable than asking households whether they wash hands; direct	Increase the number of national household surveys that include observation of handwashing facilities and track changes over time; develop	Estimates for basic services can be disaggregated by rural/urban, by wealth and by subnational region, but few countries have disaggregated data for safely managed services	WHO/UNICEF Joint Monitoring Programme (JMP) global database

water available	collect information on handwashing	rates of progress	observation of handwashing behaviour is only feasible in small studies	alternative proxies for high-income countries such as availability of piped water supplies, hot water, showers or bathrooms on premises		
6.3.1 Proportion of wastewater safely treated	Preliminary estimates available for 79 countries, but limited to household wastewater and no comprehensive data on industrial and other non-household domestic wastewater.	Limited availability of time series makes it difficult to determine rates of progress	No global estimates available for industrial wastewater; some data are based on design of wastewater treatment technologies rather than actual performance; lack of insights on all wastewater streams	Enhance monitoring of key parameters of effluent standards that go beyond environmental parameters and address public health; address exposure risks associated with reuse of wastewater	Currently not disaggregated, but could be disaggregated by subsector to distinguish domestic and industrial wastewater	WHO/UNICEF Joint Monitoring Programme (JMP) global database, UN-Habitat
6.3.2 Proportion of bodies of water with good ambient water quality	Data available for 30 countries on open water bodies, 35 on rivers, 25 on groundwater and 22 on all three	Limited availability of data makes it difficult to determine rates of progress	Limited availability of data limits the possibility to determine time trends	Use well-established monitoring systems as examples of good practices for countries yet to develop adequate central national databases on ambient water quality; incorporate Escherichia coli monitoring	Five parameters (nitrogen, phosphorus, conductivity, pH, dissolved oxygen) are monitored and combined into a water quality index	GEMStat water quality database, UN Environment
6.4.1 Change in water-use efficiency over time	Data available for 168 countries (but from different years) based on AQUASTAT and World Bank data, constantly updated	Not yet possible to determine rates of progress as this is a new indicator; data from 2002 to 2014 were used for this report, due to a lack of representative countries	Not yet possible to determine trends over time	Increase the number of countries with internal monitoring processes, not based on international data sets, leading to more updated and timely data	Subnational data would be relevant	FAO AQUASTAT, World Bank

		reporting in 2017				
6.4.2 Level of water stress: freshwater withdrawal as a proportion of available freshwater resources	Data available for 171 countries (but from different years) based on AQUASTAT and International Water Management Institute (IWMI) data, constantly updated	Data updated to 2016 were used for this report, due to a lack of representative countries reporting in 2017	Not yet possible to determine trends over time	Increase the number of countries with internal monitoring processes, not based on international data sets, leading to more updated and timely data Improve estimation of environmental flow requirements (EFR) in a country context	Few countries have started disaggregating data, and no results are yet available; subnational data would be relevant	FAO AQUASTAT, IWMI
6.5.1 Degree of integrated water resources management implementation (0–100)	IWRM Data available for 157 countries, covering all SDG regions; 58 countries have time series data	Baseline data show progress towards implementation; similar, though not identical, data sets are available for 2007 and 2011, and some progress can be identified	First global measurement of the indicator, so insufficient data available to establish trends; some degree of subjectivity to answering surveys, although this is reduced through threshold descriptions for each question and extensive guidance	Encourage consistency in individuals and authorities involved in responding to questionnaires; ensure rigorous and participatory country processes to collect data, to ensure responses are robust and widely accepted in the country	Disaggregation of surveys by question can be a useful quick diagnostic tool at the country level to identify main areas of progress or barriers to progress; this includes a range of IWRM aspects, such as laws, policies, plans, institutions, stakeholder participation, gender, private sector, monitoring and data sharing, and financing; disaggregation at different levels is also possible, including national, subnational and transboundary levels	UNEP-DHI IWRM data portal
6.5.2 Proportion of transboundary basin area with an operational arrangement for water cooperation	Data available for 107 of 153 countries sharing transboundary waters, although more than 40 countries lack data related to transboundary aquifers (TBAs)	Baseline data show that countries continue to adopt new agreements for their transboundary waters and revise existing ones	Limited data available for TBAs, and 47 countries that share transboundary waters have not responded to the initial SDG 6.5.2 reporting exercise	Improve synergy between process of monitoring this indicator and reporting on water cooperation under the Water Convention (several international meetings are planned for 2018 to review and refine monitoring methodology); capacity-	Data can be disaggregated separately for transboundary river and lake basins, and for TBAs	UNECE, UNESCO

				building would increase the number and quality of reports		
6.6.1 Change in extent of water-related ecosystems over time	National data available for 38 countries; global Earth Observation data available, measuring national spatial extent of open water bodies, for 188 countries	Limited nationally derived data make it difficult to determine progress; Earth observation data on spatial extent of open water bodies provide a baseline	Limited availability of nationally derived data to determine time trends; national trends on open water extent for 188 countries are available	Improve global data on spatial extent of lakes, reservoirs and estuaries; improve global data on water quality (turbidity and chlorophyll-a); improve country reporting on all basins	By ecosystem type, e.g. lakes, rivers and groundwater, which is important to enable protection and restoration at the ecosystem level	UN Environment
6.a.1 Amount of water- and sanitation-related official development assistance (ODA) that is part of a government-coordinated spending plan	Data on water- and sanitation-related ODA disbursements available for 140 countries	Water and sanitation ODA disbursements have increased steadily, but have remained constant as a proportion of total ODA since 2005	Good data on ODA disbursements, but challenges in assessing the proportion of ODA included in government-coordinated spending plans	Strengthen water sector financing data in countries based on standardized methods such as TrackFin[b]	Subnational, financing type, subsector	Creditor Reporting System (CRS) Aid Activity database, UN-Water GLAAS
6.b.1 Proportion of local administrative units with established and operational policies and procedures for participation of local communities in water and	Data available for 110 countries (merged data set from the two most-recent cycles of GLAAS)	Definition of progress is highly country and subsector specific	More participation may not necessarily be better; effective participation must ensure that all service users have a voice	Refine indicator to monitor the extent of participation, and assess its nature, effectiveness and value	Subsector	UN-Water GLAAS

sanitation management						

[a]Further information on SDG regions is available from https://unstats.un.org/sdgs/indicators/regional-groups/

[b] Further information on TrackFin initiative is available from http://www.who.int/water_sanitation_health/monitoring/investments/trackfin/en/.

B. Target 6.1: Drinking water

"By 2030, achieve universal and equitable access to safe and affordable drinking water for all"

The United Nations General Assembly (Human Rights Council) recognized the rights to safe drinking water and sanitation as a human right that is essential for full enjoyment of life and all human rights (United Nations, General Assembly, 2015). The 2030 Agenda reiterates this and includes an ambitious global SDG target 6.1 to secure safe and affordable drinking water for all. Universal access presents a major challenge and implies providing households with water for drinking, cooking, personal hygiene and other domestic purposes, as well as ensuring such access to water in schools, health-care facilities and other settings. Improving the availability and quality of drinking water depends on effective management of water resources and wastewater to maintain good ambient water quality and to reduce contamination risks within the supply system (SDG targets 6.2–6.6).

SDG global indicator 6.1.1 addresses the use of "safely managed" drinking water services, which comprise improved sources that are accessible on premises, available when needed and free from contamination. The population using "basic" drinking water services (improved sources for which a round trip to collect water takes no more than 30 minutes) is one of the indicators used to track progress towards SDG target 1.4, which aims for universal access to basic services. Progress on improving drinking water contributes directly to reducing poverty, and is a prerequisite for wider improvements in nutrition, health, education, gender equality and productivity (see chapter IV).

Box 4 Monitoring safely managed drinking water services in Kenya

Monitoring safely managed drinking water services requires data on the number of people using improved drinking water sources, and the number of those sources accessible on premises, available when needed and compliant with drinking water quality standards.

The Water Services Regulatory Board (WASREB) in Kenya was established to regulate the water services subsector, following passage of the Water Act in 2002. The Board has since published nine annual reports (IMPACT reports) that analyse utility performance based on nine key performance indicators. The first IMPACT report referred to compliance with residual chlorine targets. Subsequent reports have included compliance with bacteriological parameters, which were used to calculate SDG baselines in urban areas. Performance on the WASREB composite drinking water quality indicator increased to 92 per cent by 2014/2015 (WASREB, 2018).

IMPACT reports also publish data on number of hours of water supply per day, by utility, which is an indicator of water availability when needed. In addition, two household surveys in Kenya directly asked household respondents about drinking water availability (WASREB, 2018). A demographic and health survey in 2003 (supported by the United States Agency for International Development) found that 55 per cent of urban households used improved sources from which water was "usually always available" (CBS, MOH, and ORC Macro, 2004). Performance monitoring and assessment surveys conducted in 2014 and 2015 (supported by Johns Hopkins University) found that nearly three quarters of urban households were using improved sources from which water was "available when expected" (Johns Hopkins University, n.d.). However, multiple surveys conducted from 2000 to 2015 showed that only 55 per cent of households in urban areas had water supplies located on premises in 2015 (WHO and UNICEF, 2017a). Out of the three elements of accessibility on premises, availability when needed and compliance with drinking water standards, the first element was the lowest and determined an estimate for safely managed drinking water services.

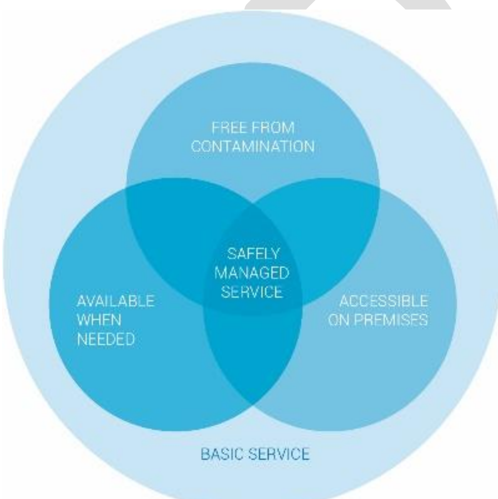
Indicator 6.1.1: Proportion of population using safely managed drinking water services

Custodian agency: WHO/UNICEF JMP

Introduction

A safely managed drinking water service is defined as providing drinking water from an improved source that is accessible on premises, available when needed, and free from faecal and priority chemical contamination.

WHO/UNICEF JMP produces internationally comparable estimates based on official data from national statistics offices and other relevant authorities. As the data sources used for different service level parameters may not be the same, it is not always possible to determine which households or populations meet all three of the service level criteria (accessible on premises, available when needed and free from contamination). Instead, safely managed drinking water services are calculated at the urban and rural levels by taking the minimum of the three service level parameters. National estimates are generated as weighted averages of the urban and rural estimates, using population data from the most-recent report of the United Nations Population Division.[8]



Key messages

Five billion people used a safely managed drinking water service.

Estimates for safely managed drinking water were available for 96 countries and four out of eight SDG regions.

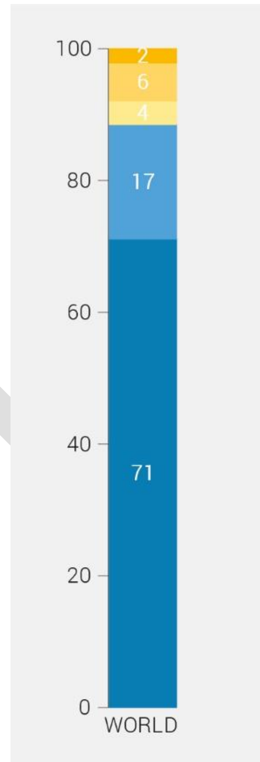
One billion people used a basic drinking water service.

Eight hundred and forty-four million people still lacked even a basic drinking water service.

Two hundred and sixty-three million used a limited service, and 159 million still collected drinking water directly from surface water sources.

Seventy-four per cent of the global population used improved water sources accessible on premises, 79 per cent had water when needed and 73 per cent drank water that was free from contamination from surface water sources.

Seven out of 10 people used safely managed drinking water in 2015.



Global drinking water coverage (per cent) in 2015 (see figure below left for colour key)

Source: WHO and UNICEF (2017a).

[8] JMP methodology: 2017 update, November 2017.

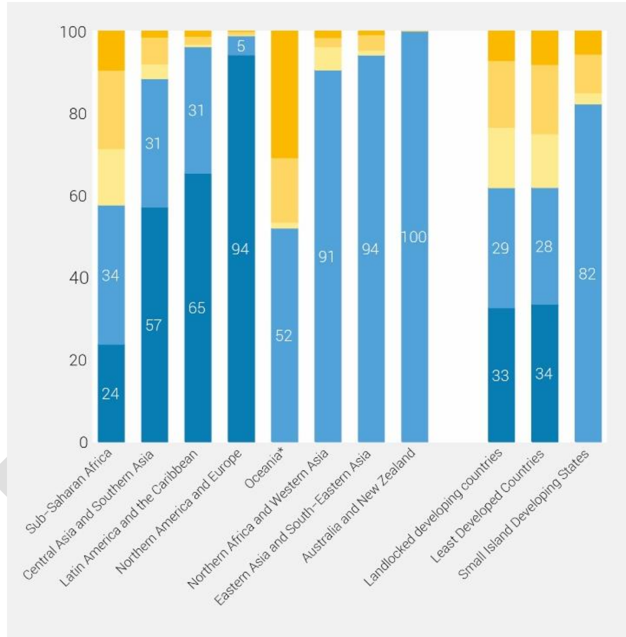
SERVICE LEVEL	DEFINITION
SAFELY MANAGED	Drinking water from an improved water source that is located on premises, available when needed and free from faecal and priority chemical contamination
BASIC	Drinking water from an improved source, provided collection time is not more than 30 minutes for a round trip, including queuing
LIMITED	Drinking water from an improved source for which collection time exceeds 30 minutes for a round trip, including queuing
UNIMPROVED	Drinking water from an unprotected dug well or unprotected spring
SURFACE WATER	Drinking water directly from a river, dam, lake, pond, stream, canal or irrigation canal

Note: Improved sources include: piped water, boreholes or tubewells, protected dug wells, protected springs, rainwater, and packaged or delivered water.

Updated JMP ladder for global monitoring of drinking water

Source: WHO and UNICEF (2017a).

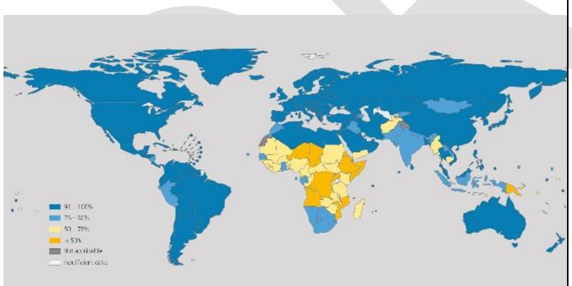
There are wide regional variations in coverage of safely managed drinking water services (from 24 per cent in sub-Saharan Africa to 94 per cent in Europe and Northern America).



Regional drinking water coverage in 2015 (per cent) (* denotes insufficient data to estimate safely managed services)

Source: WHO and UNICEF (2017a).

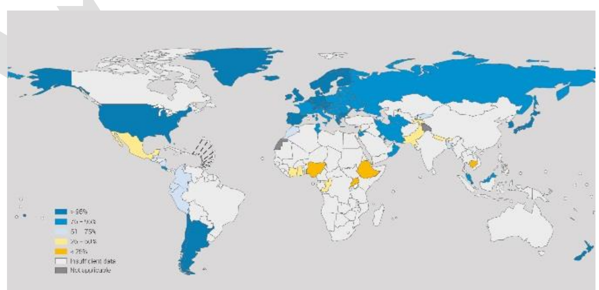
By 2015, 181 countries had achieved over 75 per cent coverage with at least basic drinking water services.



Proportion of population using at least basic drinking water services in 2015

Source: WHO and UNICEF (2017a).

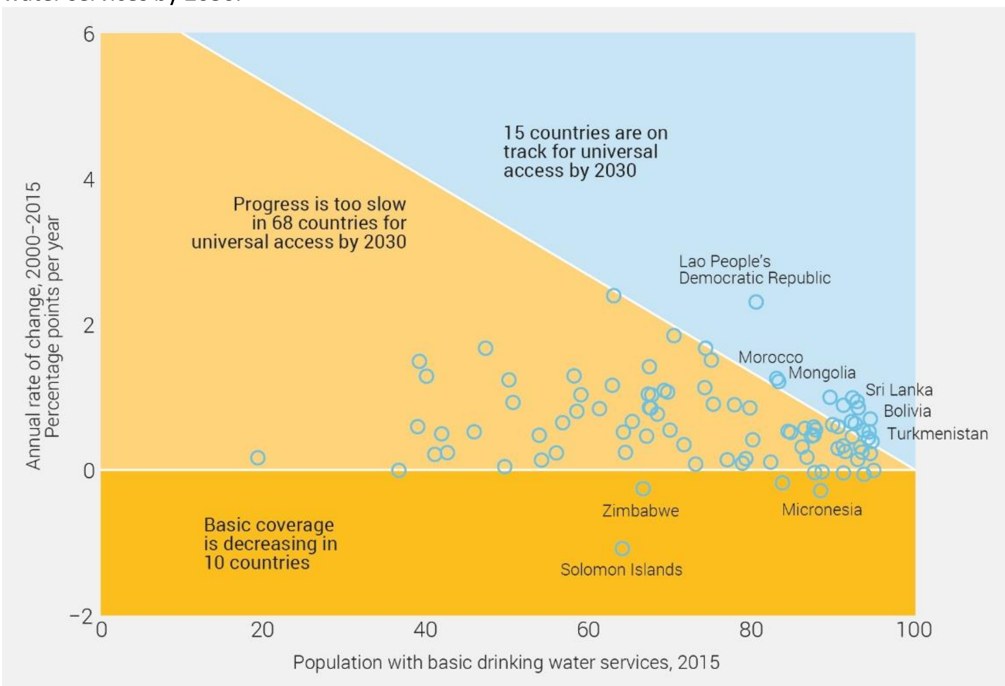
5.2 billion people used safely managed drinking water services in 2015



Proportion of population using safely managed drinking water services in 2015

Source: WHO and UNICEF (2017a).

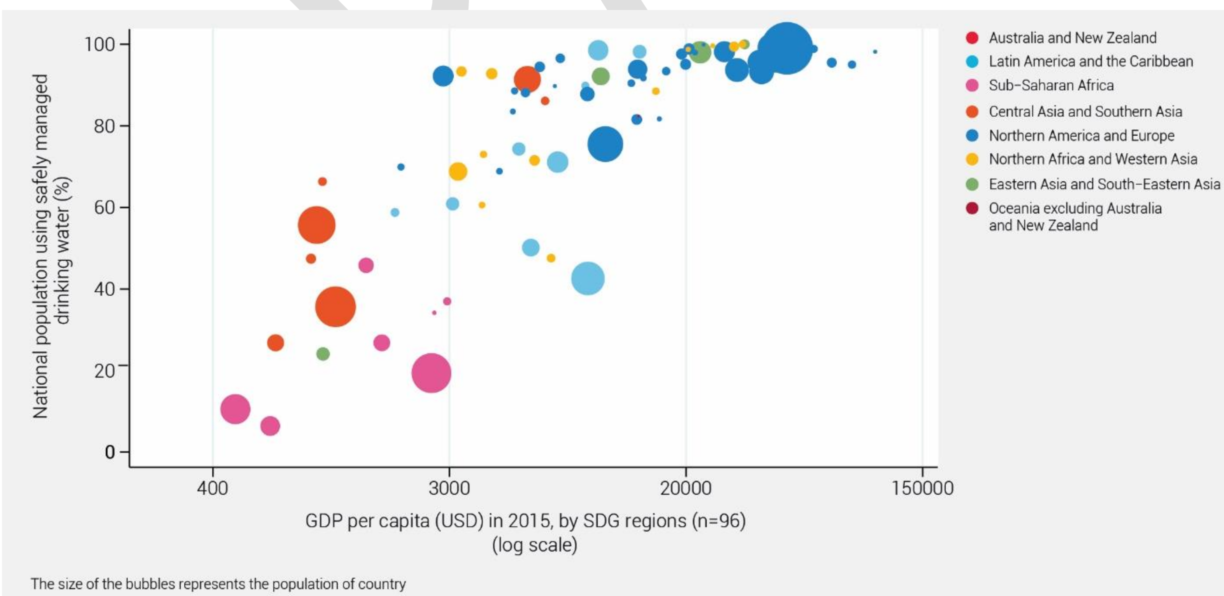
The global population using at least a basic drinking water service increased from 81 to 89 per cent between 2000 and 2015. However, only one in five countries below 95 per cent coverage in 2015 is on track to achieving universal basic water services by 2030.



Progress towards universal basic drinking water services (2000–2015) among countries where at least 5 per cent of the population did not have basic services in 2015

Source: WHO and UNICEF (2017a).

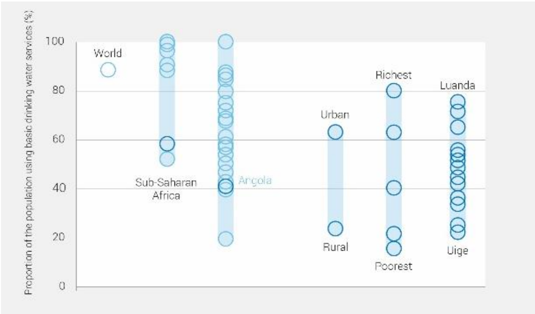
Coverage of safely managed drinking water services varies widely among countries with similar GDPs.



GDP per capita and coverage of safely managed drinking water across countries in 2015

Data source: WHO and UNICEF (2017b).

Significant disparities in basic drinking water persist between and within countries.

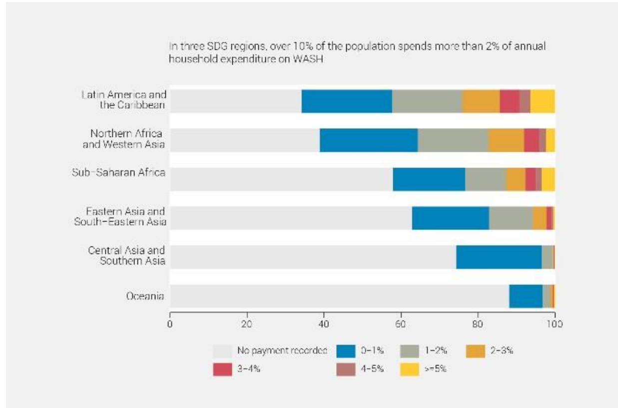


Inequalities in use of basic drinking water by region, country, residence and wealth in Sub-Saharan Africa in 2015

Source: WHO and UNICEF (2017a).

National data sources that enable disaggregation by urban/rural, by wealth and by subnational region often reveal significant inequalities among population subgroups. These data can inform efforts to reduce and eliminate inequalities within countries.

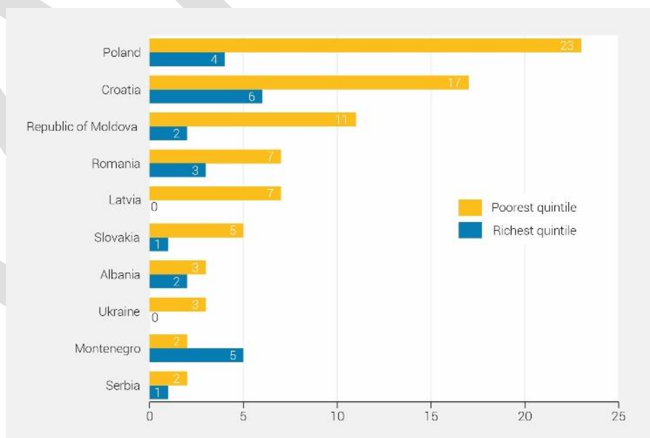
Over 10 per cent of the population spends more than 2 per cent of their annual household expenditure on water, sanitation and hygiene (WASH) in three SDG regions.



Proportion of total household expenditure on WASH services, by region (52 countries)

Source: WHO and UNICEF (2017a).

Poor households in Europe are more likely to spend over 3 per cent of total expenditure on WASH.



Percentage of households spending more than 3 per cent of total expenditure on WASH services in selected European countries

Source: WHO and UNICEF (2017a).

SDG target 6.1 specifies that drinking water should be “affordable”, which implies that payment for services should not present a barrier to access or prevent people from meeting other basic needs. Further work is required to establish a commonly agreed method for assessing affordability.

Sources:

United Nations, Department of Economic and Social Affairs, Population Division (2015). *World Population Prospects: Key Findings & Advance Tables, 2015 Revision*. Working Paper No. ESA/P/WP.241.

World Health Organization (WHO) and United Nations Children's Fund (UNICEF) (2017a). *Progress on Drinking Water, Sanitation and Hygiene: 2017 Update and SDG Baselines*. Geneva. Available from https://washdata.org/report/jmp-2017-report-final.

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Challenges, opportunities and policy implications

Achieving universal access to safe and affordable drinking water by 2030 presents a huge challenge for all countries, not just those with low incomes. It is consistent with the broader transformative ambition of the 2030 Agenda to "end poverty in all its forms" and to "set the world onto a sustainable and resilient path". Target 6.1 challenges Member States to address the "unfinished business" of extending services to those populations who remain unserved, and also to progressively improve the quality of services received. It also implies going beyond the household and considering access to services in schools, health-care facilities and other institutional settings. The commitment to "leave no one behind" will require increased attention to the needs and priorities of disadvantaged groups and deliberate efforts to monitor the reduction and elimination of inequalities in drinking water services.

Each government must establish its own targets, taking into account national circumstances. In those countries where a large proportion of the population still lacks even a basic drinking water service, the initial focus will remain on ensuring that everyone has access to an improved drinking water source and reducing the time spent (primarily by women and girls) collecting water. Countries need to increasingly pay attention to improving the quality of services, as coverage of basic services grows. This can only be achieved through substantial increases in investment from government and other sources and strengthening institutional arrangements for managing and regulating drinking water services. It also requires development of increasingly sophisticated information systems for monitoring coverage and quality of services. Establishing sustainable models of service delivery is key to building willingness to pay and attracting additional investment to keep services running in the long term.

Almost all countries and regions have robust estimates of trends in the provision of basic drinking water services. These data show that the global population using basic services increased from 81 to 89 per cent between 2000 and 2015. The two SDG regions of Australia and New Zealand and Europe and Northern America are already very close to universal access, while the two SDG regions of Latin America and the Caribbean and Eastern and South-Eastern Asia are on track to achieve universal access by 2030. However, just one in five countries with less than 95 per cent coverage is currently on track to achieve universal basic services by 2030.

Estimates for safely managed drinking water are currently only available for a subset of 96 countries and four SDG regions. These vary widely from 94 per cent in the Europe and Northern America region to 24 per cent in the sub-Saharan Africa region, and the lack of time series makes it difficult to estimate trends. There are still significant gaps in country-level systems for data collection, and further work is required to harmonize methods and standards. Most countries have data on whether services are accessible on premises, but relatively few have data on availability and quality of drinking water, particularly in rural areas and for populations using non-piped networks and private supplies. There must be a concerted effort to strengthen national systems for monitoring safely managed drinking water services, as technical innovations are reducing the cost of data collection.

A growing number of countries (80) are able to disaggregate estimates for basic services by rural and urban, wealth groups and subnational regions. This enables governments to better identify and target disadvantaged groups, but further work is required to disaggregate estimates for safely managed services (WHO and UNICEF, 2017b). Some countries already routinely collect information on water in schools and health-care facilities, and work is under way to harmonize questions and indicators used and to compile national data for the purpose of SDG reporting.

C. Target 6.2: Sanitation and hygiene

"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"

SDG target 6.2 aims for universal access to sanitation and also to hygiene, which was overlooked in previous global targets. The term "adequate" is consistent with the United Nations resolution on the human right to sanitation that defines sanitation as "a system for the collection, transport, treatment and disposal or reuse of human excreta and associated hygiene" (United Nations, General Assembly, 2009a, para. 63). It is clear that people have a right to access a latrine or toilet, and also a right not to be harmed by unmanaged faecal waste. The global indicator for SDG target 6.2 is divided into two parts, which cover sanitation and hygiene.

Indicator 6.2.1a addresses the use of "safely managed" sanitation services. These are systems that safely separate excreta and wastewater from human contact, either by safe containment, treatment and disposal in situ, or by safe transport and treatment off site. A safely managed sanitation system is essential for protecting and improving the health of individuals, communities and the environment. Leaking latrines, septic tanks and drains, and untreated faecal sludge and wastewater, can all spread disease and pollute groundwater and surface water sources used for drinking and recreation (SDG targets 6.1, 6.3, 6.5 and 6.6).

Indicator 6.2.1b focuses on the presence of handwashing facilities with soap and water on premises. Handwashing with soap and water is a top priority for improving global health and is among the most cost-effective of all public health interventions. Good hygiene practices, such as handwashing with soap and water after using the toilet and before preparing food, are essential to prevent illness and limit the spread of communicable diseases.

The proportion of the population using basic sanitation services and basic handwashing facilities is also used to track progress towards SDG target 1.4, which aims for universal access to basic services.

Target 6.2 includes an explicit reference to ending open defecation, which is a major risk to public health and closely associated with extreme poverty. It also calls for special attention to the needs of women and girls. They are disproportionately affected by the lack of sanitation facilities providing privacy, and their dignity and personal safety may be compromised by sharing facilities with other households and practising open defecation. Bringing drinking water closer to home particularly benefits women and girls, who mainly shoulder the burden of water collection, and frees up time for other things including education and work. Improved access in public places to safe drinking water, sanitation, and facilities for handwashing and menstrual hygiene management can also improve the school attendance of girls and make it easier for women to work outside the home.

Box 5 Monitoring safely managed sanitation services in Ecuador

Levels of basic sanitation services are generally high in Ecuador, but national data on the quality of these services were scarce. Therefore, the National Statistical Office (Instituto Nacional de Estadística y Censos) collaborated with the World Bank Global Water Practice and WHO/UNICEF JMP to pilot a new module in the Encuesta de Empleo, Desempleo y Subempleo, to track progress for SDG targets 6.1 and 6.2, in December 2016.

Households were asked questions about sanitation facilities, with interviewers also asking to test drinking water quality and observe handwashing facilities. New sanitation questions focused on the management of on-site sanitation facilities (septic tanks and latrines), asking where effluent from septic tanks is discharged and whether latrines and septic tanks have been emptied. WHO/UNICEF JMP managed to set a baseline for safely managed sanitation services by combining information on management of on-site sanitation facilities with data from municipalities on wastewater treatment.

Further work is needed to verify administrative data on wastewater for households connected to sewer networks and to establish mechanisms for determining the extent to which excreta from emptying septic tanks are being treated.

Source: Pozo and others (n.d.).

<table>
<tr><td colspan="3">Indicator 6.2.1a: Proportion of population using safely managed sanitation services, including a handwashing facility with soap and water</td></tr>
<tr><td>Custodian agency: WHO/UNICEF JMP</td><td rowspan="2">Key messages

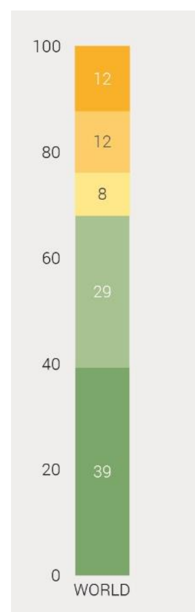
Nearly 3 billion people used a safely managed sanitation service: 60 per cent of these people lived in urban areas, with the other 40 per cent living in rural areas.

Estimates for safely managed sanitation are available for 84 countries and five out of eight SDG regions.

Two billion people used a basic sanitation service and 600 million people used a limited service.

Two billion people still lacked even a basic sanitation service; 70 per cent of these lived in rural areas.

Eight hundred and ninety-two million people still practised open defecation.</td><td rowspan="2">Two out of five people used safely managed sanitation services in 2015.



Global sanitation coverage (per cent) in 2015 (see figure below left for colour key)</td></tr>
<tr><td>Introduction

A safely managed sanitation service is defined as use of an improved facility that is not shared with other households, and where excreta are safely disposed of in situ or transported and treated off site.

WHO/UNICEF JMP produces internationally comparable estimates based on national data sources. Data on improved sanitation facilities are routinely collected in household surveys and censuses and may include information on sharing sanitation facilities and emptying on-site sanitation facilities. Data on wastewater and faecal sludge treatment from on-site sanitation systems are increasingly collected by regulators, ministries, utilities, municipalities and other government institutions with the authority for oversight of service delivery. Safely managed sanitation services are calculated by adding together the populations using on-site systems where excreta are treated in situ and those using on-site facilities and sewer connections from which excreta are transported off site and receive at least secondary treatment. National estimates are</td></tr>
</table>

generated as weighted averages of the urban and rural estimates.[9]

SERVICE LEVEL	DEFINITION
SAFELY MANAGED	Use of improved facilities that are not shared with other households and where excreta are safely disposed of in situ or transported and treated offsite
BASIC	Use of improved facilities that are not shared with other households
LIMITED	Use of improved facilities shared between two or more households
UNIMPROVED	Use of pit latrines without a slab or platform, hanging latrines or bucket latrines
OPEN DEFECATION	Disposal of human faeces in fields, forests, bushes, open bodies of water, beaches or other open spaces, or with solid waste

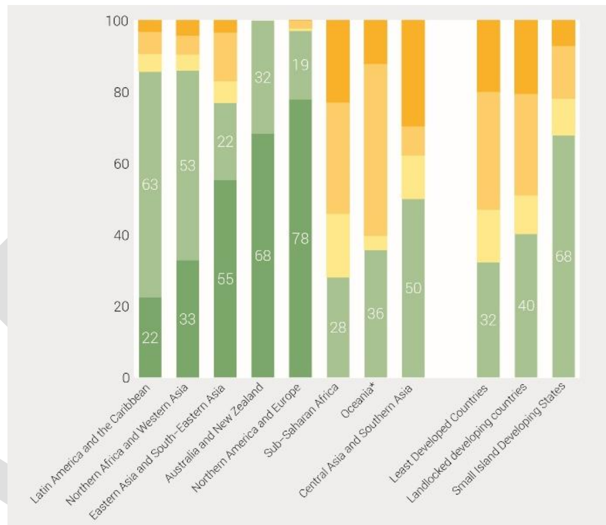
Note: *improved facilities include flush/pour flush to piped sewer systems, septic tanks or pit latrines; ventilated improved pit latrines, composting toilets or pit latrines with slabs.*

Updated JMP ladder for global monitoring of sanitation

Source: WHO and UNICEF (2017a).

Source: WHO and UNICEF (2017a).

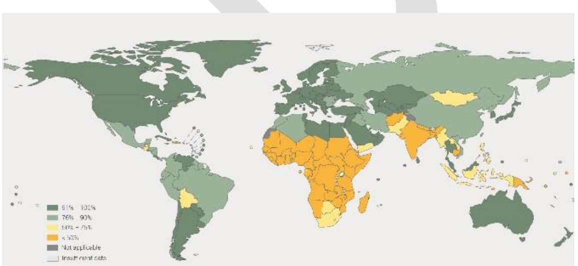
Estimates of safely managed sanitation services are available for five out of eight SDG regions.



Regional sanitation coverage (per cent) in 2015 (* denotes insufficient data to estimate safely managed services)

Source: WHO and UNICEF (2017a).

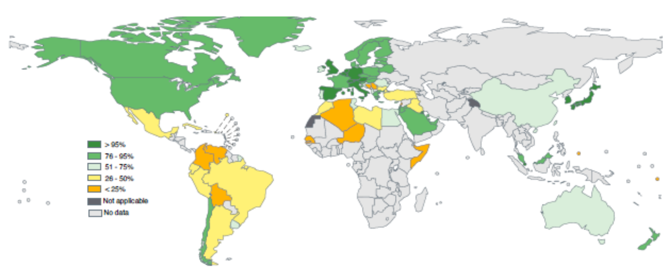
By 2015, 154 countries had achieved over 75 per cent coverage with at least basic sanitation services.



Proportion of population using at least basic sanitation services across countries in 2015

Source: WHO and UNICEF (2017a).

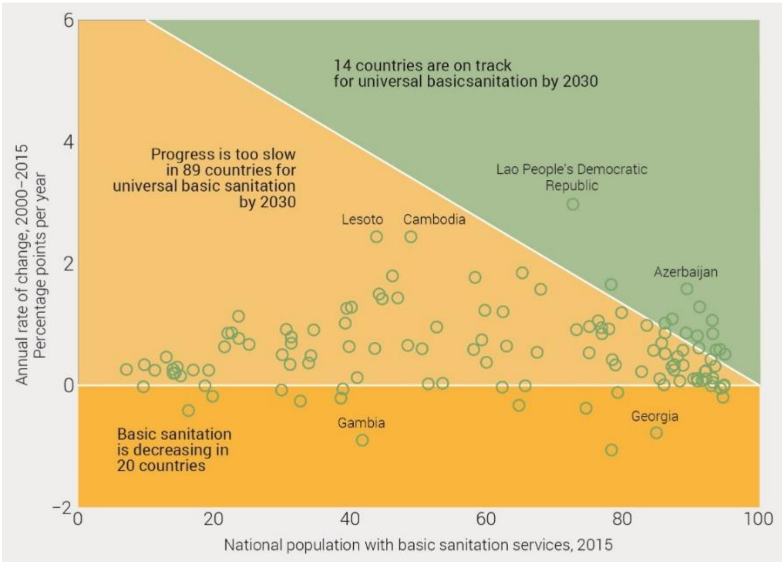
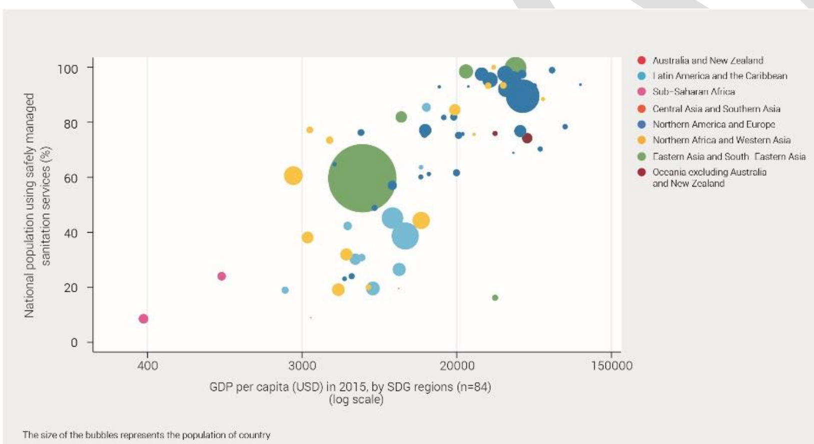
2.9 billion people used safely managed sanitation services in 2015



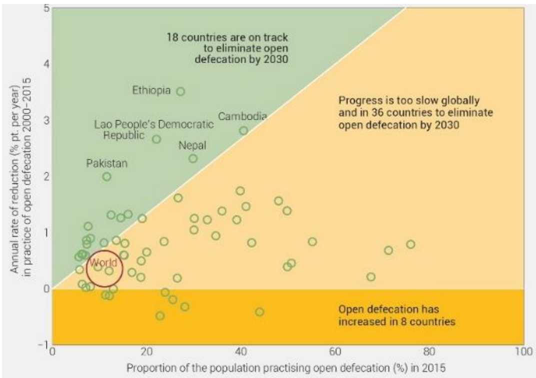
Proportion of population using safely managed sanitation services across countries in 2015

Source: WHO and UNICEF (2017a).

[9] JMP methodology: 2017 update, November 2017.

The global population using at least a basic sanitation service increased from 59 to 68 per cent between 2000 and 2015. Just one in 10 countries below 95 per cent coverage in 2015 is on track to achieve universal basic sanitation by 2030.  Progress towards universal basic sanitation services (2000–2015) among countries where at least 5 per cent of the population did not have basic services in 2015 Source: WHO and UNICEF (2017a).
Coverage of safely managed sanitation services varies widely among countries with similar GDP.  GDP per capita and coverage of safely managed sanitation services across countries in 2015 *Data source*: WHO and UNICEF (2017b).

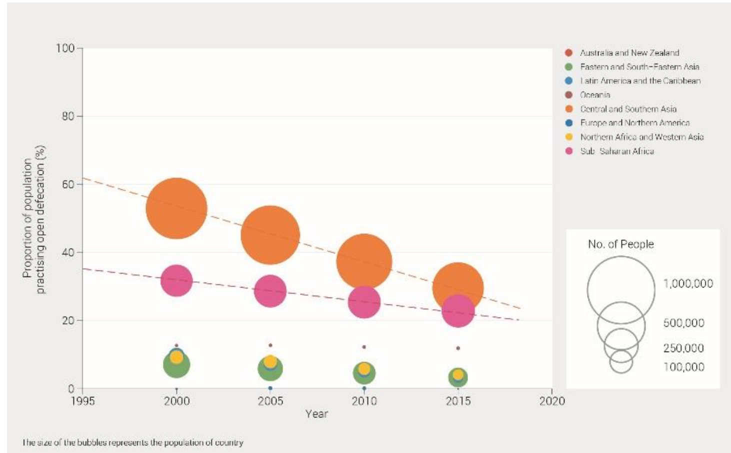
Substantial acceleration is required to end open defecation by 2030.



Progress towards ending open defecation by country and globally (2000-2015)

Data source: WHO and UNICEF (2017b).

Nine out of 10 people practising open defecation live in two SDG regions.



Open defecation across SDG regions from 2000 through to 2015

Data source: WHO and UNICEF (2017b).

The global total for open defecation fell from 1.229 billion to 892 million between 2000 and 2015. Nine out of 10 people lived in rural areas, almost two thirds (558 million) lived in Central and Southern Asia, with most of the rest (220 million) living in sub-Saharan Africa.

Significant disparities in safely managed sanitation services persist between and within countries.

Inequalities in access to safely managed sanitation services in 2015

Source: WHO and UNICEF (2017a).

Equal numbers of people use sewer connections and on-site sanitation globally.

Percentage of people using sewer connections and on-site sanitation

Source: WHO and UNICEF (2017a).

Sources:

United Nations, Department of Economic and Social Affairs, Population Division (2015). *World Population Prospects: Key Findings & Advance Tables, 2015 Revision*. Working Paper No. ESA/P/WP.241.

World Health Organization (WHO) and United Nations Children's Fund (UNICEF) (2017a). *Progress on Drinking Water, Sanitation and Hygiene: 2017 Update and SDG Baselines*. Geneva. Available from https://washdata.org/report/jmp-2017-report-final.

__________ (2017b). WHO/UNICEF Joint Monitoring Programme (JMP) global database. Updated July 2017. Available from https://washdata.org/data.

Indicator 6.2.1b: Proportion of population with a handwashing facility with soap and water available on premises

Custodian agency: WHO/UNICEF JMP

Introduction

A basic handwashing facility is defined as a handwashing facility with soap and water available on premises.

Handwashing with soap and water is widely recognized as a top priority for reducing disease transmission. Self-reports of handwashing practice are unreliable, but direct observation of the presence of handwashing facilities with water and soap is common in household surveys. Facilities include a sink with tap water, but can also include other devices that contain, transport or regulate water flow. Soap includes bar soap, liquid soap, powder detergent and soapy water.

Many middle- and high-income countries lack sufficient data to produce estimates.

SERVICE LEVEL	DEFINITION
BASIC	Availability of a handwashing facility on premises with soap and water
LIMITED	Availability of a handwashing facility on premises without soap and water
NO FACILITY	No handwashing facility on premises

Note: Handwashing facilities may be fixed or mobile and include a sink with tap water, buckets with taps, tippy-taps, and jugs or basins designated for handwashing. Soap includes bar soap, liquid soap, powder detergent, and soapy water but does not include ash, soil, sand or other handwashing agents.

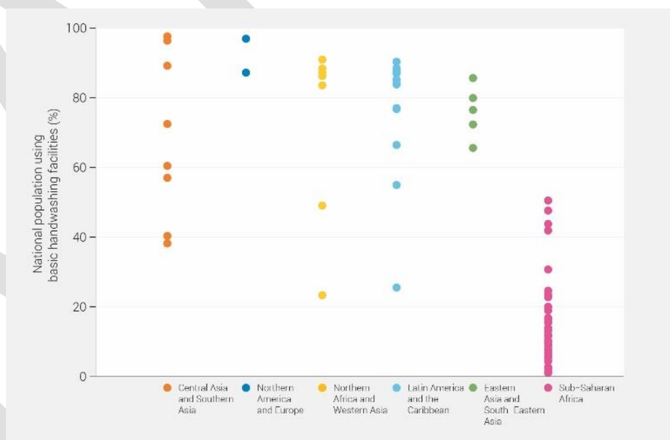
A new JMP ladder for global monitoring of hygiene

Source: WHO and UNICEF (2017a).

Key messages

- Seventy countries had comparable data available on handwashing with soap and water, representing 30 per cent of the global population.
- Coverage of basic handwashing facilities with soap and water varied from 15 per cent in sub-Saharan Africa to 76 per cent in Northern Africa and Western Asia, but current data are insufficient to produce global estimates for other SDG regions.
- In LDCs, 27 per cent of the population had basic handwashing facilities, while 26 per cent had handwashing facilities lacking soap or water. The remaining 47 per cent had no facilities.
- Less than 50 per cent of the population used basic handwashing facilities in 34 out of 38 African countries.

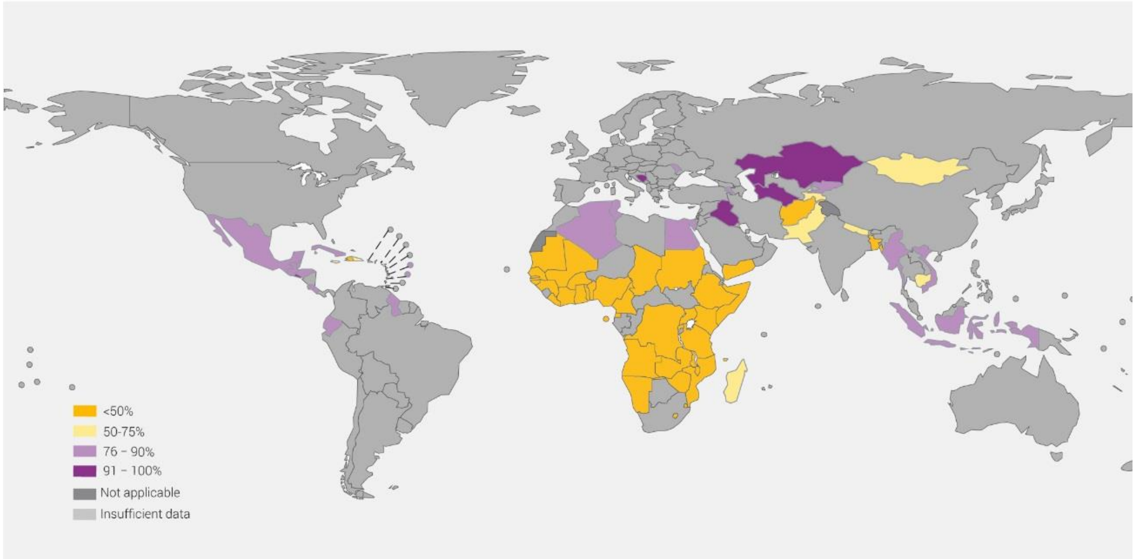
Seventy countries had comparable data available on basic handwashing facilities in 2015.



Proportion of population with basic handwashing facilities, by country and region in 2015.

Data source: WHO and UNICEF (2017b).

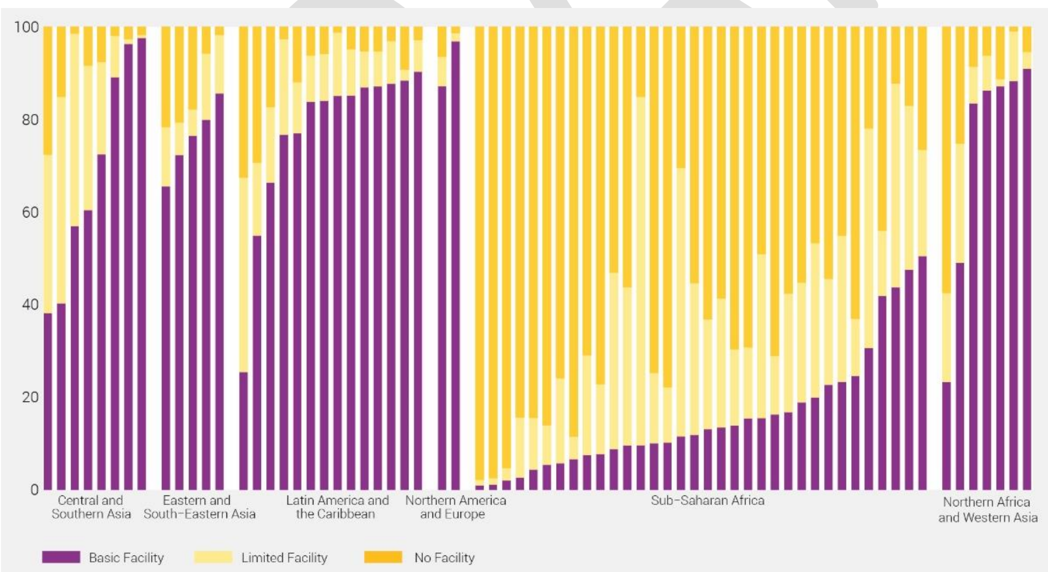
Most countries in Africa had less than 50 per cent coverage of basic handwashing facilities in 2015.



Proportion of population using basic handwashing facilities in 2015

Source: WHO and UNICEF (2017a).

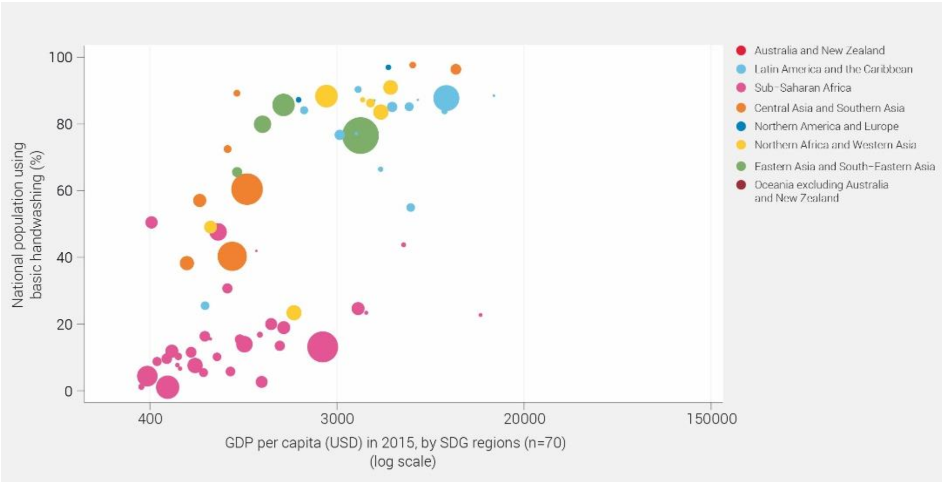
Coverage of basic handwashing facilities varies widely over 70 countries with data in 2015.



Proportion of population using handwashing facilities by region in 2015

Source: WHO and UNICEF (2017a).

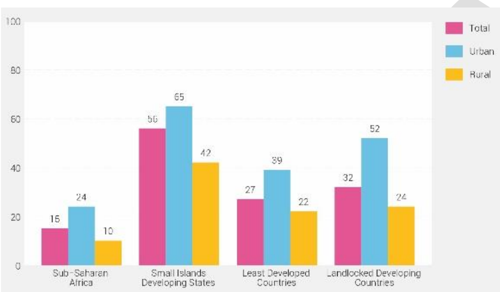
Low-income countries have the lowest coverage of basic handwashing facilities.



GDP per capita and coverage of basic handwashing facilities across countries in 2015

Da source: WHO and UNICEF (2017b).

Coverage of basic handwashing facilities was higher in urban areas in all regions with data available in 2015.



Population with basic handwashing facilities including soap and water at home, by region, in 2015

Source: WHO and UNICEF (2017a).

Sources:

World Health Organization (WHO) and United Nations Children's Fund (UNICEF) (2017a). *Progress on Drinking Water, Sanitation and Hygiene: 2017 Update and SDG Baselines*. Geneva. Available from https://washdata.org/report/jmp-2017-report-final.

__________ (2017b). WHO/UNICEF Joint Monitoring Programme (JMP) global database. Updated July 2017. Available from https://washdata.org/data.

Challenges, opportunities and policy implications

Achieving universal access to adequate and equitable sanitation and hygiene by 2030 represents a major challenge in many parts of the world. Target 6.2 calls for countries to end open defecation and to ensure that everyone has access to a basic latrine or toilet, and also to put in place systems for safe management of the excreta produced. It highlights the importance of hygiene, which has previously been neglected in national and global targets and calls for special attention to the needs of women and girls.

The proportion of the global population practising open defecation decreased from 20 to 12 per cent between 2000 and 2015, but faster progress will be required to end open defecation by 2030. The focus of efforts will need to be on the two regions of Central and Southern Asia and sub-Saharan Africa, where most of the 892 million people who still practised open defecation lived in 2015. The initial focus in many countries will continue to be on ensuring that everyone has a basic sanitation service, as 2.3 billion people still lack an improved sanitation facility that is not shared with other households. Countries need to establish systems for safely treating and disposing of the excreta produced. Substantial investment will be required, particularly in rapidly growing urban areas, although solutions will vary depending on the relative importance of sewerage networks and on-site sanitation systems. Strengthening the capacity of local and national authorities to manage and regulate sanitation systems, including the development of information management systems, is a high priority, especially in low- and middle-income countries.

Almost all countries have robust estimates of trends in basic sanitation services. While the global population using these services increased from 59 to 68 per cent between 2000 and 2015, only one SDG region is currently on track to achieve universal basic sanitation by 2030. This is Australia and New Zealand, which is already nearing universal coverage (WHO and UNICEF, 2017b). Just one in 10 countries with less than 95 per cent coverage in 2015 is on track to achieve universal basic sanitation services by 2030.

Estimates for safely managed sanitation were available for only 84 countries and five SDG regions in 2015. These varied from 78 per cent in Europe and Northern America to 22 per cent in Latin America and the Caribbean, but the lack of time series makes it difficult to determine trends. Data gaps remain in almost all countries, and further work is required to harmonize the methods and standards used to monitor the management of sanitation systems. Few countries have data on the treatment and disposal of excreta emptied from the septic tanks and latrines, which dominate in rural areas. But many countries have data on the treatment of wastewater from sewer connections, which are primarily in urban areas. This is a major data gap, given that equal numbers of people worldwide use sewer connections and on-site systems, and further work is required to strengthen systems for local and national reporting.

Estimates for handwashing with soap and water are currently available for only 70 countries. Coverage varies widely but is higher in urban than in rural areas. There are insufficient data to produce a global estimate, but coverage was generally higher in the regions of Eastern and South-Eastern Asia and Latin America and the Caribbean. Hygiene promotion efforts will need to focus on sub-Saharan Africa, where just 15 per cent of the population had basic handwashing facilities in 2015. Most countries do not yet have sufficient data to be able to determine trends, so it is difficult to assess the prospects for achieving universal access by 2030. Data on handwashing facilities are not routinely collected in most middle- and high-income countries, where access to facilities is assumed to be near universal. Work is ongoing to identify potential proxies such as availability of piped water, hot water, showers or bathrooms in dwellings.

Some countries already routinely collect data on sanitation and hygiene in schools and in health-care facilities, related to the specific needs of women and girls, such as providing single-sex toilets and making facilities available for menstrual hygiene management. Work is ongoing to harmonize the questions and indicators used for monitoring and to compile national data for the purpose of global reporting.

D. Target 6.3: Water quality and wastewater

“By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally”

Poor water quality poses risks to public health, food security, and ecosystem services and functions. Untreated domestic wastewater contains pathogens, organics and nutrients. Wastewater from industrial and other establishments may also contain hazardous substances, such as heavy metals and other pollutants. Untreated wastewater contaminates the environment, causing widespread disease and damaged ecosystems. Water pollution limits opportunities for safe and productive use and reuse of water sources to augment freshwater supplies, particularly in water-scarce regions.

Target 6.3 calls for countries to halve the proportion of untreated wastewater, to increase wastewater collection and to ensure that on-site and off-site treatment technologies[10] are operated and maintained, ensuring that effluent consistently meets national standards. Industrial wastewater generators need to be monitored and regulated through the use of permits for discharge to sewers and/or the environment. Removing hazardous pollutants at source and safely treating wastewater create opportunities for increasing the safe reuse of water to combat water scarcity.

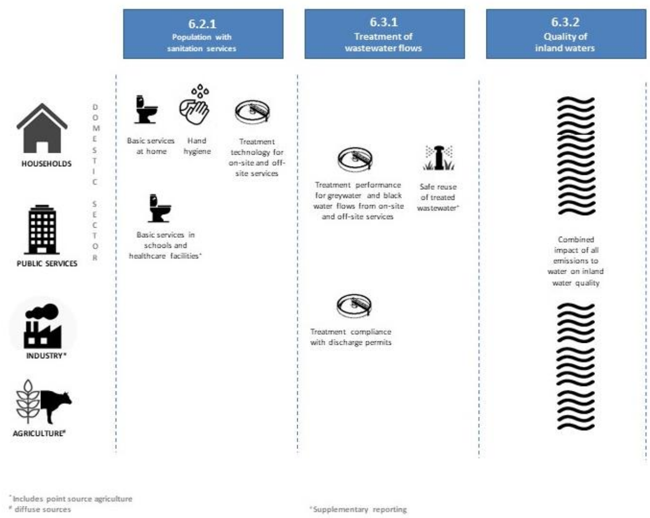


Figure 1 Linkages among indicators on sanitation wastewater and water quality

Progress on SDG target 6.3 partly relies on progress towards universal access to sanitation (indicator 6.2.1), improvement in domestic wastewater treatment performance, industrial wastewater source control and treatment (6.3.1) and reducing diffuse pollution from agriculture. Diffuse pollution is difficult to monitor, and future methodologies need to account for the contribution it makes to pollution in tandem with point sources. Indicator 6.3.2 assesses the combined impact of all wastewater discharges (including diffuse agricultural runoff not covered in 6.3.1) on inland ambient water quality (Figure 1). Water quality (Box 6) is also one of the subindicators assessed for indicator 6.6.1 on water-related ecosystems.

Progress on SDG target 6.3 also contributes to safe drinking water (SDG target 6.1) and reduction in waterborne diseases (SDG target 3.3). Increasing safe use of wastewater contributes to increasing food production (SDG target 2.4) and improved nutrition (SDG target 2.2), while also mitigating water scarcity (target 6.4), increasing water-use efficiency (target 6.4) and contributing to sustainable urbanization (target 11.2).

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[10] On-site (or decentralized) wastewater treatment systems treat wastewater in situ. Off-site wastewater treatment systems treat wastewater that has been conveyed using a sewerage system.

Box 6 Assessment of water quality worldwide

With the limited water quality monitoring data available, the recent World Water Quality Assessment (UNEP 2016) employed a modelling approach. It concluded that: pollution in Latin America, Africa and Asia increased between 1990 and 2010 because of growth in wastewater loadings to rivers and lakes. As an example, organic pollution (measured as biochemical oxygen demand) worsened in more than half of river stretches,. Pollution increased to a severe level or was already severe and had worsened by 2010 in a subset of these river stretches. However, most rivers are still in good condition, and there are great opportunities for reducing further pollution and restoring water quality.

Model output: Trend in biochemical oxygen demand concentrations in rivers between 1990–1992 and 2008–2010

Source: UNEP (2016).

Indicator 6.3.1: Proportion of wastewater safely treated

Custodian agencies: WHO/UN-Habitat/UNSD

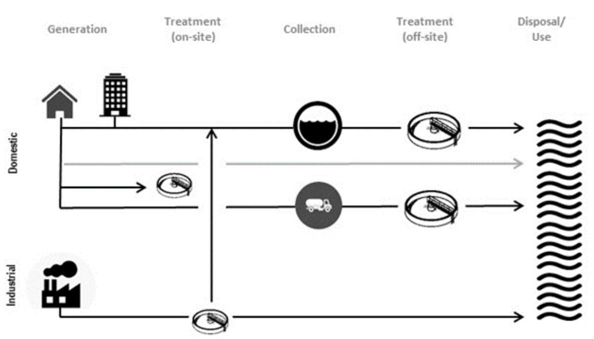
Introduction

Wastewater is defined as water that is of no further immediate value for the purpose for which it had been used or produced because of its quality, quantity or time of occurrence.

Proportion of wastewater safely treated comprises two components:

- Percentage of safely treated domestic wastewater flows
- Percentage of safely treated industrial wastewater flows

The indicator assesses actual treatment performance based on effluent quality data and discharge permits where available. By comparison, indicator 6.2.1 "safely managed sanitation" measures delivery to a secondary treatment technology or higher.



Key messages

Preliminary[11] estimates for domestic wastewater have been made for 79 are from mainly high and high-middle income countries and exclude most of Africa and Asia. Insufficient data are available to make estimates for industrial wastewater.

- Seventy-one per cent of domestic wastewater flow is collected in sewers, 9 per cent is collected at on-site facilities and the remaining 20 per cent is not collected.
- Fifty-nine per cent of all domestic wastewater flows is collected and safely treated. The untreated 41 per cent presents risks to the environment and public health.
- Seventy-six per cent of domestic wastewater flows collected in sewers is safely treated.
- Eighteen per cent of domestic wastewater flows collected in on-site facilities is safely treated.
- Estimates should be considered as upper limits because data are skewed towards higher income countries, and there are data gaps on treatment performance, other sources and sinks of wastewater.
- Data on industrial discharges are poorly monitored and seldom aggregated at national level.
- Comprehensive reporting on 6.3.1 is also impeded by major data gaps relating to on-site treatment of domestic wastewater.
- Disaggregation of pollution load by source according to households, services and industry (which can be further disaggregated by International Standard Industrial Classification (ISIC) codes), will assist in identifying heavy polluters and consequently in applying the polluter pays principle to improve treatment.

[11] Preliminary estimates are calculated using data available at the time of publication and may change.

<table>
<tr><td></td><td>A sub-indicator on reuse would respond to the full aspirations of the target 6.3.1 and would encourage better assessment of reuse potential, in support of target 6.4 on water scarcity.</td></tr>
<tr><td>Definition of indicator and methodology

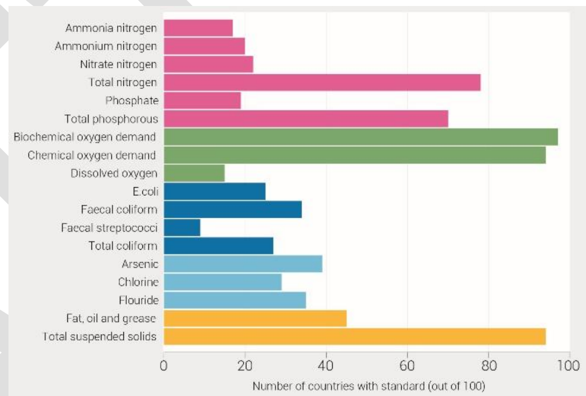
The first component measures the flow of safely treated domestic wastewater (sewage treated at treatment plants, wastewater from on-site facilities treated on site or emptied, transported and treated off site) as a proportion of all domestic wastewater generated based on household per capita water-use data.

Domestic wastewater is defined as wastewater from households and services. If the service types are defined by ISIC codes and require discharge consent, they are included in the industrial component . Preliminary domestic estimates cover households only. “Safely treated” is defined as meeting national treatment standards.

The second component measures volume of industrial wastewater flows in compliance with regulations and discharge permits as a proportion of all industrial wastewater discharged to sewers and to the environment. Industry types are defined by ISIC codes.

Comprehensive wastewater monitoring comprises tracking of: (1) household wastewater treated on site and off site to national standards, (2) wastewater generated from services, (3) industrial discharges to sewers and the environment and (4) proportion of wastewater reused. Countries can progressively monitor aspects according to their national priorities.</td><td>National standards for wastewater treatment

A review of national wastewater effluent standards analysed data from 100 counties and collated 275 national standards covering multiple wastewater effluent quality requirements. National standards, most commonly issued by ministries of environment, normally propose organic and nutrient parameters as primary measures of treatment. levels of acceptance for each parameter vary according to source, disposal and reuse type.



Review of national standard of wastewater quality parameters

Data source: WHO and UN-Habitat.

Better alignment of national standards with global norms would facilitate comparison of global data, and in some cases could improve the quality of national standards.</td></tr>
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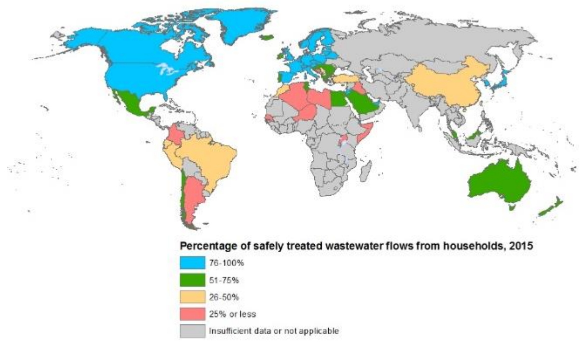
Percentage of safely treated domestic wastewater flows

In 22 of the 79 countries with data safe treatment level of household wastewater flows is 50 per cent or less.

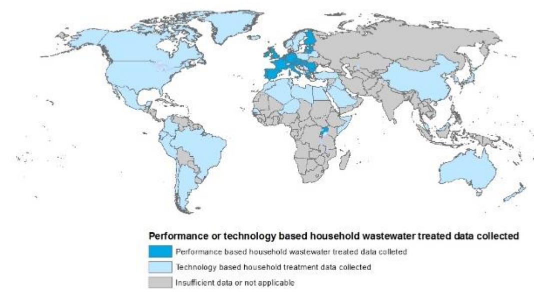


Proportion of domestic wastewater treatment which is safely treated

Data source: WHO and UN-Habitat.

Less than 25 per cent of the population is connected to sewered wastewater services in 102 countries (mostly in Africa and Asia). High-income countries are predominantly served by sewerage, and treatment plant performance rates are higher. Low- and middle-income countries have predominantly on-site facilities and very few collect data on treatment for on-site facilities.

More than a third of wastewater treatment estimates are based on treatment performance data.



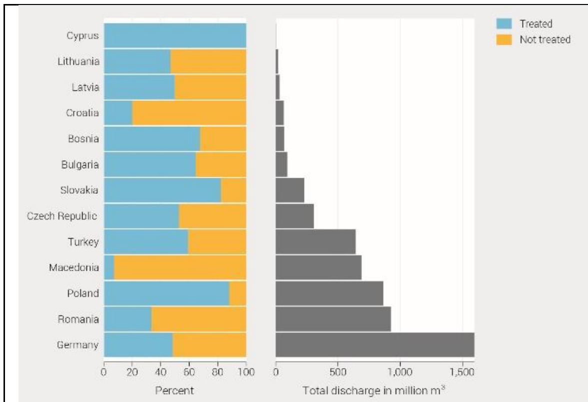
Countries reporting on wastewater treatment based in terms of performance of treatment and expected performance based on the technology used.

Data source: WHO and UN-Habitat.

Twenty-eight of 79 country estimates for wastewater are based on reliable performance data reflecting whether treatment complies with national or regional standards. The remaining 51 country estimates are based on treatment technology data. Treatment performance reflects the effects of overloading, unpermitted industrial discharge, and poor operation and maintenance on effluent quality.

Insufficient data are available to estimate treatment of industrial wastewater flows to sewers and direct to the environment. In most countries, discharge permit records are kept at the municipal level or in environmental protection agencies. They are seldom aggregated and reported at the national level. Collection and aggregation of permit data sorted by ISIC code are needed for complete reporting on indicator 6.3.1 (this could be achieved by issuing permits and ensuring that industries are compliant).

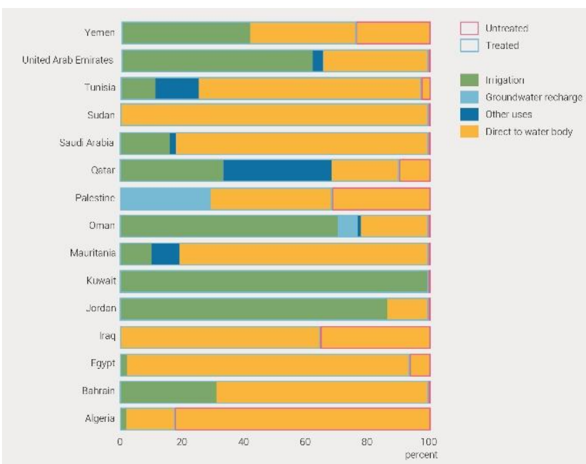
Eurostat industrial emission data for 13 countries illustrate potential data sources for the industrial component of SDG 6.3.1. However, data should be interpreted with care as they could include as “untreated” wastewater that does not need to be treated before being discharged and may constitute a substantial share. Combining the domestic and industrial components into a single indicator may be possible at a later stage when data become available on pollution loads expressed as the five-day biochemical oxygen demand for domestic and industrial discharges.



Percentage of safely treated industrial wastewater flows. Note: “untreated” wastewater may include wastewater that does not need to be treated before being discharged.

Data source: European Union (2016).

Wastewater as a resource



Reuse of wastewater in Arab States

Data source: Leagues of Arab States, UNESCWA and ACWUA (2016).

Target 6.3 calls for a substantial increase of safe reuse of wastewater. Data on the use of wastewater and sludge are routinely collected in some regions to inform responses to water scarcity and pollution. Including a subindicator on reuse at the country and regional levels or during the 2020 revision of the SDG indicator framework would address the target more completely. Definitions of “safe reuse” for monitoring purposes are needed. Levels of treatment required should correspond to the level of risk to human health and the environment for each reuse type.

The arid Arab States have proactive policies that address water scarcity and monitor progress. Jordan, Kuwait and Oman use at least secondary treatment prior to water use in agriculture.

Other countries still have significant proportions of untreated wastewater. These represent opportunities to increase treatment and productive use for irrigation and groundwater recharge.

Sources:

European Union (2016). Eurostat database. Available from http://ec.europa.eu/eurostat/data/database.

League of Arab States, United Nations Economic and Social Commission for Western Asia and (UNESCWA) and Arab Countries Water Utilities Association (ACWUA) (2016). *Regional Initiative for Establishing a Regional Mechanism for Improved Monitoring and Reporting on Access to Water Supply and Sanitation in the Arab Region (MDG+ Initiative). Second report.* Amman. (In Arabic). Available from http://acwua.org/mdg+/library/9-second-report-2016-ar/file.

United Nations, Department of Economic and Social Affairs, Statistical Division (2012). *International Recommendations for Water Statistics*. New York. Sales No. E.10.XVII.15.

World Health Organization (WHO) and United Nations Children’s Fund (UNICEF) (2017). *Progress on Drinking Water, Sanitation and Hygiene: 2017 Update and SDG Baselines*. Geneva. Available from https://washdata.org/report/jmp-2017-report-final.

Indicator 6.3.2: Proportion of bodies of water with good ambient water quality

Custodian agency: UN Environment

Introduction

Ambient water quality refers to natural, untreated water in rivers, lakes and groundwater, and represents a combination of natural and anthropogenic influences. Indicator 6.3.2 enables the impact of human development on ambient water quality to be evaluated over time. It provides an indication of the services that can be obtained from aquatic ecosystems, such as clean water for drinking, preserved biodiversity, sustainable fisheries and water for irrigation.

Monitoring the indicator and methodology

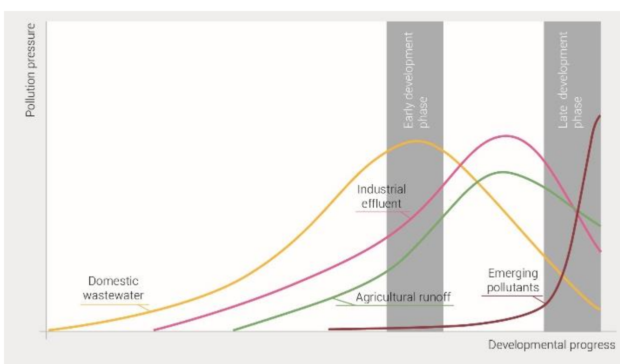
Monitoring and assessing water quality is essential, but natural variability in water bodies caused by differences in geology and climate means that it is not practical to set global ambient water quality standards or targets. Each country must define "good ambient water quality" and set its own standards and targets based on its specific conditions. These should ensure the aquatic ecosystem is healthy, and that there is no unacceptable risk to human health arising from intended use of the water without prior treatment. The selected core parameters for indicator 6.3.2 are simple to measure and are a good starting point for countries with less-developed monitoring capacities. They allow conclusions to be drawn on anthropogenic pollution such as wastewater discharge and agricultural runoff.

Parameters for monitoring SDG indicator 6.3.2

Parameter	River	Lake	Groundwater
Dissolved oxygen	X	X	
Electrical conductivity	X	X	X
Nitrogen	X	X	
Nitrate			X
Phosphorus	X	X	
pH	x	x	X

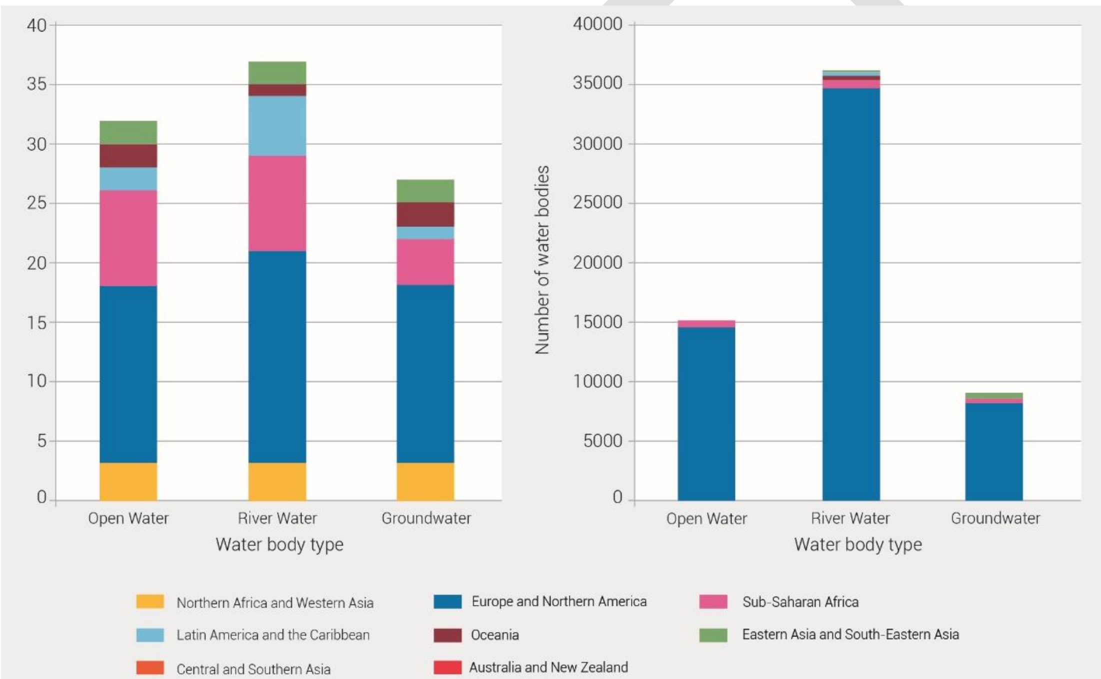
Key messages

- Ambient freshwater quality is at risk globally. Freshwater pollution is prevalent and increasing in many parts of Latin America, Africa and Asia. The lack of water quality monitoring in many parts of the world does not allow for an exact global estimate of water pollution.
- Monitoring programmes can be perceived as expensive, but costs are minimal compared to the relative value of the water resources and the savings made by scientific decision-making.
- Increasing population and economic activity can propel a substantial increase in water pollution due to the emphasis on economic activity at the expense of environmental quality.
- Public concern is often the instigator of change. There is pressure on relevant authorities to respond to rising pollution by initiating control measures aimed at reducing the pollution increase. If control measures are sufficient, the intensity of water pollution peaks, then levels of organic pollution, nutrient loading and pathogen contamination diminish.
- Water quality problems persist, even in developed countries, including the continued loss of pristine quality water bodies and also effects associated with changes in hydromorphology, the rise in emerging pollutants and the spread of invasive species.
- The figure below highlights various pressures on water quality as they rise and fall relative to increasing development. Actions can be taken to mitigate or avoid the effects, once drivers are identified. The main technical options for avoiding water quality deterioration are pollution prevention, treatment of polluted water, safe use of wastewater, and restoration and protection of ecosystems.



The methodology[12] allows countries to increase the sophistication of their submissions by including additional parameters, using supplementary methods of assessing water quality such as biological methods and remotely sensed data, and by encouraging countries to expand their monitoring networks over time.	Pressures on water quality with increasing development: experiences from developed countries *Source:* Adapted from Borchardt and others (2016).

Indicator 6.3.2 calls for available in-situ data derived from national monitoring systems to be combined into a water quality index. This process will provide a broader database to reflect water quality status and a trend over time during the lifetime of the 2030 Agenda. The 2017 baseline data drive for indicator 6.3.2 resulted in 48 country submissions as of January 2018 for open waters, rivers and groundwater bodies. Thirty-two countries reported on 15,056 open water bodies, 37 on 36,142 rivers and 27 on 8,993 groundwater bodies. Twenty-four countries reported on all three water body types, nine on two types and six on one type.



Number of reporting countries (left) and water bodies (right) by water body type and region in 2017

Source: International Centre for Water Resources and Global Change (ICWRGC)

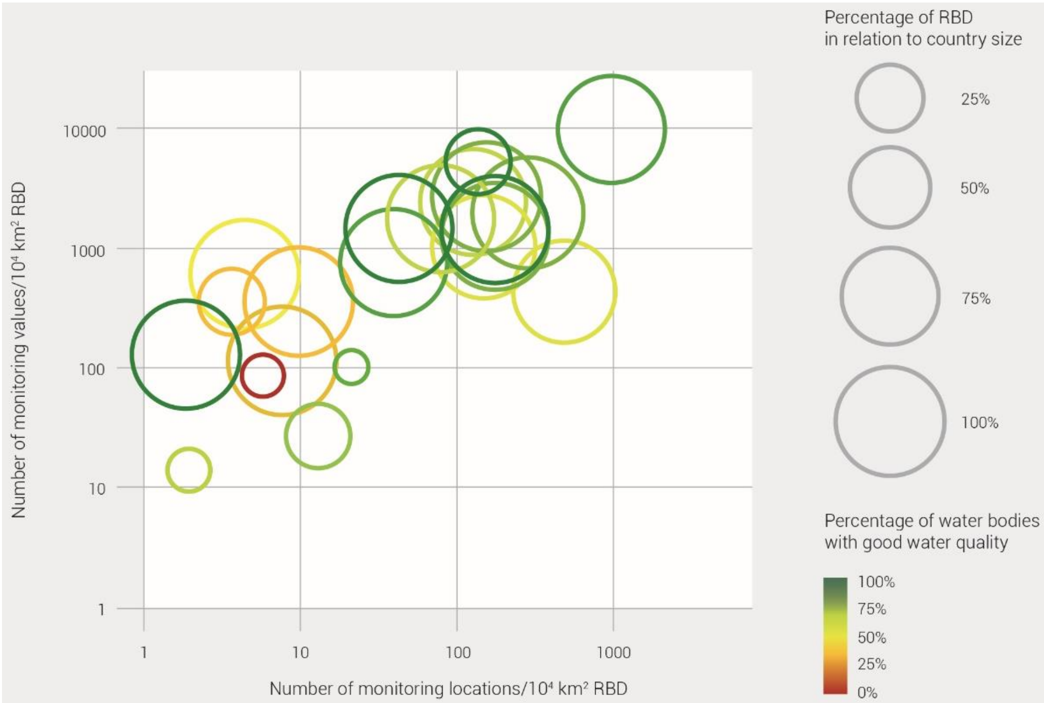
Note: Data were available and collected from six out of eight SDG regions (Central and Southern Asia and Australia and New Zealand are pending clarification), and for all water body types, but countries in Europe and Northern America used the most data as output from developed and extensive monitoring programmes.

Data scarcity

Some countries report using a low density of monitoring stations and monitoring values for a large proportion of the country (large circles, located bottom left, in the figure below). As a result, the likelihood of the submitted value reflecting real-world water quality is low compared to those using many monitoring stations and values (top right).

[12] Further information on the methodology is available form http://www.unwater.org/publications/step-step-methodology-monitoring-water-quality-6-3-2/.

Some of the more developed countries used tens of thousands of monitoring records to calculate the indicator, while some LDCs had limited monitoring programmes, or only reported on a single key waterbody.



Summary of 2017 baseline indicator 6.3.2 submissions

Source: International Centre for Water Resources and Global Change (ICWRGC)

Notes: RBD is reporting basin district. The circle size relates to the proportion of the individual country covered. The location of the circle indicates the number of monitoring stations and monitoring values used in the indicator calculation in the individual country.

Sources:

Borchardt, Dietrich and others, eds. (2016). *Integrated Water Resources Management: Concept, Research and Implementation.* Basel: Springer international Publishing.

Lovett, Gary M. and others (2007). Who needs environmental monitoring? *Frontiers in Ecology and the Environment*, vol. 5, No. 5, pp. 253–260.

Global Environment Monitoring System for Water (GEMS/Water) (2017). GEMStat. Available from http://gemstat.org/about/#gemstat.

United Nations Environment Programme (UNEP). 2016. *A Snapshot of the World's Water Quality: Towards a Global Assessment.* Nairobi. Available from https://uneplive.unep.org/media/docs/assessments/unep_wwqa_report_web.pdf.

Challenges, opportunities and policy implications

Water pollution has worsened since the 1990s in almost all rivers in Latin America, Africa and Asia, with severe pathogen pollution affecting around one third of all river stretches in these regions. The number of people at risk of health issues by coming into contact with polluted surface waters may be tens of millions on these continents (UNEP, 2016).

Managing wastewater by increasing wastewater collection and treatment (on-site and off-site) can support achievement of the 2030 Agenda. Wastewater should be seen as a sustainable source of water, energy, nutrients and other recoverable by-products, rather than as a burden. Choosing the most appropriate type of wastewater treatment system that can provide the most co-benefits is site specific, and countries need to build capacity to assess this. Reuse of water needs to take into account the whole river basin, as wastewater from one part of a basin may well be the source of supply for others downstream. A coordinated and pragmatic policy environment bringing together industry, utilities, health, agriculture and the environment is needed to promote innovative safe recycling and reuse of wastewater (WWAP, 2017).

Reporting on indicator 6.3.2 relies on a country's capacity to implement an ambient water quality monitoring programme. Monitoring programmes and data interpretation in many developed countries are routine and fulfil national and regional reporting requirements aimed at protecting or restoring water resources. However, most developing countries lack capacity to collect and analyse the data needed for indicator 6.3.2. Regional reporting of ambient water quality provides opportunities and challenges, and data collation to provide a complete picture can be problematic for many countries. Data are often stored either regionally or within single institutions, and many countries do not have a central database facility for water quality data. Data often reside in the laboratories where samples were analysed and are not made available for reporting at any level. Policies for harmonization of data standards and open data access need to be put in place, to allow establishment of information systems and data sharing to enable intra- and intersectoral cooperation within and beyond national boundaries.

Managing wastewater and water quality also needs to include better knowledge of pollution sources. SDG reporting could support countries in aggregating wastewater subnational data and publicly reporting at the national level. This would include monitoring performance to ensure treatment plants are managed and maintained to deliver effluent suitable for safe disposal or use according to national standards, which may vary from country to country. Countries that do not have national standards and monitoring systems need to assess performance of on-site and off-site domestic wastewater treatment systems. Formalizing the informal sector through various policy instruments is needed to prevent excessive contamination. Incentives for the informal sector to be registered with the government could be accompanied with combined analysis of all wastewater sources and their relative contribution to health and environmental risks. This would enable countries to prioritize investments on pollution control that contribute most to achieving SDG target 6.3.

Key challenges in large parts of the world are localized in the technical, personnel and financial capacities to establish, maintain and further develop water quality monitoring. Monitoring everything is either simply not possible or not cost-effective. Capacity development needs to look at the hardware available (laboratory level) and the process of data collection in the field, as well as the analysis of data, upscaling solutions and institutional collaboration on statistics. A specific policy focus also needs to be put on groundwater monitoring (a neglected area), to inform water management decisions with regard to quality, quantity and recharge dynamics. The use of Earth observation and citizen science as well as private sector data, now and in the future, must play an increasing role in addressing data gaps in time and space, and could also provide complementary evidence and broaden the awareness and engagement of civil society and the private sector.

Pollution, climate change, conflicts, water-related disasters and demographic shifts are putting unprecedented pressure on water resources in many regions of the world. More information on these complex linkages will improve the performance of decision makers. However, political acceptability to regulate pollution and decision implementation are two of the main barriers for tackling the water pollution challenge, in addition to the problem of gaps in data. The evidence available to inform decision-making will always be uncertain, as demonstrated by the emergence of new pollutants and the identification of diffuse pollution sources. Action has to be taken at some point.

E. Target 6.4: Water use and scarcity

"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"

This target aims to ensure there is sufficient water for people, the economy and the environment, by reducing water withdrawals and increasing water-use efficiency across all sectors of society. Securing environmental water requirements is essential for maintaining ecosystem health and resilience, so that enough water is left in the environment at any given moment to sustain natural processes.

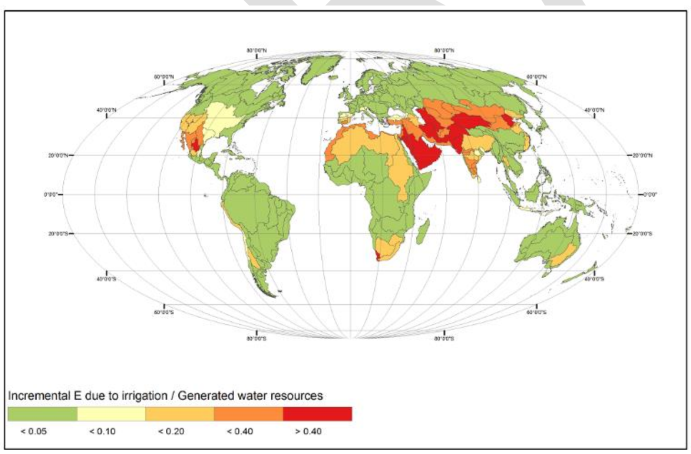
Increasing water-use efficiency means using less water while carrying out society's economic activities. This can be done by increasing agricultural water productivity and reducing water losses, such as tackling leakage in municipal distribution networks. This is particularly relevant to sectors that use or consume high volumes of water, such as agriculture, industry, energy and municipal water supply.

A high level of water stress (indicator 6.4.2) can affect economic development and food security and increase competition and potential conflict among users. This calls for effective supply and demand management policies (linked to SDG targets 6.3 and 6.5).

Box 7 Assessing water scarcity in irrigated agriculture

Irrigated agriculture is one of the main subsectors causing water scarcity in an increasing number of regions. The figure below shows estimated water stress in major river basins expressed as a percentage of incremental evaporation due to irrigation over groundwater and surface water resources.

These results were generated by GlobWat, a freely available global soil water balance model developed by FAO and designed to assess water use in irrigated agriculture. Water balance is calculated using a two-step process. The first stage is a "vertical" water balance that includes evaporation from in situ rainfall ("green" water) and incremental evaporation from irrigated crops. The second stage is a "horizontal" water balance that determines discharges from river (sub)basins, taking into account incremental evaporation from irrigation, open water and wetlands ("blue" water).



Water stress per major river basin expressed as a percentage of incremental evaporation (E) due to irrigation over generated groundwater and surface water resources,

Source: Hoogeveen and others (2015).

Indicator 6.4.1: Change in water-use efficiency over time

Custodian agency: FAO

Introduction

This indicator is designed to assess the economic and social use of water resources in terms of the value added when water is used in different sectors of the economy. It includes losses that occur in distribution networks.

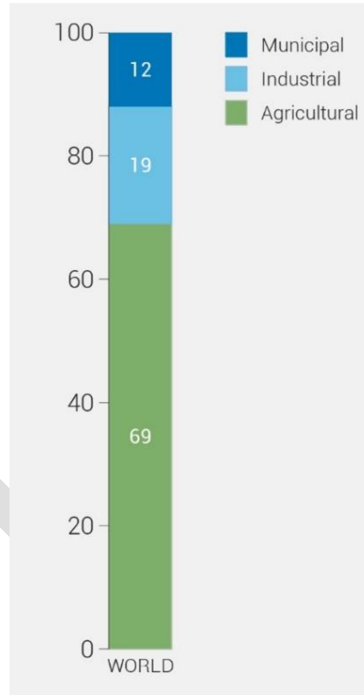
Water-use efficiency is defined as the gross value added per unit of water used, expressed in US$/m^3. It can help formulate water policy by focusing attention on those sectors or regions with low water-use efficiency, and on how to transfer successful actions from sectors or regions where water-use efficiency is much higher. This is a “blue” water indicator, meaning that it does not take into account the direct use of rainfall.

Increasing water-use efficiency over time means decoupling economic growth from water use across the main water-using sectors of agriculture, industry, energy and municipal water supply. This has strong synergies with sustainable food production (SDG 2), economic growth (SDG 8), infrastructure and industrialization (SDG 9), cities and human settlements (SDG 11) and consumption and production (SDG 15).

Key messages

- The rationale consists of providing information on efficiency of the economic and social usage of water resources.
- Interpretation would be enhanced by using supplementary indicators at country level, including irrigation efficiency and municipality network efficiency.
- Water-use efficiency is strongly influenced by the economic structure and the proportion of water-intensive sectors.
- Change in water-use efficiency is influenced by “real” improvements and deteriorations, as well as by changes in economic and social structure.
- Increasing values in time series indicate decoupling of economic growth from water use. This does not necessarily indicate decline in total water use or a reduction in the impact of water use (indicator 6.4.2).
- Preliminary data show that water-use efficiency accounts for 15 US$/m^3 globally, with country values ranging from about 2 to 1,000 US$/m^3.

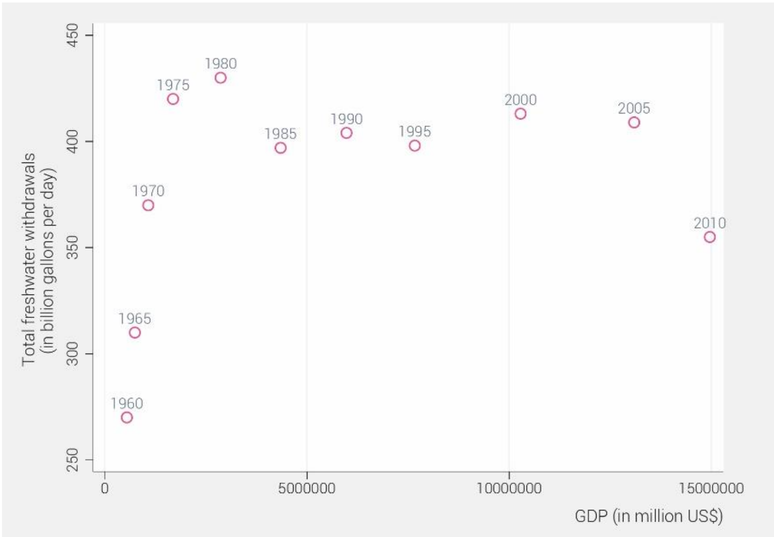
Agriculture accounts for 69 per cent of annual water withdrawals



Water withdrawal by sector in the world (per cent), 2010

Source: FAO (2016).

The figure below shows an example of decoupling: water abstraction in the United States grew with increasing GDP from 1960 to 1980, then stabilized and ultimately decreased by 2010.



Water abstraction and GDP in the United States from 1960 to 2010

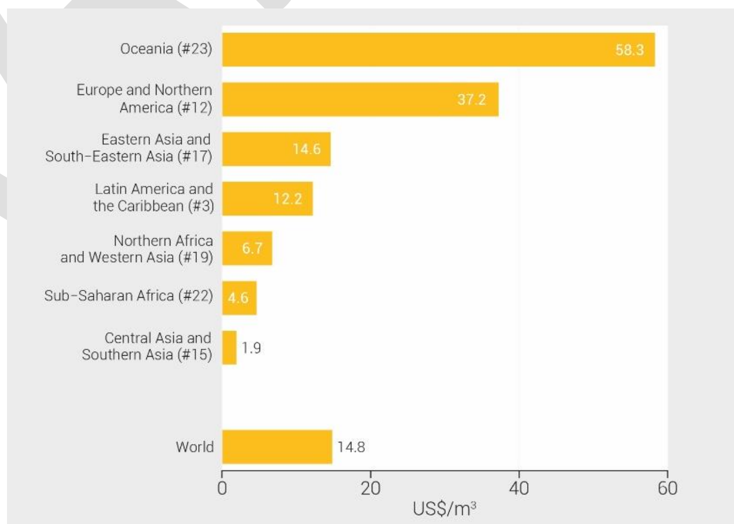
Sources: USGS (2018); World Bank (2018).

Methodology and monitoring[13]

This indicator is defined as the change in value added divided by the volume of water used, in US$/m^3, over time in a given major sector (showing the trend in water-use efficiency). The economic sectors are defined following the ISIC codes. Water use is intended as water that is received by an industry or households from another industry or is directly abstracted (from SEEA-Water[14]). While just a few countries have reported on this indicator, preliminary figures can be computed using the data available on FAO AQUASTAT, FAO FAOSTAT and the World Bank database.[15]

Preliminary estimates for water-use efficiency were available for 168 countries and for all the SDG regions in 2017.

Indicator 6.4.1: Water-use efficiency



Level of water-use efficiency by region (US$/m3)
Source: FAO (2016).

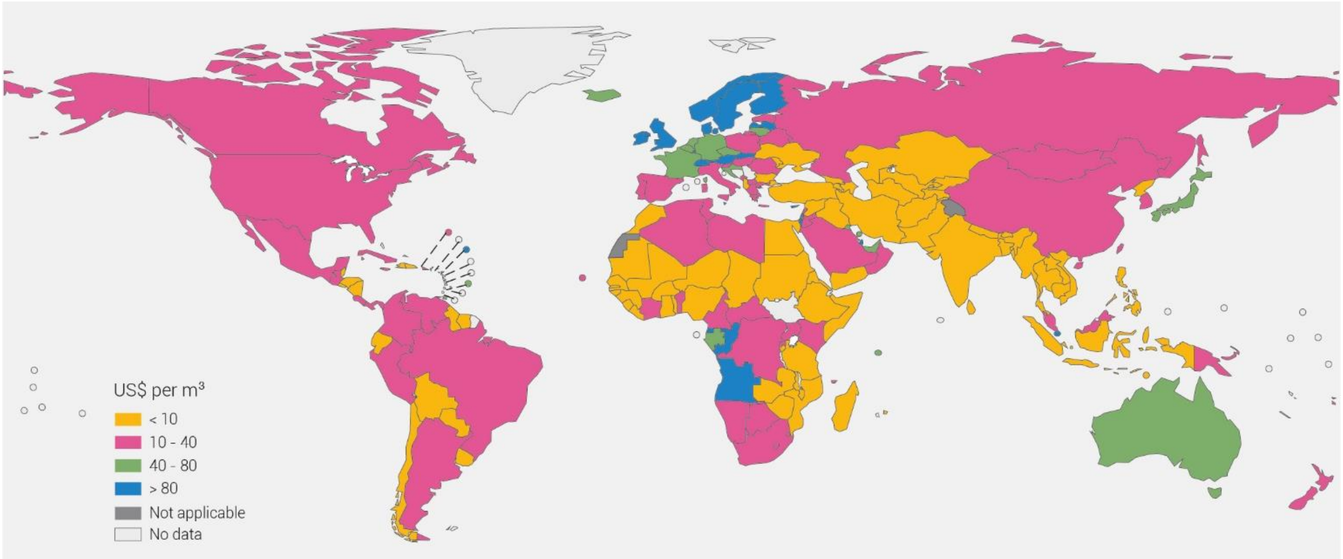
While the map shows substantial differences among regions in terms of aggregated water-use efficiency, it indicates that countries at a different level of general development have comparable values of water-use efficiency. This is because the indicator takes into account a combination of economic size and water use. As water use generally increases with economic development, it is difficult

[13] The methodology for this indicator was endorsed at Tier II by IAEG-SDGs during its session in November 2017. The next revision will take place in March 2020. FAO is also working with country partners towards developing a third indicator that could focus more on those resources.

[14] Further information on SEEA-Water is available from https://unstats.un.org/unsd/envaccounting/seeaw/.

[15] The metadata for this indicator are available from https://unstats.un.org/sdgs/metadata/files/Metadata-06-04-01.pdf.

to predict the outcome based on simple hypotheses. However, the actual indicator is based on the change of water-use efficiency over time, which will be computed at the country level. Data for computation are not yet available.



Water-use efficiency (US$/m^3)

Source: FAO (2017).

Sources:

Food and Agriculture Organization of the United Nations (FAO) (2016). AQUASTAT database. Water withdrawal by sector, around 2010. Available from http://www.fao.org/nr/water/aquastat/tables/WorldData-Withdrawal_eng.pdf.

__________ (FAO) (2017). AQUASTAT database.

United Nations, Department of Economic and Social Affairs (2017). Sustainable development knowledge platform. Available from https://sustainabledevelopment.un.org/.

UN-Water (2017). *Integrated Monitoring Guide for SDG 6. Step-by-step Monitoring Methodology for Indicator 6.4.1 on Water-use Efficiency*. Available from http://www.unwater.org/publications/step-step-methodology-monitoring-water-use-efficiency-6-4-1/.

United States Geological Survey (USGS) (2018). USGS water use data for the nation. Available from https://waterdata.usgs.gov/nwis/wu.

World Bank (2018). DataBank – world development indicators. Available from http://databank.worldbank.org/data/home.aspx.

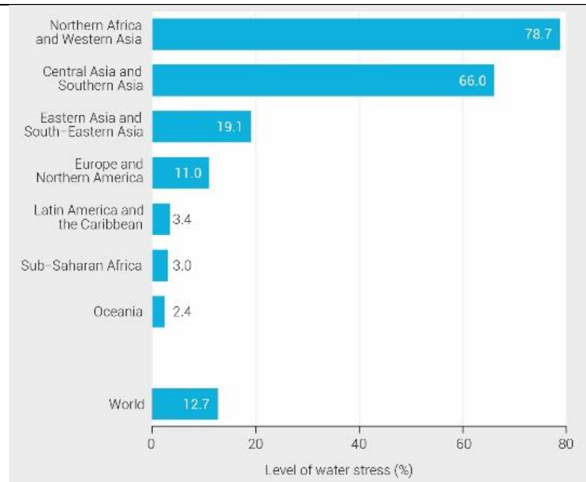
<table>
<tr><td colspan="2">Indicator 6.4.2: Level of water stress: freshwater withdrawal as a proportion of available freshwater resources</td></tr>
<tr><td>Custodian agency: FAO</td><td rowspan="2">Key messages
More than 2 billion people live in countries experiencing high water stress. The situation will likely worsen as populations and the demand for water grow, and as the effects of climate change intensify.
Water stress affects countries on every continent, and hinders the sustainability of natural resources, as well as economic and social development.
Estimates for the level of water stress are available for 171 countries and for all SDG regions. Thirty-one countries experience water stress between 25 and 70 per cent, and 22 countries are above 70 per cent and are considered to be seriously stressed. Eleven countries are above 100 per cent and include Libya, Saudi Arabia, United Arab Emirates and Kuwait, where the demand for fresh water is largely being met from desalination.
The global average water stress is 11 per cent, but there are significant differences among countries and regions, which global and regional assessments hide. Water stress values at the national level can hide differences between wet and dry areas of a country. One example is the large difference between the humid Amazon basin and the dry Pacific coast in Peru.
Regions with the highest water stress are Northern Africa and Western Asia (79 per cent) and Central and Southern Asia (66 per cent).
Sub-Saharan Africa, has a low level of water stress at 3 per cent, but this hides the large differences between the wetter north and drier south.</td></tr>
<tr><td>Introduction

Indicator 6.4.2 derives from indicator 7.5 on water stress that was applied during the MDG period, defined as “Proportion of total water resources used (percentage)”. However, during the MDG period, this indicator only accounted for water use due to human activities. Environmental flow requirements (EFR) are now also explicitly factored in as an important water user. Thus, water stress is defined as the ratio of total fresh water withdrawn by all major sectors to the total renewable freshwater resources, including environmental water requirements, and is expressed as a percentage.

Low water stress indicates little potential impact on resource sustainability and on potential competition among users. High water stress indicates substantial use of water resources, with larger impacts on resource sustainability, and the potential for conflicts among users. This indicator is useful for policymaking and helps to focus attention on those regions under high water stress.</td></tr>
<tr><td>Methodology and monitoring

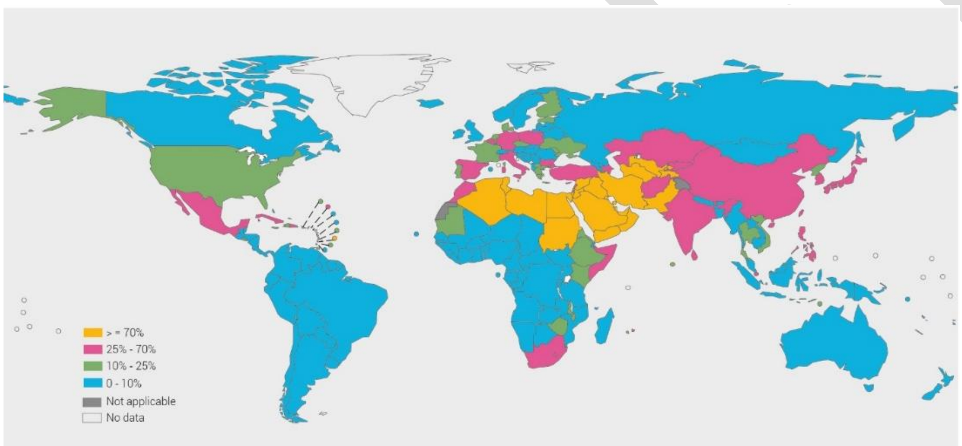
The indicator was upgraded to Tier I at the IAEG-SDGs session in November 2017.[16]</td><td>Indicator 6.4.2: Level of water stress</td></tr>
</table>

[16] The metadata for this indicator are available from https://unstats.un.org/sdgs/metadata/files/Metadata-06-04-02.pdf.



Levels of water stress by region (per cent), 2000–2014

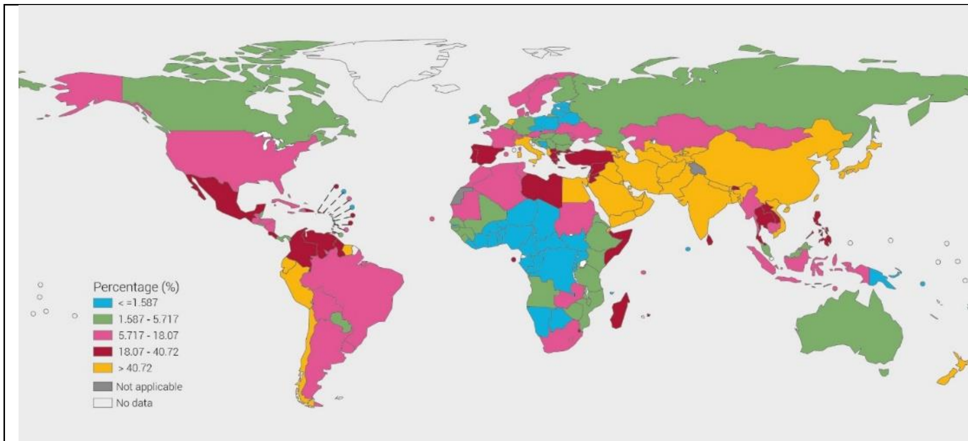
Source: FAO (2016).



Level of water stress

Source: FAO (2016).

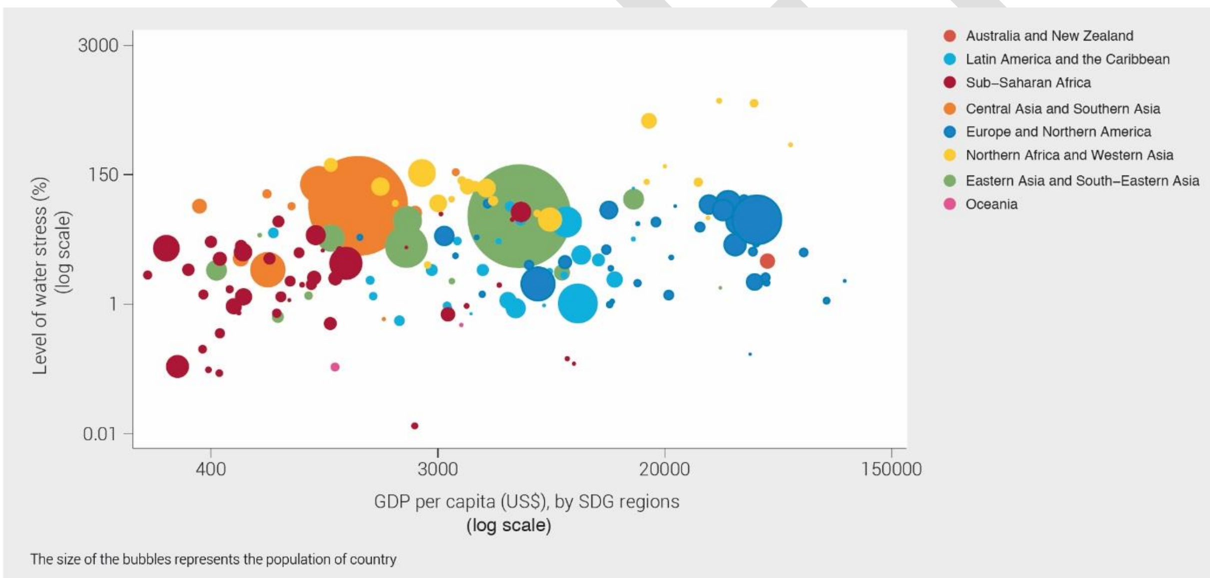
The map above shows the level of water stress estimated with data from AQUASTAT. Areas usually interpreted as very dry, like the Sahel region, appear to have low levels of stress, similar to more humid zones such as the Congo basin and Borneo. This is not contradictory. The indicator is based on the amount of water actually withdrawn in each country, which is generally low. This can be seen in the map below, which shows the proportion of cultivable land equipped for irrigation. The values mean that countries have scope for improving and increasing their water supply, for agriculture, industry and households, within the sustainable use of resources. This is a call for more investments in infrastructure and education and should not be interpreted as a denial of the huge problems of water supply and access that many people in those countries actually face.



Area equipped for irrigation as a percentage of cultivated area

Source: FAO (2016).

Water stress level varies widely among countries with similar GDP.



Level of water stress and GDP per capita in US$, 2002–2014

Source: FAO (2016).

Sources:

Food and Agriculture Organization of the United Nations (FAO) (2016). AQUASTAT database. Available from http://www.fao.org/nr/water/aquastat/main/index.stm.

United Nations, Department of Economic and Social Affairs (2017). Sustainable development knowledge platform. Available from https://sustainabledevelopment.un.org/.

UN-Water (2017). *Integrated Monitoring Guide for SDG 6. Step-by-step Monitoring Methodology for Indicator 6.4.2 on Water Stress*. Available form http://www.unwater.org/publications/step-step-methodology-monitoring-water-stress-6-4-2/

Challenges, opportunities and policy implications

Countries will need to make best use of their available water resources to achieve SDG target 6.4. The agriculture sector is by far the largest consumer in many LDCs, and therefore also offers the greatest opportunities for water saving. Saving just a fraction can significantly alleviate water stress in other sectors, particularly in arid countries where agriculture consumes a considerable amount of the available water resources. Agricultural water savings can come in many forms: through more sustainable and efficient food production ("more crop per drop"), through sustainable water management practices and technologies, and through reducing water consumption by growing crops that are less water intensive in water-scarce regions.

Employing smart technological solutions can help to increase irrigation efficiency and using treated wastewater can help to reduce freshwater withdrawals. Implementing sustainable agricultural practices (SDG 2), such as selecting drought-tolerant crop species, using reduced-volume irrigation systems and managing crops to reduce water losses, can also help to reduce water withdrawals and increase the effective use of available water resources.

Another option for water-scarce countries is to import food grown in water-rich countries, but this may conflict with political sensitivities as countries seek food security in terms of self-sufficiency. Although food production consumes most water, almost all the components of the food value chain offer opportunities to save water. Water savings in other sectors, such as in cooling for energy production, industrial plants and household use, must also be considered.

Indicator 6.4.1 measures the financial value produced by the economy per volume of water used and includes all sectors that use water. However, this does not tell the whole story for those developing countries whose GDP relies heavily on low-value agriculture. As most countries rely less than 30 per cent on agriculture for their GDP, it is necessary to consider all the sectors using water in order to assess the capacity of economy growth without overexploiting water resources.

While both indicators of target 6.4 can be disaggregated by economic sector, thus providing information for a detailed analysis of water use, in most cases, it would be futile to try to construct policies that aim to move water from one economic sector to another to increase the value of water-use efficiency. Other indicators will signal problems and demand changes if the development path becomes unbalanced.

As economies grow, countries tend to use more water for irrigation, households, energy, industry, mining and leisure. These have different capacities to produce value. Data show that in most countries, there is scope to increase water use without affecting water resources. However, a decline in water-use efficiency, particularly if accompanied by an increase in water stress, would instead indicate that the development pattern will become unsustainable in the future.

"Water-use efficiency" (indicator 6.4.1) refers to the economy and society. However, the information it provides is not sufficient to define detailed policies and to take specific operational decisions to improve the grass-roots efficiency of various water users. Additional indicators reflecting those uses would be useful in such situations. Improvements in water productivity and irrigation efficiency in agriculture, reduction of losses in municipal distribution networks, and industrial and energy cooling processes are among the main issues that such indicators should monitor. These will then provide decision-makers with the information they need to orient their development choices.

Box 8 “Saving” water on irrigation schemes in the corn belt of the western United States

The western United States corn belt includes approximately 7.3 million hectares cultivated with maize. About 43 per cent of this area is irrigated and accounts for 58 per cent of the total annual maize production. Data on maize grain yield, applied irrigation, irrigation system and nitrogen fertilizer rate collected over a three-year period (2005–2007) from commercial farms concluded that water savings can be made from changes to the irrigation system and irrigation management. While sprinkler and subsurface drip irrigation have the potential to increase irrigation efficiency when compared to gravity surface irrigation systems, irrigation schedules based on real-time crop requirements, soil water monitoring and short-term forecasts also appear to be good options. Scheduling irrigation based on soil water content and crop requirement could produce water savings up to 35 per cent with no yield penalty in eastern Nebraska, compared with standard farming practices. Centre pivot systems used 36 per cent less irrigation water than gravity surface irrigation to achieve the same yield, and conservation tillage required 20 per cent less irrigation water than conventional tillage. Crop residues under conservation tillage may diminish irrigation requirements by increasing precipitation storage efficiency and by reducing direct soil evaporation and surface runoff.

Note: “Irrigation efficiency” in this context is defined as water consumed by the crop divided by the amount withdrawn from a water source, and not as defined in indicator 6.4.1. Also, improvements in irrigation efficiency do not always directly translate into water savings. Research shows that farmers who “save” water tend to increase their irrigated area rather than hand the water back for others to use.

Source: FAO (2012).

F. Target 6.5: Water resources management and transboundary cooperation

"By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate"

The 2030 Agenda fully commits Member States to IWRM and transboundary cooperation over water resources. Putting this into practice will arguably be the most comprehensive step that countries can make towards achieving SDG 6. Implementing a holistic IWRM approach will provide institutional structures and multi-stakeholder processes to balance the development and use of water resources for people, for sustainable economic growth and for supporting vital ecosystem services. SDG target 6.5 thus embodies the core principles of the 2030 Agenda, and directly or indirectly supports all SDGs.

Transboundary cooperation is essential for ensuring sustainable development and use of water bodies, with 153 countries sharing rivers, lakes and aquifers with other countries. Managing water bodies that cross national administrative boundaries can catalyse cooperation, bring peace and stability to regions, and promote economic development. The need for cooperation among nations has been endorsed by numerous international organizations, governmental organizations and non-governmental organizations (NGOs). This target is important because it is one of the few SDG targets that explicitly demands transboundary cooperation over natural resources management. Achieving it will have wide-ranging benefits, such as supporting SDG 16 (peace and justice).

Target 6.5 builds on Agenda 21 of the United Nations Conference on Environment and Development in 1992 calling for "the application of integrated approaches to the development, management and use of water resources" (UNCED, 1992, chap. 18). With regard to transboundary cooperation, target 6.5 also builds on the global opening of the 1992 Water Convention (United Nations, Economic Commission for Europe, 1992),[17] the entry into force of the 1997 Watercourses Convention (United Nations, General Assembly, 1997) and the adoption, by the United Nations General Assembly, of Resolution 63/124 including its Annex on the Draft Articles on the Law of Transboundary Aquifers (United Nations, General Assembly, 2009b).

Box 9 Putting IWRM into practice

Having a low human development index (HDI) does not necessarily constrain countries from putting IWRM into practice.

Eight African countries with a low HDI reported medium to high levels of IWRM implementation, with scores ranging from 53 to 63: Benin, Burkina Faso, Mali, Mozambique, Senegal, Swaziland, Uganda and Zimbabwe. They reported medium to high implementation of policies, laws and plans (65) and institution and stakeholder participation (69). Most of these countries reported having high national institutional capacity and coordination among sectors, high levels of stakeholder participation at national and local levels, and regular opportunities for private sector involvement in water resources development and management.

However, they reported much lower levels of implementation for financing (41), which typically hindered implementation of management instruments (54). With the exception of Burkina Faso, these countries reported that the national budget for investment in water resources development and management, including infrastructure, was either insufficient to cover planned investments, or budget was allocated but not disbursed.

Source: UNEP-DHI (2018).

[17] The Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention) was originally pan-European but has been global since 2016.

Box 10 Positive steps towards transboundary cooperation

Many countries recognize the importance of adopting basin-wide agreements. For example, an agreement between Ukraine and Moldova, on cooperation in the field of protection and sustainable development of the Dniester River Basin, was adopted in 2012 and entered into force on 28 July 2017 (United Nations, Economic Commission for Europe, 2017). Similarly, Mozambique and Zimbabwe are currently negotiating operational arrangements for the Pungwe, Save and Buzi Rivers (IUCN, n.d.).

The 1944 Treaty between Mexico and the United States for the Utilization of the Waters of the Colorado and Tijuana Rivers and of the Rio Grande has evolved to better account for transboundary groundwater, restoration in the Colorado Delta and drought management (IBWC, n.d.).

The 1995 Mekong Agreement and Commission has proven to be an important platform for the countries of the lower Mekong region to exchange data and information and to develop joint plans and programmes. This has led to a better collective understanding of the social, economic and environmental dynamics of the basin and brought countries together to consider the benefits and potential impacts of existing and planned infrastructure projects (MRC, n.d.).

Indicator 6.5.1: Degree of implementation of IWRM

Custodian agency: UN Environment

Introduction

Implementing IWRM supports the equitable, efficient and sustainable use of water, which is vital to balancing the social, economic and environmental dimensions of SDG 6 and the 2030 Agenda.

Reporting on IWRM is a country-driven process

The completion of the 6.5.1 questionnaire (see below) is a country-driven process, providing the opportunity to bring multiple governmental and non-governmental stakeholder groups together. Completed questionnaires, which contain reasoning for the scores for each question, provide national policymakers with a simple diagnostic tool to identify which areas are progressing well, and those that may be facing barriers to progress.

Key messages

In 2017/2018, the global average degree of implementation of IWRM was 48 per cent, corresponding to medium low, but with great variation among countries.
More than 80 per cent of countries (157) reported on IWRM implementation, with strong representation from all regions and levels of development.
Comparisons with earlier surveys in 2007 and 2011 show that while modest progress is being made, most countries will not achieve indicator 6.5.1 by 2030 at current rates of implementation.
Governments and external support agencies should learn from experience and increase implementation efforts, to ensure accelerated progress and positive outcomes.
Attention should be given to building on IWRM monitoring and reporting, to address barriers to progress.

Financing for water resources management lags behind the other three key components of IWRM by about 10 per cent.

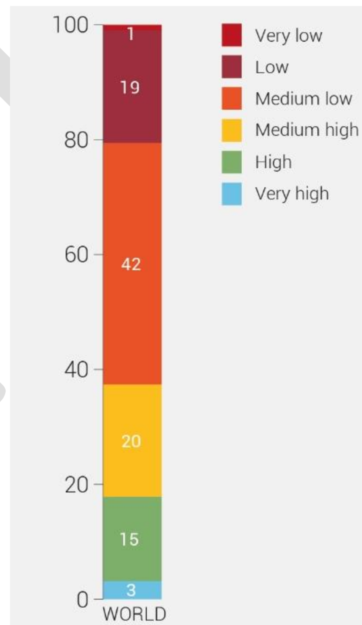
Key components of IWRM questionnaire 2017/2018

Aspects of IWRM with the greatest degree of implementation are reported to be cross-sectoral coordination and public participation at the national level (62 per cent implementation).

Aspects of IWRM with the lowest degree of implementation are reported to be financing (particularly subnational level, 33 per cent), gender considerations (particularly transboundary level, 33 per cent) and aquifer management instruments (41 per cent).

Arrangements and organizational frameworks for transboundary management are reported to be more advanced (56 per cent) than data and information sharing (48 per cent) and financing (40 per cent) for transboundary cooperation.

Thirty-eight per cent of countries reported at least medium-high IWRM implementation in 2017/18



IWRM implementation (per cent) in 2017/2018

Indicator definition

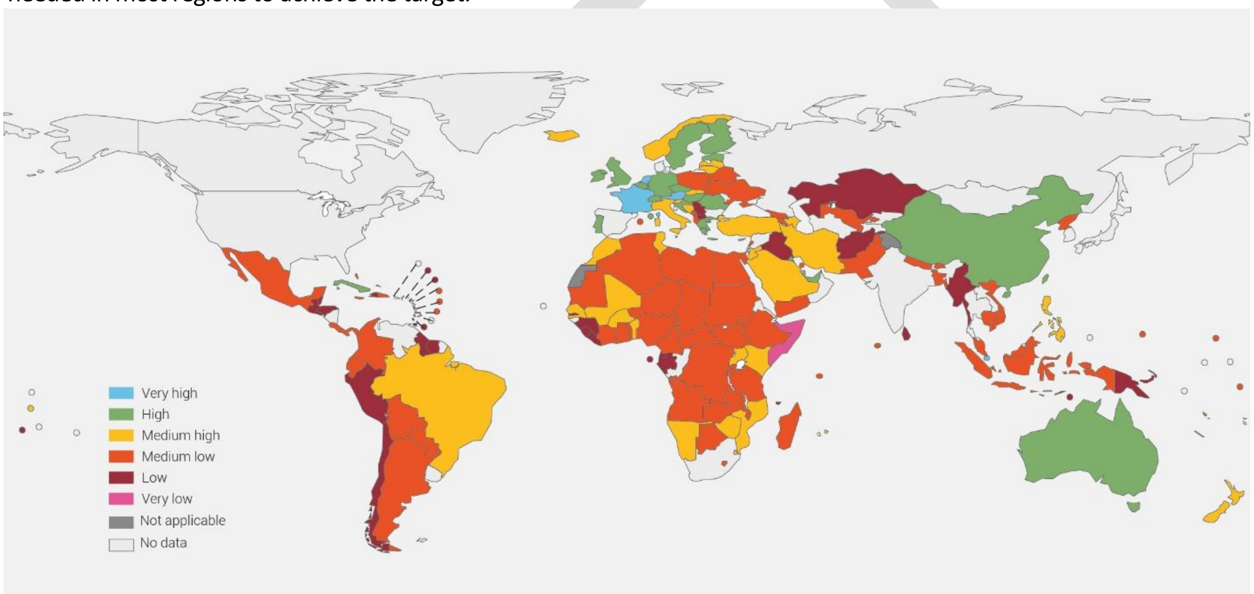
Indicator 6.5.1 measures the degree to which IWRM is being put into practice as a score between 0 and 100. The score is determined through a self-assessed country questionnaire, with 33 questions split into four sections: policy, laws and plans; institutions and participation; management instruments; and financing.[18]

Each section is divided into two subsections, addressing the "national" and "other" levels. Each country assigns each question a score from 0 to 100. The score selection is guided by descriptive thresholds. For each question, countries are encouraged to provide the reasoning behind their score. These measures help to increase the objectivity of the questionnaire, and the ability to subsequently compare and better understand the scores, as well as track progress over time. Question scores are averaged to provide the overall score for indicator 6.5.1.

IWRM implementation (0–100 per cent) is reported in the following categories:

	Very low	Low	Medium low	Medium high	High	Very high
Percentage thresholds	0–10	11–30	31–50	51–70	71–90	91–100

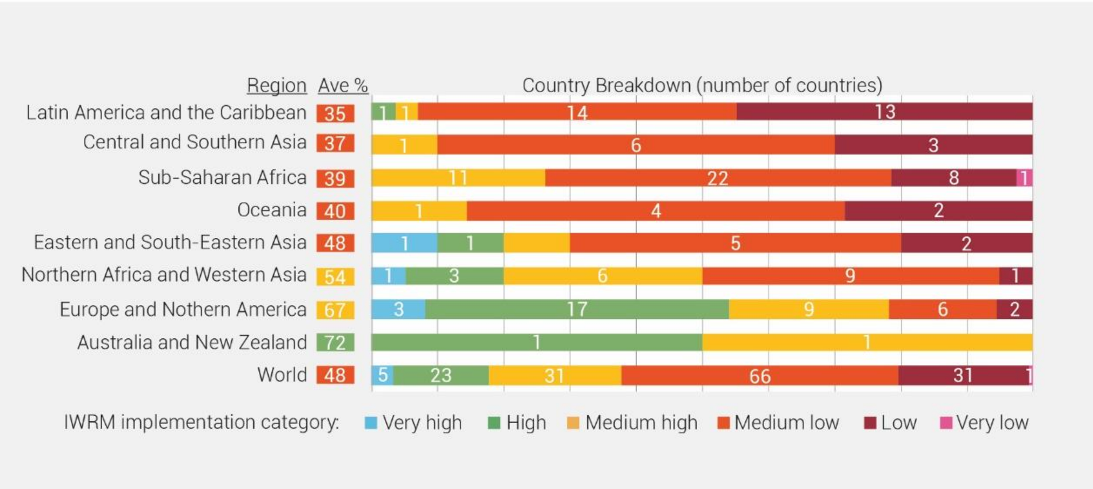
In 2017/2018, 62 per cent of countries reported medium-low IWRM implementation or lower. Accelerated progress is needed in most regions to achieve the target.



Status of IWRM implementation in countries in 2017/2018

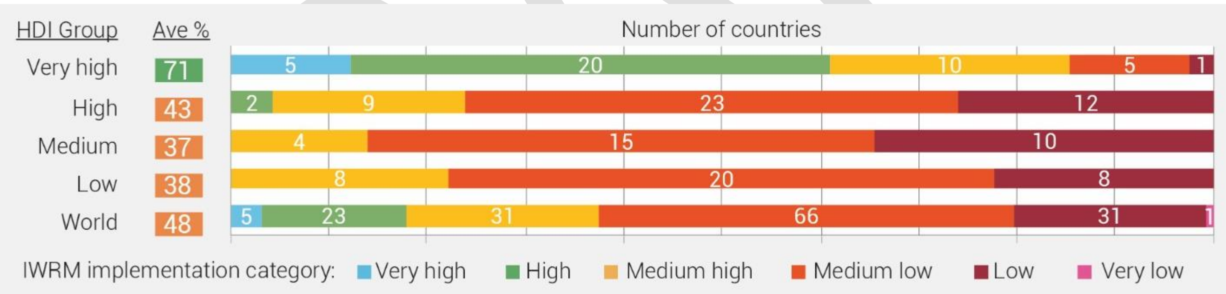
Each region contains examples of countries with at least medium-high implementation, although regional differences exist. This indicates that the level of development need not be an absolute barrier to progress, but it is an influencing factor.

[18] The full questionnaire and associated guidelines are available from http://iwrmdataportal.unepdhi.org/iwrmmonitoring.html.



Average percentage of implementation of IWRM (left column), and the number of countries in each IWRM implementation category (right bar chart) in 2017/2018

Of the countries in the very high HDI group, 85 per cent reported at least medium-high IWRM implementation. In the other three HDI groups, less than 25 per cent of countries had reached this level of implementation. This may be due to countries that are not yet in the very high HDI group prioritizing sectoral development and use of water resources in a non-integrated manner. However, this development path is not likely to result in sustainable water use. The countries with at least medium-high implementation in each HDI group may provide learning opportunities for other countries in similar situations.



Average percentage of implementation of IWRM (left column), and the number of respondent countries in 2017/2018

Source:

UN Environment-DHI Partnership (UNEP-DHI) (2018). IWRM data portal. Available from http://iwrmdataportal.unepdhi.org/iwrmmonitoring.html.

Indicator 6.5.2: Proportion of transboundary basin area with an operational arrangement for water cooperation

Custodian agencies: UNECE/UNESCO

Introduction

Indicator 6.5.2 measures and monitors transboundary water cooperation.

A questionnaire was sent to all 153 countries that share transboundary basins (rivers, lakes and aquifers) in the first quarter of 2017, inviting them to report on transboundary water cooperation. Responses were received from 107 countries. Not all country responses are included in the baseline data, as 44 reports require clarification from the relevant country.

Data coverage, especially in relation to TBAs, is expected to improve as the SDG monitoring process continues.

Indicator definition

SDG indicator 6.5.2 measures the proportion of transboundary basin area within a country covered by an operational arrangement, including the area of river and lake basins and aquifers.

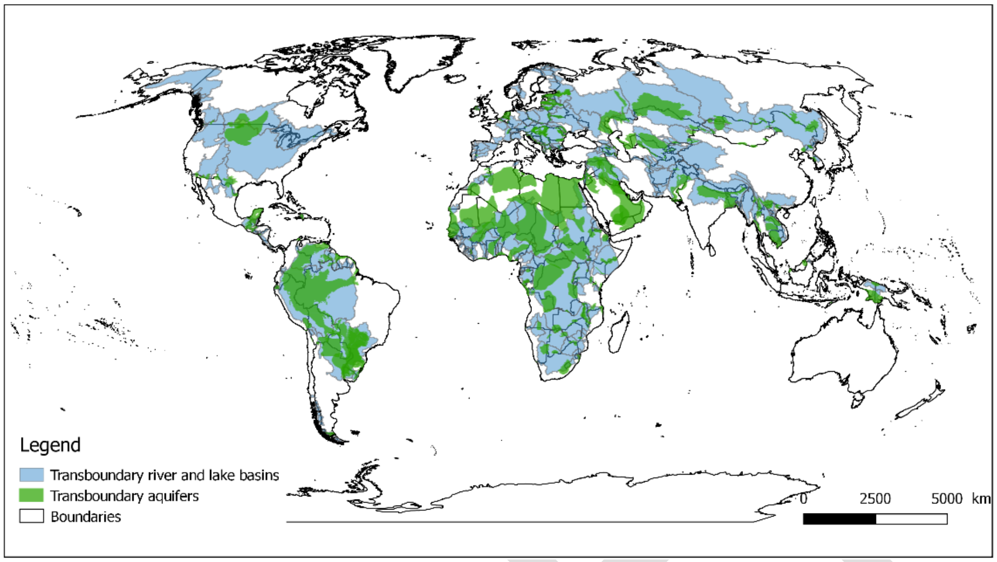
An “operational arrangement” is defined as a treaty, convention, agreement or other formal arrangement that meets the following criteria: there is a joint body for transboundary cooperation in place; the countries involved meet at least once per year; there is a joint or coordinated water management plan, or joint objectives have been set; and there is at least an annual exchange of data and information.

By considering the operationality of transboundary water cooperation, these criteria seek to go beyond simply measuring whether arrangements are in place.

Key messages

- The average of the national percentage of transboundary basins covered by an operational arrangement is 59 per cent in the period 2017/2018, based on data received from 61 out of 153 countries sharing transboundary waters. This value suggests that a significant effort is needed to ensure that operational arrangements are in place for all transboundary waters by 2030.
- Seventeen countries reported operational arrangements in place for all their transboundary basins, 14 of which are in Europe.
- An assessment of SDG indicator 6.5.2 across the four criteria of operationality demonstrates considerable diversity in the types of transboundary water arrangements that countries have entered into and the joint bodies established.
- Countries highlight the challenges in developing transboundary cooperative arrangements as including power asymmetries among countries; fragmentation in national legal, institutional and administrative frameworks; lack of financial, human and technical capacity; and poor data availability, especially in relation to transboundary aquifers and their delineation.
-

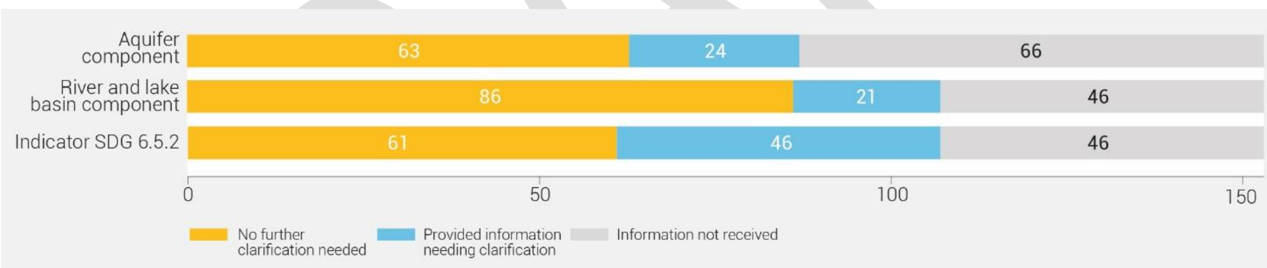
Two hundred and eighty-six transboundary rivers and lakes, and 592 TBAs, are shared by 153 countries. Fourteen transboundary river basins with the highest levels of economic dependence are home to 1.4 billion people. Areas of high groundwater development stress in TBAs are presently limited, but are likely to more than double between now and 2050.



Geospatial localization of transboundary rivers, lake basins and aquifers and national borders

Sources: UNESCO-IGRAC and UNESCO-IHP (2015) and UNESCO-IHP and UNEP (2016b).

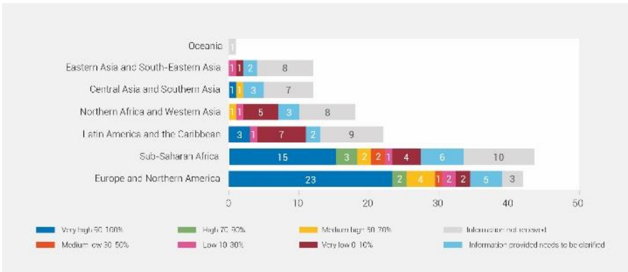
As of 28 February 2018, 107 countries had reported during the first reporting exercise for SDG indicator 6.5.2.



Number of respondent countries to SDG 6.5.2 questionnaire in 2017/2018

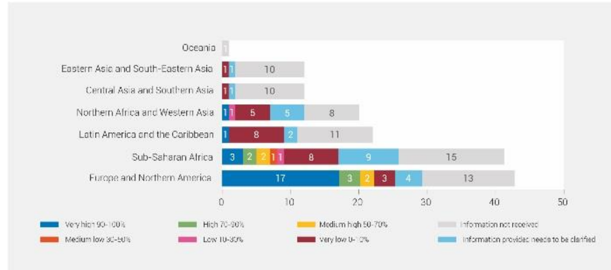
Reporting must be viewed as a national perspective. Efforts have been made to harmonize the process of data collection, and to consider relevant international data sources, such as the Global Environment Facility (GEF) Transboundary Waters Assessment Programme and UNESCO International Hydrological Programme (IHP) Internationally Shared Aquifer Resource Management Initiative (ISARM). However, data provided by the countries have been prioritized where discrepancies remained between international data sources and national data.

The average of the national percentage of transboundary river and lake basins covered by an operational arrangement is 64 per cent, based on 86 countries.



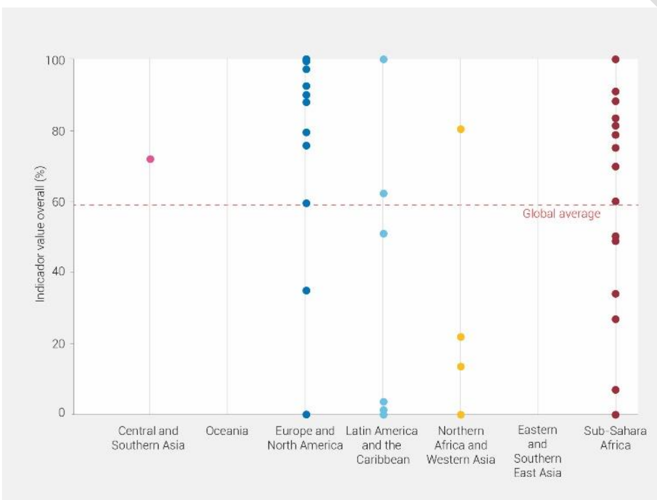
Regional breakdown of the number of countries sharing river and lake basins and responses to SDG indicator 6.5.2 in 2017/2018

The average of the national percentage of TBAs covered by an operational arrangement is 47 per cent, based on 63 countries.



Regional breakdown of the number of countries sharing aquifers and responses to SDG indicator 6.5.2 in 2017/2018

A significant effort is needed to ensure that all transboundary basins are covered by operational arrangements.



Proportion of transboundary basin area with an operational arrangement for water cooperation in 2017/2018

- Out of the 19 countries in sub-Saharan Africa, 12 show that at least 50 per cent of their transboundary basins are covered by operational arrangements. For transboundary rivers and lakes only, 18 out of 27 countries reported at least 75 per cent coverage, whilst for transboundary aquifers only, 5 out of 18 meet this threshold. Countries in Europe and Northern America show the highest levels of transboundary cooperation. Out of the 24 countries considered, 21 reported an indicator value of at least 75 per cent.
- Operational arrangements are absent in many basins in Northern Africa and Western Asia and in Latin America and the Caribbean.
- Data are only available for 2 out of 24 countries sharing transboundary waters in Central and Southern Asia, and Eastern and South-Eastern Asia.

Sources:

United Nations Educational, Scientific and Cultural Organization-International Groundwater Resources Assessment Centre (UNESCO-IGRAC) and United Nations Educational, Scientific and Cultural Organization-International Hydrological Programme(UNESCO-IHP) (2015). Transboundary Aquifers of the World Map. Scale 1:50000000.

United Nations Educational, Scientific and Cultural Organization-International Hydrological Programme (UNESCO-IHP) and the United Nations Environment Programme (UNEP) (2016a). Transboundary Aquifers and Groundwater Systems of Small Island Developing States: Status and Trends. Nairobi: UNEP.

United Nations Educational, Scientific and Cultural Organization-International Hydrological Programme (UNESCO-IHP) and the United Nations Environment Programme (UNEP) (2016b). Transboundary Aquifers and Groundwater Systems of Small Island Developing States: Status and Trends. Database portal. Available form http://twap-rivers.org/indicators/

United Nations Environment Programme-DHI Partnership (UNEP-DHI) and UNEP (2016). Transboundary River Basins: Status and Trends. Nairobi: UNEP.

Challenges, opportunities and policy implications

All countries have at least started implementing various aspects of IWRM (indicator 6.5.1) since the 1992 United Nations Conference on Environment and Development where UN members states called for more integration among the water and water-using sectors. For example, approximately 75 per cent of countries have approved water resources policies and laws that are based on integrated approaches. However, only modest progress has been made in terms of implementing a fully integrated approach. Most countries are not on track to achieve target 6.5 by 2030, although good progress has been made in some aspects of IWRM. This is illustrated by the progress on implementing IWRM (Figure 2), and that only 17 countries reported having operational arrangements in place for all their transboundary basins in 2017/2018. Most of the 51 countries that participated in IWRM surveys in 2007, 2011 and 2017 have advanced their implementation by one or two categories over the last decade. Experience has shown that full implementation often takes more than a decade, particularly when arrangements among countries need to be negotiated and adopted. Most countries will therefore have to accelerate their progress of implementation to achieve target 6.5 by 2030.

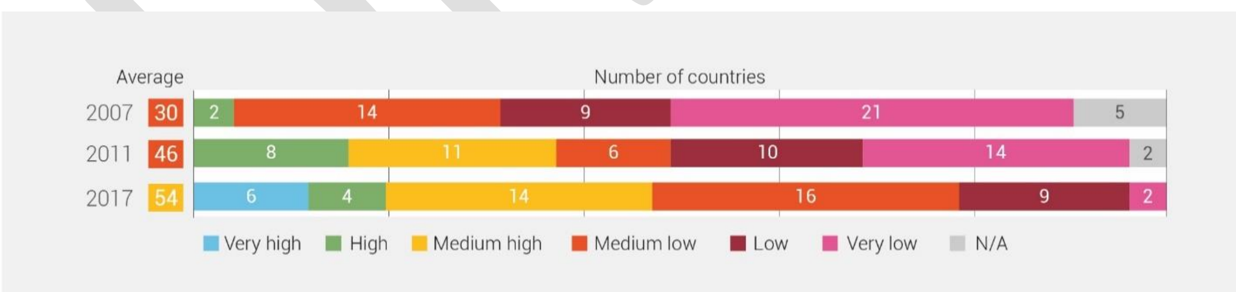


Figure 2 Progress in implementation of IWRM, 2007–2017
Source: UNEP-DHI (2018).

Governments and external support agencies will need to increase implementation efforts, to ensure accelerated progress and positive outcomes. There is a wealth of experience and opportunities for learning from countries who have achieved advanced levels of implementation, although there is no simple, universal approach. Each country must develop its own pathway based on its political, social, environmental and economic circumstances, taking experiences into account. Evidence suggests that where to start and what to do should focus on a country's economic development, political stability and HDI status.

One of the strengths of the questionnaires developed for indicators 6.5.1 and 6.5.2 is that the data can be easily disaggregated by question and used by countries as a quick diagnostic tool to identify which aspects of IWRM are progressing well, and at which level (local, national or, where relevant, transboundary). In addition, the questionnaires can be used to highlight aspects that may be facing barriers to progress. The greatest opportunities for accelerated implementation appears to be in financing for water resources development and management, and in devolving IWRM to the lowest appropriate level.

Ensuring that operational arrangements cover all transboundary waters will demand a significant effort at the transboundary level (indicator 6.5.2). There is a need to increase and better target technical and financial assistance from development partners to enhance the capacity of countries to negotiate and implement transboundary cooperative arrangements. An opportunity exists to capitalize on the entry into force of the 1997 Convention on the Law of the Non-Navigational Uses of International Watercourses, the opening of the Water Convention to countries outside the pan-European region, and the adoption, by the United Nations General Assembly, of Resolution 63/124 including its Annex on the Draft Articles on the Law of Transboundary Aquifers. There are positive signs that countries are working to enhance transboundary water cooperation with their neighbours in light of these global frameworks. Many countries have recently adopted new agreements or revised existing ones, and there are many instances where countries are negotiating operational arrangements for transboundary waters where none exist. However, cooperation over TBAs is critical to managing water resources in many regions, particularly North Africa where shared groundwater resources dominate water resources planning and management. TBAs should be sufficiently integrated into transboundary basin agreements, or new aquifer-specific arrangements should be established.

Box 11 Transboundary aquifer cooperation: the Stampriet Transboundary Aquifer System

UNESCO IHP launched ISARM owing to the lack of knowledge on transboundary groundwater. The aim was to improve governance and management of TBAs using a multidisciplinary approach.

The insights and knowledge gained through ISARM led UNESCO IHP to undertake the first baseline multi-criteria assessment of 199 TBAs worldwide under the GEF-funded Transboundary Waters Assessment Programme. The methodology developed allows for comparative analysis and prioritization of risks and interventions through a set of indicators.

This methodology was improved to include all relevant TBA aspects required for joint decision-making and TBA management in the Governance of Groundwater Resources in Transboundary Aquifers project, funded by the Swiss Agency for Development and Cooperation.

This was applied to an in-depth assessment of the Stampriet Transboundary Aquifer System (STAS) shared by Botswana, Namibia and South Africa, combining science and water diplomacy to facilitate multilevel and interdisciplinary dialogues to foster cooperation. The Governments of Botswana, Namibia and South Africa established a Multi-Country Cooperation Mechanism for the management and governance of STAS. This was the first of its kind to be nested in a river basin organization, fully capturing the IWRM approach and directly contributing to the implementation of SDG target 6.5 at national and transboundary levels.

Source: UNESCO IHP (2016).

G. Target 6.6: Water-related ecosystems

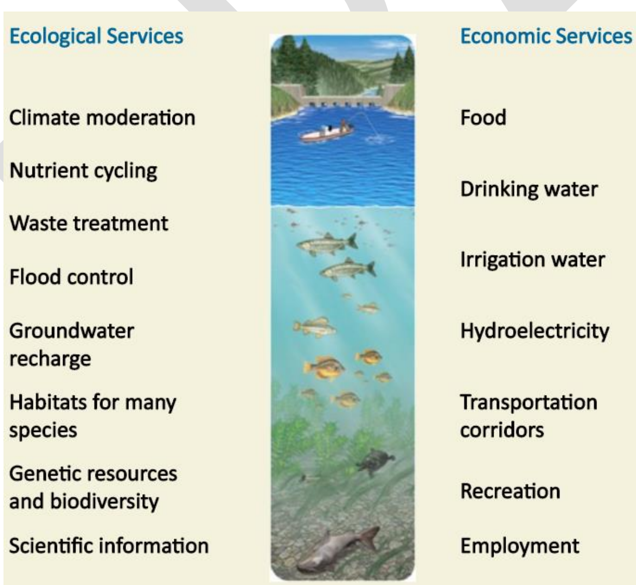
"By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes"

Freshwater aquatic ecosystems are the world's most biologically diverse environments and provide many products and services on which human well-being depends. Water-related ecosystems help to sustain the global hydrological cycle, the carbon cycle and nutrient cycles, and they also support water security. They provide natural freshwater storage, regulate flows, purify water and replenish groundwater. Complementary services include maintaining forests and providing water for agriculture, employment, energy generation, navigation, recreation and tourism. Water mediates all these services. However, ecosystems are still often managed for short-term gain at the expense of long-term benefits, and large-scale human activities threaten to degrade and destroy them (GWP, 2016).

SDG target 6.6 focuses on protecting and restoring water-related ecosystems to ensure they continue to provide sustainable social and economic services and benefits to society. This target seeks to halt ecosystem degradation and destruction and to assist in recovering those already degraded. The target includes water-related ecosystems such as vegetated wetlands, rivers, lakes, reservoirs and groundwater, and those occurring in mountains and forests that play a special role in storing fresh water and maintaining water quality. Monitoring highlights the need to protect and conserve ecosystems and enables policymakers and decision makers to set management objectives. SDG target 6.6 directly contributes to wider improvements in ecosystem health, both marine (SDG 14) and terrestrial (SDG 15).

Box 12 Water-related ecosystem services

Water-related ecosystems provide ecological and economic services and benefits to society by generating income, promoting well-being and preventing damage that inflicts costs on society.



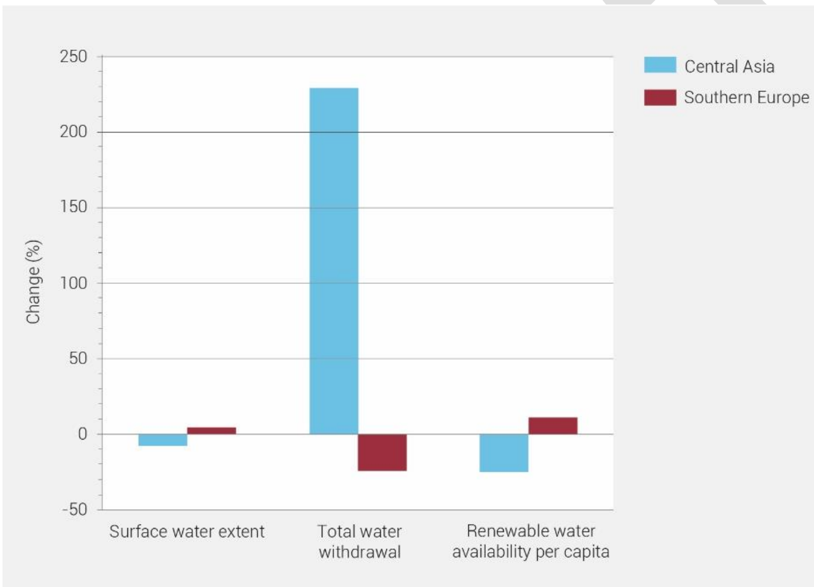
Ecological and economic services provided by freshwater ecosystems

Source: Miller and Spoolman (2009).

Box 13 Regional surface water extent in Central Asia and Southern Europe

The spatial extent of surface water was assessed at a regional level using data provided by the Joint Research Centre (JRC) of the European Commission (Pekel and others, 2016). One observation from analysing this data set is a notable decline in surface water extent in Central Asia. The region experienced a decline of −7.4 per cent between 2001 and 2015, which was linked to an increase in total water withdrawals of 229 per cent. Renewable water availability per capita declined by 25 per cent between 2002 and 2014 (see figure below). The situation was different in Southern Europe. Surface water extent increased by 4.5 per cent between 2000 and 2010, which corresponded with a decline in total water withdrawal of 24 per cent and an 11 per cent increase in renewable water availability per capita (2002–2014).

However, surface water extent only tells part of the story because the data do not differentiate between artificial and natural water bodies. Although regional trend data show surface water extent increased in many regions from 2001 to 2015, this is likely to be the result of constructing new reservoirs and increases in flood irrigation (Pekel and others, 2016). Research suggests that some artificial reservoirs can damage riparian ecosystems by changing their ecological cycles and biodiversity (Rosenberg and others, 1997).



Comparison of surface water extent (2000–2015), total water withdrawal (2000–2010) and renewable water availability per capita (2002–2014)

Sources: Pekel and others (2016); FAO (2016)

Indicator 6.6.1: Change in the extent of water-related ecosystems over time

Custodian agency: UN Environment

Introduction

Target 6.6 focuses on the protection and restoration of water-related ecosystems to ensure they continue to provide sustainable services to society. Water is essential for all ecosystems, and this target focuses on those that are exclusively water bodies. Other water-related ecosystems, such as forests and mountains, are covered elsewhere in the SDGs.

Definition of indicator and methodology

The indicator method defines "extent" as "the size or area of something", thus going beyond spatial area to include other size (quantitative) measures of water-related ecosystems, i.e. quantity, quality and health. This indicator monitors four main categories of ecosystems: vegetated wetlands (including swamps, swamp forests, marshes, paddies, peatlands and mangroves), open water bodies (such as lakes and reservoirs), rivers and estuaries and groundwater. Four subindicators (spatial extent, water quantity, water quality and ecosystem health) describe different aspects of these ecosystems.

Key messages

- Water-related ecosystems underpin and depend on other SDGs, in particular those relating to food and energy production, biodiversity and ecosystems on land and sea. Protecting and restoring water-related ecosystems cannot be achieved without progress on these other goals, and vice versa.
- The world has lost 70 per cent of its natural wetland extent, including a significant loss of freshwater species, over the last 100 years. Artificial water bodies, such as reservoirs, dams and rice paddies, have been increasing in most regions of the world.
- There are currently insufficient data to adequately measure progress towards SDG target 6.6. However, monitoring changes to water-related ecosystems can be supported using Earth observations. Such global data have a significant role to play in supporting countries in monitoring and reporting on indicator 6.6.1.
- Protecting and restoring water-related ecosystems refers to actions that include: valuing the benefits and co-benefits provided by water-related ecosystem services; understanding and addressing land-use change impacts on water-related ecosystems; and prioritizing restoration and protection of source watersheds such as forests and critical basins.

Monitoring

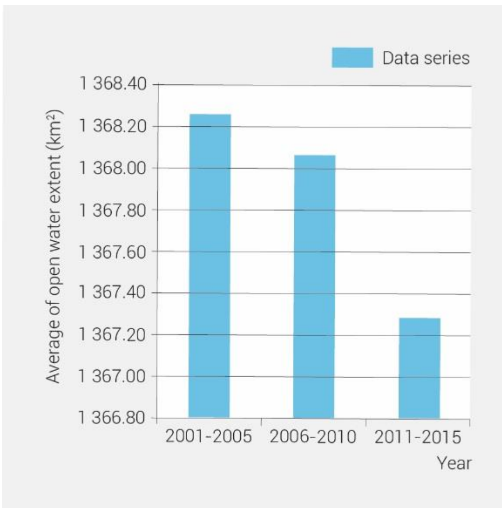
As of early 2018, 38 countries have reported data for indicator 6.6.1, which is 20 per cent of the 193 Member States requested to provide data. Of these 38 countries, 82 per cent submitted data on all three of the subindicators: spatial extent, quantity and quality.

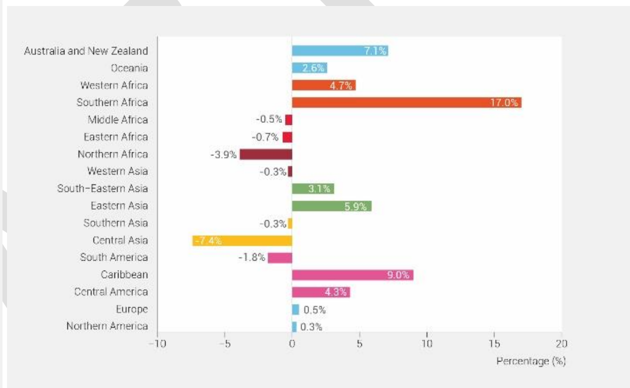
Summary of countries reporting against subindicators and ecosystem types

Subindicator	Number of reporting countries	Ecosystem type	Number of reporting countries
Spatial extent	33	Vegetated wetlands	21
		Open water bodies	31
		River water bodies	18
Quantity	29	Open water bodies	19
		River water bodies	24
		Groundwater bodies	14
Quality	32	Open water bodies	21
		River water bodies	31
		Groundwater bodies	25

Notes: Countries reporting include those from Europe (15 countries), sub-Saharan Africa (11), Northern Africa and Western Asia (4), Latin America and the Caribbean (3), Eastern and Southern Asia (2) and Oceania (2). Most of the data reported are from 2015 onwards. Countries were asked to select and report on their most significant water-related ecosystems, with the result that some countries reported on most of their water-related ecosystems while others reported on a few. Sixteen countries reported data on basins covering more than 75 per cent of the surface area of their country; two countries submitted data for basins that cover between 25 and 75 per cent; and eight countries submitted data for basins that cover less than 25 per cent.

Trends in the spatial extent of surface water were assessed using the data available from 188 United Nations Member States provided by JRC, to fill data gaps and generate regional analysis. These global data were captured from 1984 to 2015 at 30 m resolution every eight days, and accounted for seasonal fluctuations. This raw data set was processed and packaged into country data sets and shared with national statistical offices. Each country data set comprised annual national spatial extents from 2001 to 2015, percentage change statistics based on five-year averages and graphical depictions of the data.[19] The figures below show national and regional loss and gain trends in the spatial extent of open water.

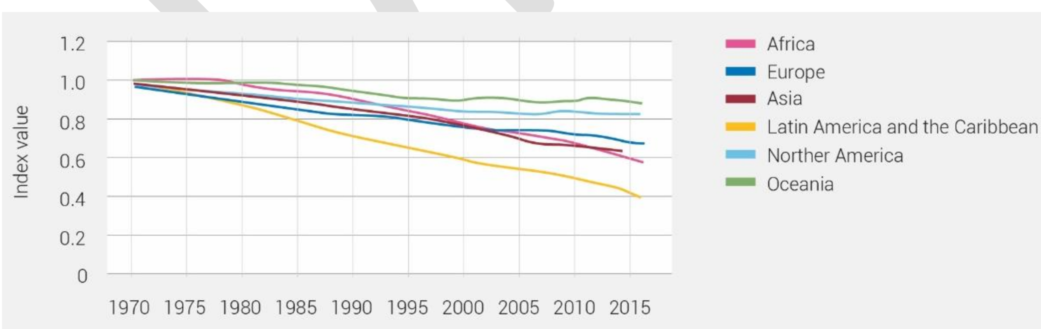




Country example: change in spatial extent of open water

Regional analysis: average loss and gain trends of open water[20]

The concurrent loss in natural wetlands indicates that there may be significant conversion to artificial wetlands or other land-use types such as agriculture. The JRC data do not differentiate between types of surface water and do not capture some of the major areas of vegetated wetland, so they are complemented by the wetland extent trend index, which calculates average trends in natural wetland extent over time. The figure below shows a decline in average wetland extent in all regions, which varies from 12 per cent (Oceania) to 59 per cent (Latin America and the Caribbean, excluding Orinoco and Amazon) for the wetlands sampled.



Wetland extent trend index

Sources: Dixon and others (2016); UNEP-WCMC (2017).

[19] From the 188 countries that had Earth observation data available, 36 were not provided with data because they had already submitted nationally derived data. From the resulting 152 countries, 133 National Statistical Offices (NSOs) had no objection to the data being shared. Twenty-one countries preferred not to validate the data because they were a Tier III indicator or countries wished to use their own geospatial data.

[20] This figure presents the regional percentage change in average spatial extent of open water from 2001 to 2015. It is important to note that the JRC data set includes all open water (both natural and artificial) and therefore the data capture the spatial extent of water within new reservoirs and areas that have been flooded for irrigation.

Note: Regional average trends in natural wetland extent, which is the aggregation of equally weighted marine/coastal and inland wetland trends, relative to 1970. Trends indicate an average percentage decline in natural wetland extent for the sampled localities in the data set.
Sources: Davidson, Nick C. (2014). How much wetland has the world lost? Long-term and recent trends in global wetland area. *Marine and Freshwater Research*, vol. 65. Dixon and others (2016). Tracking global change in ecosystem area: the wetland extent trends index. *Biological Conservation*, vol. 193, pp. 27–35. https://doi.org/10.1016/j.biocon.2015.10.023. International Rice Research Institute (IRRI) (2017). IRRI World Rice Statistics. Available form http://ricestat.irri.org:8080/wrsv3/about.html. Lehner, Bernhard and Günther Grill (2013). Global river hydrography and network routing: baseline data and new approaches to study the world's large river systems. *Hydrological Processes*, vol. 27, pp. 2171–2186. Lehner, Bernhard and others (2011). High-resolution mapping of the world's reservoirs and dams for sustainable river-flow management. *Frontiers in Ecology and the Environment*, vol. 9, pp. 494–502. Miller, G. Tyler and Scott E. Spoolman (2009). *Living in the Environment: Concepts, Connections, and Solutions*, 16th ed. Belmont, California: Brooks/Cole. Pekel, Jean-Francois and others (2016). High-resolution mapping of global surface water and its long-term changes. *Nature*, vol. 50, pp. 418–422. doi:10.1038/nature20584. UN Environment World Conservation Monitoring Centre (UNEP-WCMC) (Forthcoming). Wetland extent trends (WET) index – 2017 update. In *Global Wetland Outlook: State of the World's Wetlands and their Services to People*. Gland: Secretariat of the Ramsar Convention on Wetlands. World Wildlife Fund (WWF) (2016). Living Planet Report. Available form https://www.wwf.or.jp/activities/data/summary_wwf_living_planet_report_2016.pdf. Gland, Switzerland: WWF.

Challenges, opportunities and policy implications

Historically, the drive for economic and social development has largely depended on exploitation of natural resources, including water-related ecosystems. Today, as populations expand, livelihoods improve and the demand for fresh water increases, awareness is now focusing on ensuring that the limited capacity of the natural environment to sustain the multiple services that society has come to rely on is maintained.

The global indicator is helpful but broad in nature. Further detailed data (quantitative, geospatial and qualitative) will be essential for accurate understanding of water-related ecosystems and the benefits they provide. Earth observations can complement local ground data and support the national burden of acquisition and reporting. Member States will therefore need to strengthen operational capacity and increase financial resources, implement clear roles and responsibilities for data collection and processing, and ensure political will at the highest level. Monitoring at the ecosystem level and at the basin scale is important. The local level provides evidence for practical action, while larger basin monitoring provides an overall perspective within hydrological boundaries.

Global data collected through the SDG process do not reflect the general state or trends known about freshwater ecosystems from other data sources, given the "newness" of indicator 6.6.1. However, monitoring has revealed a variety of opportunities, such as monitoring change over time. Understanding how ecosystems are changing will provide evidence of their value that can underpin decision-making towards their future protection and restoration. Steps that countries can take to boost the achievement of SDG target 6.6 include the following:

- **Improve data availability and compilation.** There are currently insufficient data available to adequately measure progress towards the target. Monitoring changes to water-related ecosystems can be supported using Earth observations. Combining different types of data (i.e. nationally derived data and global/geospatial data) generates an accurate and contextualized understanding of changes in extent of water-related ecosystems. Earth Observation data are readily available and accurate and can reduce the monitoring and reporting burden on countries and complement in situ data such as river flows.
- **Develop monitoring and reporting capacity.** Country feedback has indicated a general lack of capacity among institutions for collecting water-related ecosystem data. Data collection was conducted by a variety of different institutions at national and subnational levels that were not used to sharing data. Many countries reported they were unable coordinate, compile and report on complete accurate data. National governments are urged to (1) strengthen operational capacity including provision of adequate time and financial resources, (2) implement clear roles and responsibilities for data collection and (3) ensure political will exists for this at senior government level. This indicator does not yet have any internationally established methodology or standards available, though methodology and standards are being developed and tested for future use.
- **Understand the value of water-related ecosystem services.** Protecting and restoring water-related ecosystems, in particular source watersheds such as forests and critical basins, requires decision makers to understand the social and economic values of ecosystem services to society. For example, it is more cost-effective to invest in protecting wetland areas, which may provide water filtration and purification services, than to invest in water treatment facilities. In addition, data relating to land cover (SDG 15) should be reviewed in conjunction with data on changes in extent of water-related ecosystems because of the symbiotic relationship between land and water ecosystems.

H. Targets 6.a and 6.b: Means of implementation

The targets on MoI create an enabling environment necessary for the success of the 2030 Agenda. MDGs were criticized as being overly focused on outcomes, with insufficient attention paid to MoI and the resources required to achieve them. SDGs therefore include MoI targets under each of the first 16 goals as well as a dedicated goal (SDG 17) on MoI. SDG 17 (*Strengthen the means of implementation and revitalize the global partnership for sustainable development*) defines seven MoI building blocks: (1) finance, (2) technology, (3) capacity-building, (4) trade, (5) policy and institutional coherence, (6) multi-stakeholder partnerships and (7) data, monitoring and accountability. Defining meaningful and measurable indicators for MoI is more challenging than using established outcome measures, such as access to basic drinking water and sanitation. This section discusses the MoI targets for SDG 6. Chapter III deals with the detailed aspects of MoI, including finance, capacity development and participation.

Data on the effectiveness of the enabling environment are limited, and systems for monitoring MoI have yet to be established in most countries. Establishing MoI targets and indicators within SDG 6 provides a unique opportunity to mobilize support and resources as well as shape policy priorities at the global and national levels to galvanize implementation. As much as MDG monitoring has helped to establish monitoring systems at the national level and has supported building capacity in national statistical offices to monitor outcome indicators, selecting appropriate targets and indicators can support development of monitoring systems for MoI at all levels.

The MoI targets provide a key to achieving SDG 6 through supporting implementation to meet SDG targets 6.1–6.6. There are economic, social and environmental benefits from meeting these targets. There are costs involved, but these must be weighed against the economic costs of not achieving them. This includes coping with poorer health among populations and the economic impacts of insecure access to clean, reliable water resources and safe sanitation.

1. Target 6.a: Cooperation and capacity-building

"By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies"

Expanded international cooperation can contribute to many goals and targets. International cooperation is often multifaceted. Efforts that aim to improve water supply and sanitation can help to reduce preventable deaths of babies and young children (SDG target 3.2) and combat waterborne diseases (SDG target 3.3). Programmes that support IWRM can ensure conservation, restoration and sustainable use of freshwater ecosystems (SDG targets 15.1 and 6.6) and help to restore degraded land and soil and to reduce drought and flood risk (SDG targets 15.3 and 6.4). Capacity-building in the water sector can promote job creation (SDG target 8.3), promote equal access to vocational, technical and tertiary education (SDG target 4.3) and improve education and awareness-raising on climate change mitigation and adaptation (SDG target 13.3). Support for technology should result in improved infrastructure and industries that are more resource efficient and environmentally sound (SDG target 9.4).

The need for increased financial resources to reach SDG targets 6.1–6.6 is clear. The capital investments necessary to achieve drinking water supply, sanitation and hygiene targets (SDG targets 6.1 and 6.2) are around three times the current levels of investment, with additional financing required for operation and maintenance of existing services and infrastructure (Hutton and Varughese, 2016). Similarly, financing to achieve SDG targets 6.3–6.6 will require a significant increase.

Expanding international cooperation and support for capacity development is fundamental to achieving SDG 6.

Indicator 6.a.1: Amount of water- and sanitation-related official development assistance that is part of a government-coordinated spending plan

Custodian agencies: WHO/UN Environment/OECD

Introduction

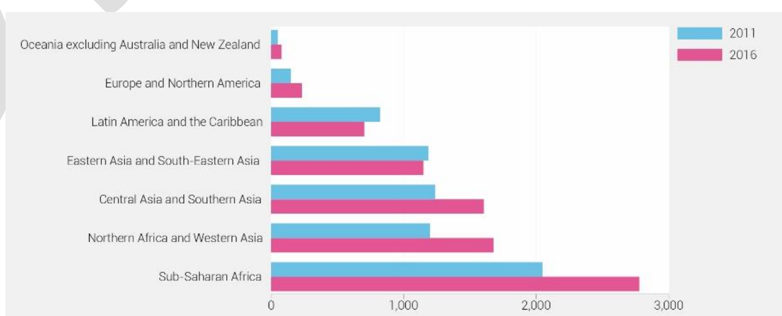
Hundreds of billions of dollars still need to be raised to fund the implementation of SDG 6, which is expected to generate socioeconomic and health benefits that greatly exceed the cost of doing so. Needs are greatest in developing countries. This calls for increased mobilization of domestic funds, and also a significant scaling-up of external support to cover interim gaps while national capacity and resources are under development. Target 6.a seeks to expand international cooperation and capacity-building support to developing countries.

Definition of indicator and methodology

International cooperation refers to external aid in the form of grants or loans from external support agencies, for the purposes of monitoring this target. ODA can be used as a proxy for this, captured annually by the OECD CRS. The indicator assesses the proportion of water- and sanitation-related ODA included in government-coordinated spending plans, as an indication of alignment and cooperation among donor and recipient countries.

Key messages

- Adequate financial resources are critical for achieving SDG 6 by 2030, whether by attracting new sources or better utilizing existing resources.
- Total water sector ODA data show that disbursements increased from US$7.2 billion to US$8.8 billion between 2011 and 2016.
- Funding has increased across the sector since 2005, with aid for agricultural water resources nearly tripling. However, water sector ODA has remained relatively constant as a proportion of total ODA disbursements at approximately 5 per cent since 2005.
- The GLAAS 2017 finance-focused report indicates that government WASH budgets are increasing (annual average rate of 4.9 per cent over inflation); at the same time, over 80 per cent of participating countries reported insufficient financing to meet national WASH targets.
- There is some evidence that ODA commitments to water and sanitation have declined since 2012, in particular for sub-Saharan Africa, indicating uncertainty in future investments.
- Regional changes have varied. Water sector ODA disbursements to sub-Saharan Africa increased by US$731 million from 2011 to 2016 and the region received the largest proportion of water sector ODA in 2016 at 39 per cent. Northern Africa and Western Asia followed with an increase of US$478 million in water sector ODA from 2011 to 2016, which allowed the region to reach 24 per cent of the total water sector ODA in 2016. Latin America and the Caribbean was the only region that experienced a decrease in water sector ODA disbursements from 2011 to 2016 (US$120 million). Basic drinking water and sanitation systems accounted for nearly a quarter (22 per cent) of total ODA disbursements in sub-Saharan Africa. ODA for large drinking water and sanitation systems remained steady as a proportion of total ODA disbursements from 2011 to 2016, at approximately 40 per cent.



Regional ODA water- and sanitation-related disbursements for 2011 and 2016 (millions of US$, constant 2015 US$)
Source: OECD (2017).

About the data

The current data included in the monitoring of the indicator are ODA flows from all donors to developing countries eligible for ODA in the water sector. The data available are not yet sufficient to assess whether the ODA is included in the government budget for all countries. ODA to the water sector includes aid for drinking water supplies, sanitation and hygiene (i.e. water and sanitation, OECD-DAC 140) as well as aid in other areas, such as agricultural water resources, flood protection and hydroelectric power.

Data on the amount of water- and sanitation-related ODA included in government-coordinated spending plans will be collected through future UN-Water GLAAS country surveys. The GLAAS initiative collects data through country surveys sent to national representatives as well as through external support agency surveys sent to key donors and NGOs in the WASH sector. Eighty-three countries and 25 external support agencies participated in the most-recent data-collection cycle in 2017. In addition, more comprehensive data on national and subnational financial flows can be obtained through the GLAAS TrackFin initiative, for those countries implementing the methodology.

ODA disbursements to the water sector reached US$8.8 billion in 2016, which was an increase of 22 per cent in real terms since 2011.

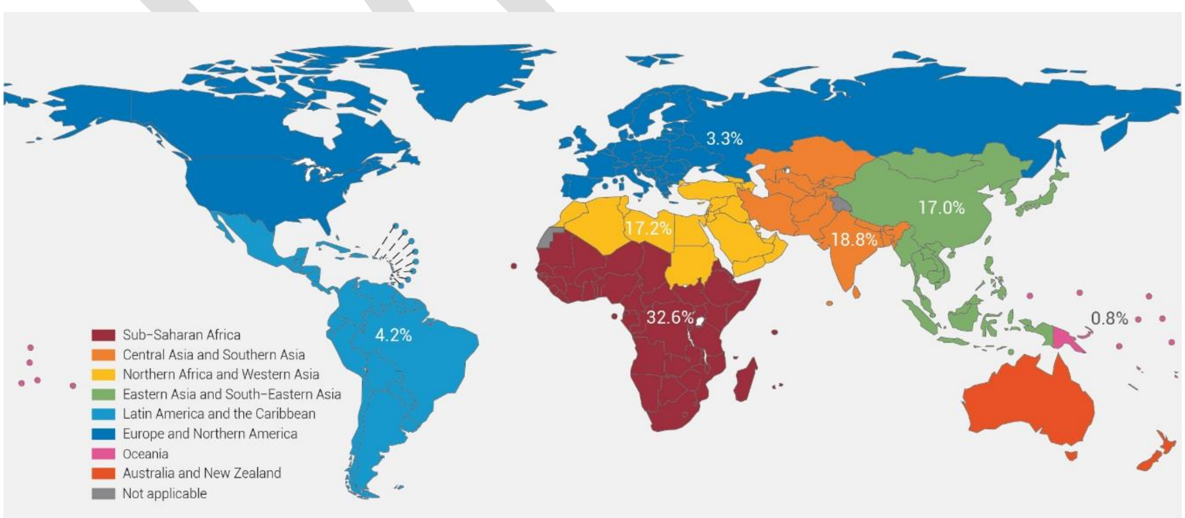
SDG regions	Year	Water resources policy/administrative management (CRS 14010)	Water resources protection (CRS 14015)	Water supply and sanitation - large systems (CRS 14020, 14021, 14022)	Water supply and sanitation - basic systems (CRS 14030, 14031, 14032)	River basins development (CRS 14040)	Waste management/disposal (CRS 14050)	Education and training in water supply and sanitation (CRS 14081)	TOTAL	Hydro-electric power plants (CRS 23220)	31140: Agricultural water resources (CRS 31140)	Flood prevention/control (CRS 41050)	Total Water Sector ODA
	2016	1,009.181	182.104	3,563.055	1,548.753	336.068	256.424	34.553	6,930.137	555.388	953.920	376.987	8,816.432
TOTAL*	2011	705.687	153.060	2,997.003	1,137.362	249.857	215.677	39.237	5,497.883	606.676	913.780	214.406	7,232.745
	2016	60.325	30.654	644.656	266.294	71.458	32.663	3.432	1,109.483	140.218	272.245	81.573	1,603.519
Central Asia (M49) and Southern Asia (MDG=M49)	2011	80.417	27.314	488.266	180.373	9.858	42.286	1.530	830.046	128.258	223.870	55.828	1,238.002
	2016	64.230	33.618	345.207	212.072	45.248	49.874	0.243	750.493	67.582	189.557	141.365	1,148.997
Eastern Asia (M49) and South-eastern Asia (MDG=M49)	2011	74.638	77.137	300.798	159.963	161.432	61.187	2.098	837.253	45.649	190.165	114.510	1,187.577
	2016	128.200	22.203	265.986	84.961	104.412	26.418	4.181	636.361	30.944	20.252	14.762	702.319
Latin America and the Caribbean (MDG=M49)	2011	22.163	5.964	519.679	70.585	7.730	17.932	2.328	646.381	130.663	32.663	12.298	822.005
	2016	7.021	3.411	136.887	7.602	16.578	21.382	0.258	193.140	2.584	1.551	33.510	230.784
Northern America (M49) and Europe (M49)	2011	6.534	0.836	79.458	9.947	6.478	21.528	0.013	124.795	20.634	2.681	1.536	149.647
	2016	9.383	2.503	10.008	41.152	1.480	3.667	0.423	68.615	9.352	0.000	0.999	78.966
Oceania (M49) excluding Australia and New Zealand (M49)	2011	23.891	0.500	4.946	16.988	0.124	3.168	0.000	49.616	0.000	0.000	0.000	49.616
	2016	396.935	42.159	1,009.116	609.907	64.334	56.422	11.048	2,189.921	263.559	235.450	87.414	2,776.343
Sub-Saharan Africa (M49)	2011	132.137	12.664	918.934	502.203	35.843	25.291	19.796	1,646.869	155.905	222.505	20.133	2,045.411
	2016	133.075	15.761	1,019.459	164.338	18.674	54.261	2.017	1,407.585	39.161	215.095	15.067	1,676.908
Western Asia (M49) and Northern Africa (M49)	2011	132.783	7.024	609.660	64.204	15.299	29.685	2.959	861.616	99.512	231.091	6.264	1,198.483

* Includes regional aid that cannot be categorized by SDG region. Also includes aid for Kosovo.

Disbursement of ODA to the water sector (2011-2016).

Source: OECD (2017).

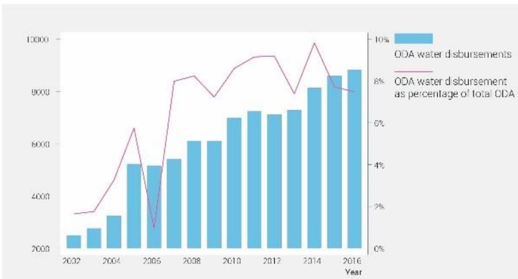
Aid commitments for water and sanitation to sub-Saharan Africa declined from US$3.8 billion to US$ 2.9 billion in the period 2012–2016.



Regional breakdown for water and sanitation commitments, 2015

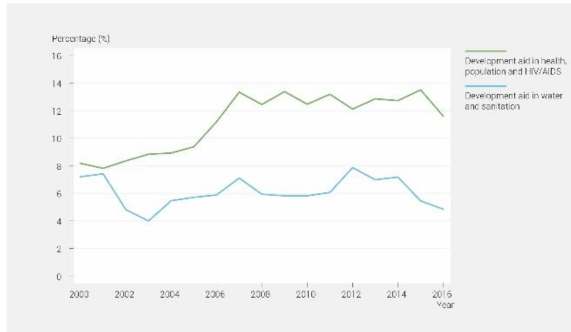
Source: OECD (2017).

ODA to the water sector has remained relatively constant since 2005, at about 5 per cent of the total ODA disbursements.



Annual water sector ODA disbursement (billions of constant 2015 US dollars), and water sector ODA as a percentage of total ODA disbursements, 2002-2016
Source: OECD (2017).

External aid commitments for water and sanitation declined from 8 to 5 per cent of the total aid commitments between 2012 and 2016.



Comparison between the development aid commitments in water and sanitation and the development aid commitments in health, population and HIV/AIDS, 2000-2016

Source: OECD (2017).

Achieving SDG targets 6.1 and 6.2 will require tripling of capital investments to US$114 billion per year, in addition to operations and maintenance costs, which are key for sustainable services. Investments in WASH will also have positive effects and contribute to improving other critical areas related to public health covered by the SDGs such as nutrition, economic development, education and climate resilience.

Sources:

Hutton, Guy and Mili Varughese (2016). *The Costs of Meeting the 2030 Sustainable Development Goal Targets on Drinking Water, Sanitation, and Hygiene*. Washington, DC: World Bank. Available from https://openknowledge.worldbank.org/handle/10986/23681.

Organisation for Economic Co-operation and Development (OECD) (2017). Creditor Reporting System: aid activities, OECD international development statistics (database). Available from http://dx.doi.org/10.1787/data-00061-en. Accessed 28 September 2017.

World Health Organization (WHO) and UN-Water (2017). UN-Water Global Analysis and Assessment of Sanitation and Drinking-Water (GLAAS) 2017 Report: Financing Universal Water, Sanitation and Hygiene under the Sustainable Development Goals. Geneva. Available from http://www.who.int/water_sanitation_health/publications/glaas-report-2017/en/.

Challenges, opportunities and policy implications

The current data are not sufficient to assess whether the ODA is included in government-coordinated spending plans. It is expected that the monitoring framework for this target will develop over time. There is a need for better understanding of the extent and value of international cooperation, particularly support for capacity development, as this is currently not part of the indicator. Both the target and the indicator are strongly focused on external support and refer to the potential and need for stronger domestic engagement. Defining additional indicators or rewording indicators to take account of this should be considered. See chapter III for further discussion on challenges and opportunities regarding finance and capacity development.

Box 14 Improving coordination and disbursement of ODA funding

Most countries indicated limited availability of financial reports on external aid expenditures for WASH in 2017. Reasons included: (1) partners reporting only activities and outcomes, but not financial information; (2) direct implementation of projects and programmes by development partners with little reporting or collaboration with national authorities; and (3) other reporting difficulties, including a lack of disaggregation of projects into separate subsectors.

Some countries have established coordination frameworks at the national level to encourage improved collaboration among technical and financial partners and national institutions. This collaboration includes development partners, donors and international NGOs, using a database as a key instrument to centralize aid commitments and disbursements that are disaggregated by subsector and regions, and which are updated on a quarterly basis. For example, Madagascar has established a Permanent Technical Secretariat for the Coordination of Aid.

The National Target Programme for Rural Water Supply and Sanitation in Viet Nam disperses affordable finance to households, in the form of low interest loans through the Vietnam Bank for Social Policies This scheme, which was first a national level initiative of the government, has evolved to be an effective means for multiple international donors, including the UK Department for International Development (and others), to disperse ODA at the local level.

Source: WHO and UN-Water (2017).

2. Target 6.b: Stakeholder participation

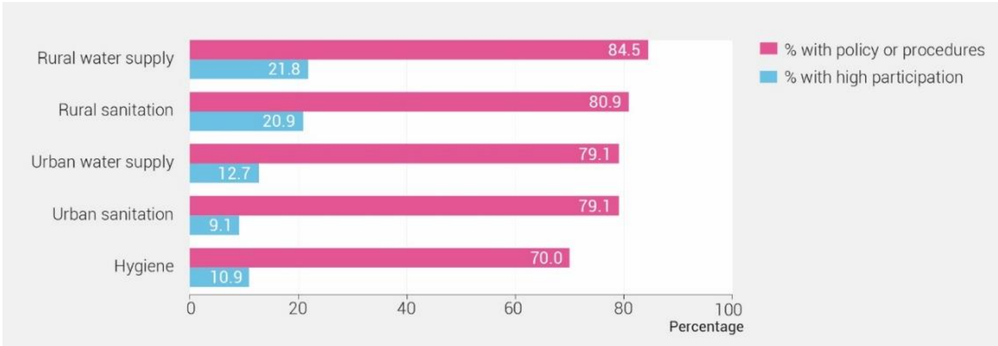
"Support and strengthen the participation of local communities in improving water and sanitation management"

Effective and sustainable water and sanitation management depends on the participation of a range of stakeholders, including local communities, which is the focus of target 6.b. Participation implies provision of mechanisms to enable affected individuals and communities to meaningfully contribute to decisions related to water and sanitation planning and management. This can promote "local ownership" and lead to long-term sustainability of services.

Community participation is a key component of increasing sustainable WASH service provision, particularly in rural areas (SDG targets 6.1 and 6.2), and also for IWRM (target 6.5). Achieving this can contribute towards increased participation of women in political, economic and public life (target 5.5), and empower and promote social, economic and political inclusion (targets 10.2 and 10.3). It can also contribute towards ensuring conservation, restoration and sustainable use of freshwater ecosystems and their services (target 15.1) and ensuring responsive, inclusive, participatory and representative decision-making at all levels (target 16.7).

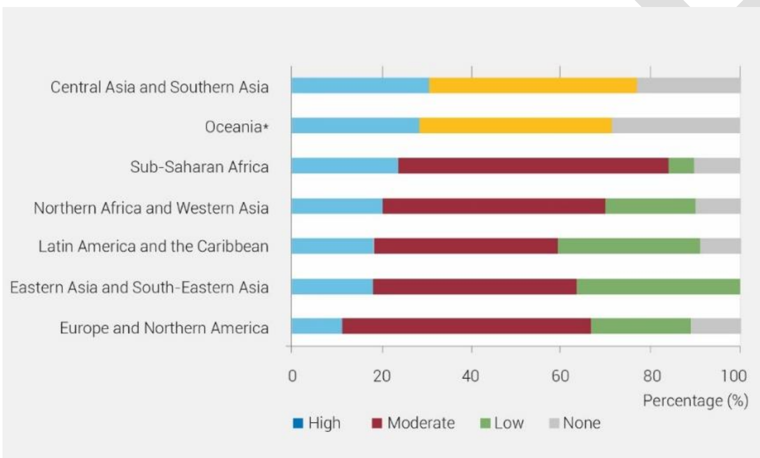
Indicator 6.b.1: Percentage of local administrative units with established and operational policies and procedures for participation of local communities in water and sanitation management.	
Custodian agencies: WHO/UN Environment/OECD	Key messages
Introduction Target 6.b aims for the participation of local communities in water and sanitation planning and management. This is essential for ensuring that the needs of local users are being met and that the impact of development decisions is fully understood by local communities. The involvement of all relevant stakeholders is necessary to ensure that technical and administrative solutions are adapted to the local context and to encourage local ownership, which, in turn, promotes long-term sustainability. Defining the procedures for participation of local communities in policy or law is vital for ensuring that the needs of everyone in the community are met, including the most vulnerable. Indicator 6.b.1 is measured by the number of local administration units with operational policies and procedures for local participation divided by the total number of local administrative units in the country. This indicator provides a starting point but gives a limited understanding of the role of public participation in water and sanitation management. It does not address the nature and effective implementation of the public participation, and whether this participation is useful for water and sanitation management. An in-depth study is currently under way, to better understand the complex issue of participation and how it is currently measured, and to provide recommendations on the monitoring of this target.	Data from the 2013/2014 and 2016/2017 cycles of GLAAS have been merged for the purposes of this analysis, taking the most-recent data points for 110 participating countries: • Over 75 per cent of countries report having clearly defined policies and procedures in place for the participation of service users and communities in planning programmes for drinking water supply (urban: 79 per cent, rural: 85 per cent) and sanitation (urban: 79 per cent, rural: 81 per cent). • Levels of participation remain comparatively low, although most countries report having clearly defined procedures for local participation. Less than 25 per cent of countries report a high level of participation in any subsector. Levels of participation tend to be higher for drinking water supply (22 per cent) and sanitation (21 per cent) in rural areas compared to urban areas (13 per cent and 9 per cent, respectively). • Rural drinking water supply tends to have the highest proportion of countries with defined procedures for participation, among the four subsectors, and urban sanitation has the lowest. This is a result that has been seen consistently since the 2009/2010 cycle of GLAAS. • Eighty-three per cent of 82 countries reported having policies and procedures for water resources planning and management, which was added to the GLAAS survey in 2016/2017.
Definition of indicator and methodology Local administrative units refer to subdistricts, municipalities, communes or other local community-level units covering urban and rural areas as defined by governments. Policies and procedures for participation of local communities in water and sanitation management define a formal mechanism to ensure participation of users in planning water and sanitation activities. This indicator assesses the percentage of local administrative units that have an established operational mechanism by which individuals and communities can contribute to decisions and directions about water and sanitation management. The current data on local community participation are not sufficient at the local administrative unit level to report on this indicator globally. A set of questions in the GLAAS country survey is directed at understanding the role of local participation in water and sanitation planning. The relevant questions include whether there are policies and procedures defined in law or policy, whether there is any specific mention of women's participation and the degree to which communities participate in planning. OECD has set water governance indicators, including stakeholder engagement, that will further inform this indicator. Additional information on public participation in water resources, policy, planning and management at the national and local levels is available from the IWRM survey (see section on indicator 6.5.1).	

The number of countries that report high levels of user participation remains comparatively low, although the proportion of countries with clearly defined procedures for participation by service users/communities in WASH planning programmes and water resources planning and management is consistently high.



Percentages of countries with defined procedures in law or policy for participation (number of countries = 110)
Source: WHO and UN-Water (2017).

Levels of participation by SDG region for rural drinking water supply vary. The Central and Southern Asia region showed the highest proportion (31 per cent) of countries reporting high participation, and over 80 per cent of countries in sub-Saharan Africa reported having moderate or high levels of participation.



Percentages of countries with low, moderate, high and no levels of participation by SDG region (rural drinking water supply); (*no data available for Australia and New Zealand)
Source: WHO and UN-Water (2017).

GLAAS is currently undertaking an in-depth study on target 6.b, to better understand the complex issue of participation, including identifying the types of participation that exist in the sector and assessing the effectiveness of participation policies, with the objective of refining the monitoring of this indicator.

Sources:

Organisation for Economic Co-operation and Development (OECD) (2018). *Implementing the OECD Principles on Water Governance: Indicator Framework and Evolving Practices.* OECD Studies on Water. Paris. Available from http://dx.doi.org/10.1787/9789264292659-en.

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__________ (2017). UN-Water Global Analysis and Assessment of Sanitation and Drinking-Water (GLAAS) 2017 Report: Financing Universal Water, Sanitation and Hygiene under the Sustainable Development Goals. Geneva. Available from http://www.who.int/water_sanitation_health/publications/glaas-report-2017/en/.

Challenges, opportunities and policy implications

Policies to promote and incorporate public participation in water and sanitation management were considered so important that an entire target was dedicated to stakeholder participation. The monitoring framework for this target is still under development, and monitoring participation was limited prior to approval of the SDGs. A clearer set of indicators may be needed that can monitor the existence of participation, and also its nature, effectiveness and value. This additional information will provide insights into the challenges to achieving target 6.b. Indicator 6.b.1 does not currently recognize that participation cannot be measured by quantity alone. Rather, it must also be assessed by quality and the extent to which participation is effective.

The assessment of progress on this target is dominated by information in the WASH sector, because of the extensive availability of GLAAS data. Collection of data in other areas such as IWRM was included in the most-recent cycle of data collection in 2016/2017, although trend data are still lacking. Refined monitoring is needed to give a voice to groups in other sectors, particularly in agriculture where there is a long tradition of farmer participation through water user associations.

Box 15 Forms of participation

Public participation includes the use of procedures and methods to inform, consult and involve local communities and citizens (OECD, 2015). This concept differs from that of stakeholder engagement, which implies, beyond civil society, the involvement of several actors such as governments, the private sector, regulators, service providers, donor agencies and investors. It is possible to distinguish across several forms of stakeholder engagement: from communication, to consultation, participation, representation, partnership and co-production. These various forms imply a gradual consideration of stakeholder comments, advice and ideas. Participation means that stakeholders play an active part in decision-making. The risk is that stakeholder views may not necessarily affect final decisions, although they will improve transparency in decision-making.

Countries recognize that different forms of participation occur for national processes (e.g. development of laws, regulations and national strategies) versus operational- or community-level processes (e.g. user committees, citizen complaints and tariff reviews). The framework for local participation can be set at the national level, through defining public dissemination, hearing procedures and deadlines for government units, or, where appropriate, by transboundary institutions. Albania, Costa Rica and Peru define public hearing procedures as part of a formal process of tariff regulation. Mexico defines user participation in the National Water Law, specifically through bodies such as the basin councils, groundwater technical committees and irrigation units, as well as federalized programmes.

Local participation can take many forms, such as WASH committees at village level, as in Lao People's Democratic Republic, Rwanda, United Republic of Tanzania and Zimbabwe, or in national workshops as part of developing national WASH policies and strategies as in Costa Rica and Senegal. One recurring aspect of local participation is gender inclusion where some countries, such as Fiji, Mozambique, Nepal, Peru and Rwanda, define a minimum percentage of female participation in user committees and encourage active female participation in all phases of the project cycle.

Source: WHO and UN-Water (2017).

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Abbreviations and acronyms used in chapter II (in addition to those already used in chapter I)

CRS	Creditor Reporting System
GEF	Global Environment Facility

HDI	human development index
IHP	International Hydrological Programme
ISARM	Internationally Shared Aquifer Resource Management Initiative
ISIC	International Standard Industrial Classification
IWMI	International Water Management Institute
JRC	Joint Research Centre (European Commission)
MDG	Millennium Development Goal
NGO	non-governmental organization
ODA	official development assistance
STAS	Stampriet Transboundary Aquifer System
TBA	transboundary aquifer
WASH	water, sanitation and hygiene
WASREB	Water Services Regulatory Board

III. Enabling and accelerating progress towards SDG 6

A. Introduction

This chapter focuses on the enablers for progress in the water sector and the challenges and obstacles faced. It targets priorities that can accelerate progress towards achieving SDG 6 by 2030.

The water sector is struggling to improve water resources management and to increase coverage of water and sanitation services. The lack of long-term sustainability and functionality of many water systems undermines progress. Additional investments are needed to ensure that systems reach end-users. However, the areas where needs are the greatest are not always those where most of the resources are spent.

Some of the many challenges that the water sector faces are relatively straightforward physical actions that provide the “visible” side of water, such as installing taps and toilets, building reservoirs, drilling boreholes, and treating and reusing/recycling wastewater. Much of this material progress can be achieved in the short term, keeping in mind the operations and maintenance necessary to ensure it remains sustainable over time.

However, some challenges are much “less visible”. Yet they underpin progress across all aspects of the water sector and are highly complex. They include the need for IWRM (and transboundary cooperation) and tackling the thorny issue of inequality, where richer people generally have better access to water and sanitation services than poorer people, and wealthy land owners control water resources in ways that reduce the productivity of smallholders who depend on ecosystem integrity. These are persistent and stubborn problems that cannot be resolved quickly (some may even take decades). Such issues should not be put to one side and ignored, as is often the case, because they will not disappear. Failure to deal with them can only make matters worse in the future and may prevent sustainable development.

SDG 17 (*Strengthen the means of implementation and revitalize the global partnership for sustainable development*) offers a framework for enabling and accelerating progress in all aspects of SDG 6, including the challenging issues of IWRM and eliminating inequalities, which will be essential for achieving SDG 6 and leaving no one behind.

B. Integrating water resources management

The biggest steps towards achieving SDG 6 will come from recognizing the interconnected nature of water and sanitation and acting on the linkages. Governments have traditionally taken a “silo” or fragmented approach to managing water and sanitation, even in countries with good governance. This approach is often reflected in the way international development agencies are organized and provide support to LDCs.

International organizations have long emphasized the need to address water issues in an integrated manner, particularly in water-scarce areas with potential conflicts among competing uses for water. The 1992 International Conference on Water and the Environment was responsible for developing ‘Dublin Principles’ (Box 16) that provide the foundation for an integrated approach to managing water resources. The demand for more cooperation across the water sector has grown, and the concept of IWRM has gradually become accepted to the point where it is now incorporated within the 2030 Agenda, in SDG indicator 6.5.1. The essential elements of IWRM comprise an enabling environment for integration, a strong institutional framework (including participation), management instruments to effectively manage water resources (including the transboundary waters), and financing for water resources development and management.

Box 16 'Dublin Principles' for managing water

● Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment

● Water development and management should be based on a participatory approach, involving users, planners and policymakers at all levels

● Women play a central part in the provision, management and safeguarding of water

● Water has an economic value in all its competing uses and should be recognized as an economic good

Source: ICWE (1992).

Current progress towards IWRM is encouraging, with 38 per cent of countries having reached medium-high, high or very high levels of implementation. Many countries have embedded IWRM in policies and legislation and have prepared legal and financial tools for implementation. But most countries have yet to seriously put plans into action. There is still a need for greater awareness among some countries that water links all socioeconomic goals, and cross-sectoral cooperation will be essential.

Water resources differ in scope, scale and quality among countries, as do social and economic issues and development priorities. Hence, there is 'no one size fits all' solution to putting IWRM into practice, and each country must seek its own unique solution (in partnership with other countries when resources are shared). Guidance for those pursing integration will come from the experiences of other countries that have already followed this pathway.

Lessons have been learned from IWRM successes and failures through work by Shah (2016) and the Global Water Partnership (GWP). A generic framework was established as a first step towards integration (Shah, 2016) which links progress IWRM progress to the state of the national economy and the level of effective governance that this implies (Table 3). It ranges from Stage I (fragile States) to Stage IV (highly formal States such as most western countries). Shah (2016) suggests the kinds of interventions needed for each stage in six key areas of: (1) capacity-building, (2) institutional reform, (3) policy and legal regime, (4) investment priorities, (5) management of ecosystem impacts and (6) water pricing and cost recovery.

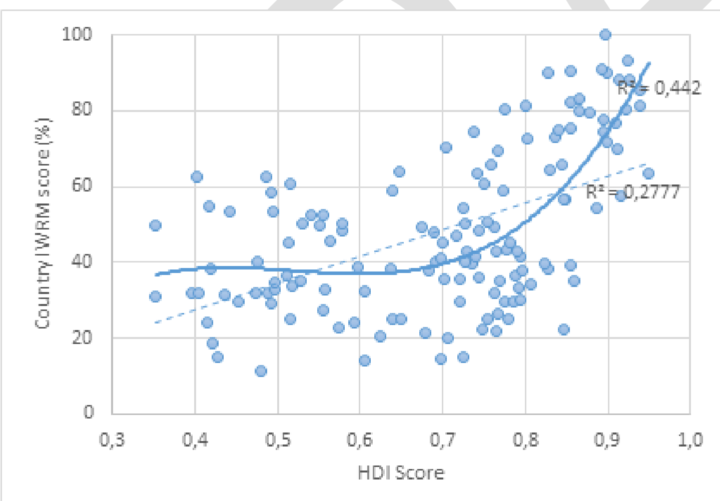
Table 3 Indicative priorities for an IWRM strategy to succeed

Evolutionary stage	Stage I: Completely informal	Stage II: Largely informal	Stage III: Formalizing	Stage IV: Highly formal
Percentage using formal water economy	5–15	15–35	35–75	75–95
Examples	Bhutan, Congo	Bangladesh, United Republic of Tanzania	China, Mexico, Thailand, Turkey	Australia, Canada, France, USA
Capacity-building	Invest in basic techno-managerial capacities for creating affordable infrastructure and service	Build capacities for efficient management of water infrastructure and water service provision	Build local capacities for water resources management at the catchment/river basin level	High-level techno-managerial capacity for water and energy-efficient water economy
Institutional reforms	Make existing institutions equitable and gender sensitive	Create representative and participatory institutions at project or watershed levels	Integrate customary and formal user organizations and territorial agencies into basin organization	Modern water industry with professionally managed service providers
Policy and legal regime	Build effective policies for water for livelihoods and food security; create a regulatory framework for bulk water users	Establish basic water policy and water law consistent with local institutions and customary law	Introduce a policy and legal regime for transition to basin-level water governance	Policy and regulatory framework for a modern water industry and transboundary water governance
Investment priority	Establish and improve water infrastructure for consumptive and productive use by the poor and women	Invest in infrastructure modernization for improved service delivery and water-use efficiency	Invest in infrastructure for basin-level water allocation and management including inter-basin transfers and managed aquifer recharge	Technologies and infrastructure for improving water and energy efficiency in the water economy

Managing ecosystem impacts	Create broad awareness of aquatic ecosystems; regulate water diversion and pollution by corporate consumers	Proactively manage water quality and ecosystem impacts at project level; invest in low-cost recycling	Focus on water quality and health management, urban wastewater recycling and control of groundwater depletion	Zero or minimal discharge water economy; reduce carbon footprint
Water as a social and economic good	Minimize perverse subsidies; make subsidies smart, rationing to minimize waste	Use volumetric water pricing for bulk users; establish partial cost recovery for retail consumers; target subsidies for the poor	Provide full financial cost recovery of water services; establish metered water supplies; cover 90 per cent of the population by service providers	Full economic cost recovery of water services including the costs of managing ecosystem impacts

Source: Based on Shah (2016).

Evidence linking IWRM indicator data on the degree of implementation with HDI, as a proxy for socioeconomic development, suggests there is merit in this framework (Figure 3). There is little linkage for HDI scores up to about 0.7. However, above this value (high HDI and very high HDI), there appears to be greater potential for countries to have IWRM implementation scores above 70 per cent (UNEP-DHI, 2018).



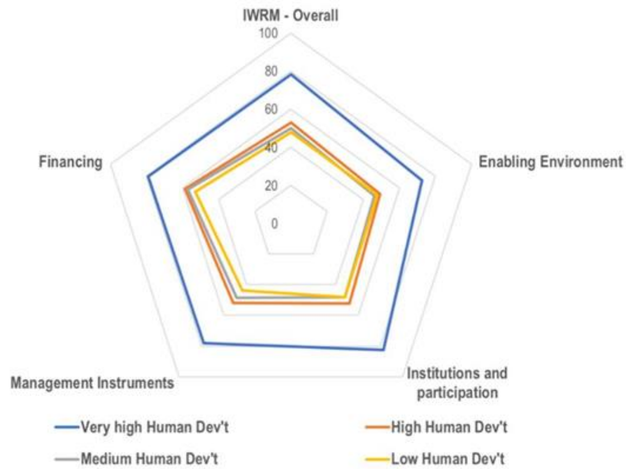


Figure 3 Relationship between HDI (2015) and degree of IWRM implementation
Source: UNEP-DHI (2018).

There is logic to the framework, in addition to the link between HDI and IWRM. For example, in fragile States, where formal water infrastructure and institutions are mostly non-existent, and people rely on informal water supplies, IWRM priorities are likely to be creating infrastructure, building local capacity and developing basin planning. Trying to implement water pricing and cost recovery in such a socioeconomic environment would clearly be inappropriate.

It is difficult to persuade countries to spend time and money on environmental issues and water management instruments, when their priority is eradicating hunger and poverty and providing access to basic water and sanitation services. It is primarily the more developed countries with strong economies and institutions that focus on management tools, cost recovery of water and sanitation services, and the aquatic environment. A number of middle-income countries are also beginning to focus on these issues. Some developing countries in Africa that have strong institutions and acute water shortages are also taking steps towards integration. These countries are likely to have put in significant efforts towards regulating water resources for the benefit of people, freshwater ecosystems and economic development.

Putting IWRM into practice in different countries is about finding a balance between learning from the experiences of other countries and adapting this to local conditions. Too much focus on the former may be problematic because the organization of water economies in poor countries can vary. But if poor countries only see their exceptional circumstances, they may forfeit the opportunity to learn from the mistakes and successes of others and can waste time and energy in trying to do something that has already been done elsewhere (Shah, 2016).

Experience shows that forcing the pace on developing countries does not work and can be counterproductive. Water management actions must build on the knowledge, experience and achievements of the past. The use of rigid formulas or methods has often failed to deliver the desired benefits (Shah, 2016).

Transboundary cooperation

SDG target 6.5 calls for implementation of IWRM at all levels, including the transboundary level as appropriate. This is further evidence and recognition of the critical need to strengthen cooperation over transboundary waters. However, a large gap exists between aspirations and actions that lead to improved water security.

The holistic and indivisible nature of water poses a challenge when water crosses political boundaries. The world's 286 transboundary river and lake basins cover almost half of the Earth's surface area, over 153 countries have territory in a transboundary water basin and almost 600 TBAs have been identified. Africa has many of the world's major transboundary watercourses, which cover more than half of its surface area and constitute more than 90 per cent of its surface water resources. Transboundary groundwater constitutes an important source of water, particularly for meeting basic human needs in water-scarce countries.

States need to cooperate to ensure that transboundary rivers, lakes and aquifers are managed in an equitable and sustainable manner. Cooperation has the potential to promote accelerated economic growth, increase human well-being, enhance environmental sustainability and secure political stability (United Nations, Economic Commission for Europe, 2015a). It allows countries to better assess, agree and implement actions that fully capture the potential of transboundary water sources, which can lead to benefits beyond water itself. Cooperation can also ensure that effective adaptation measures are in place at the basin level to deal with risks associated with climate change (United Nations, Economic Commission for Europe, 2009). Conversely, a lack of cooperation among countries sharing transboundary waters can constitute a major barrier to sustainable development. Unilateral action on transboundary waters may even cause or exacerbate political tensions in some instances (UN-Water, 2018).

The need for cooperation among nations has been endorsed by numerous international organizations, governmental organizations and NGOs. Key milestones include: the entry into force of the Convention on the Law of the Non-Navigational Uses of International Watercourses in 2014; the Convention on the Protection and Use of Transboundary Watercourses and International Lakes opened to all United Nations Member States in 2016; and the adoption of the International Law Commission's Draft Articles on Transboundary in 2008. Box 17 gives an example of how international cooperation has created benefits in a transboundary watershed in South-eastern Europe.

There are many examples of cooperation, but cooperation for its own sake will not necessarily provide benefits. There is too much focus on "input" cooperation and not enough on "output" cooperation (Tarlock, 2015). The need is emerging for measurable benefits from cooperation, such as shared hydropower revenues, agreements on water abstraction and restoration of ecosystem services. International law offers an important framework by which States must cooperate over their transboundary waters in an equitable and reasonable manner (Wouters, 2013).

Constraints to making progress remain severe. Data from SDG indicators 6.5.1 and 6.5.2 suggest that a significant number of transboundary basins lack operational arrangements. Such findings reflect previous estimates, which suggest that only 158 of the world's 286 transboundary rivers, lakes and aquifers are covered by some form of cooperative management framework (UNEP and others, 2002). Intersectoral coordination, together with a collaborative governance model that engages stakeholders at multiple levels, will be critical for ensuring that transboundary rivers, lakes and aquifers fulfil their potential as catalysts for regional cooperation and sustainable development.

Box 17 Benefits of cooperation in the Drina River basin

The Drina River basin, a tributary of the Sava River basin, is shared by Montenegro, Serbia, and Bosnia and Herzegovina. This water-rich river basin is characterized by untouched landscapes and good biodiversity. The area has a high level of unemployment among youth, which is driving migration towards large cities as well as to other countries. The population of the Drina basin was severely affected by floods in 2010 and 2014.

Key economic activities in the basin include power generation, small-scale agriculture and nature-based tourism. Hydropower generation is key in contributing to energy security, delivering on international commitments on greenhouse gas emission reductions and electricity export potential. Groundwater represents the main water supply. Biodiversity is significant, particularly within the upper parts of the basin, which are home to rare and endangered species such as brown bear, wolf, chamois, wildcat and otter (United Nations, Economic Commission for Europe, 2017).

A multidisciplinary nexus assessment was carried out in the Drina basin to identify (through a transboundary dialogue) key linkages among energy, water, land and ecosystem resources (United Nations, Economic Commission for Europe, 2015b). Its purpose was to assist sector authorities and stakeholders.

Economic benefits of transboundary cooperation were identified as increased electricity production (e.g. optimizing water release regimes), increased agricultural production (e.g. by improving irrigation systems though coordination and exchange of experience), reduced damage from floods and droughts (e.g. by better modelling of flood and drought risk, developing protective infrastructure and cooperation in flow regulation) and development of the tourism sector. Other benefits included increased energy trade and integration and energy security, increased numbers of people employed due to cross-border economic activity, reduced rural–urban migration, reduced economic and human costs of floods, increased resilience of local communities to climate change, and protection of water quality and ecosystems (e.g. through improved wastewater treatment and solid waste disposal).

The Sava River Basin Commission and its legal framework were identified as an important basis for promoting cooperation at the basin level. However, improvements in governance at many levels (e.g. improved coordination among sectors within each country, more formal cooperation arrangements among countries, broader engagement of stakeholders and greater focus on compliance) are critical, together with the needs for technical solutions and a coordinated basin-wide investment strategy (United Nations, Economic Commission for Europe, 2017).

C. Eliminating inequalities

Inequality and the need "to leave no one behind" are persistent problems with no clear solutions. Equal access to sufficient safe and affordable water and adequate and equitable sanitation and hygiene can mean the difference between prosperity and poverty, well-being and ill-health, and even living and dying. Only 62 per cent of people in LDCs had access to a basic drinking water service in 2015, compared to 89 per cent of the global population. The disparity in sanitation and hygiene was greater: only 32 per cent had access to a basic sanitation service in LDCs, compared to 68 per cent of the global population. Only 27 per cent of people in LDCs had a basic handwashing facility at home (WHO and UNICEF, 2017a). While poverty is decreasing, inequalities are increasing, and are at an all-time high. This affects almost every country in the world and is not just a developing country problem.

Income is a good predictor of access to water and sanitation at a general level (Figures 4 and 5). However, income or economic influences are only part of the picture. Inequalities in societies and in access to water resources and services are multifaceted.

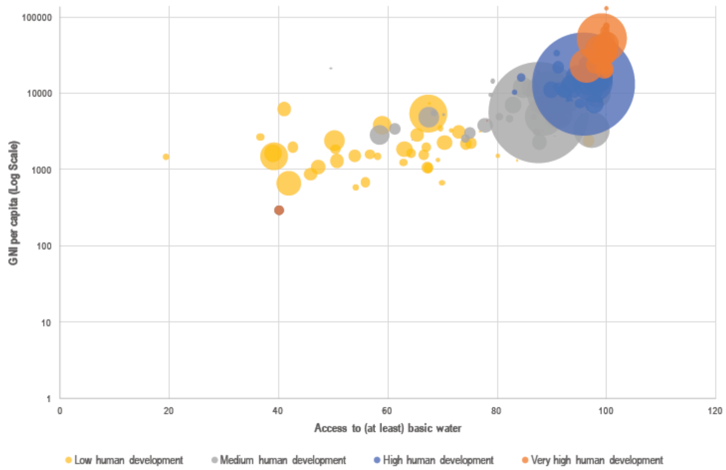


Figure 4 Access to basic drinking water and gross national income (GNI) per capita by HDI group (circle size is proportional to population)

Data source: WHO and UNICEF (2017b); World Bank (2017a).

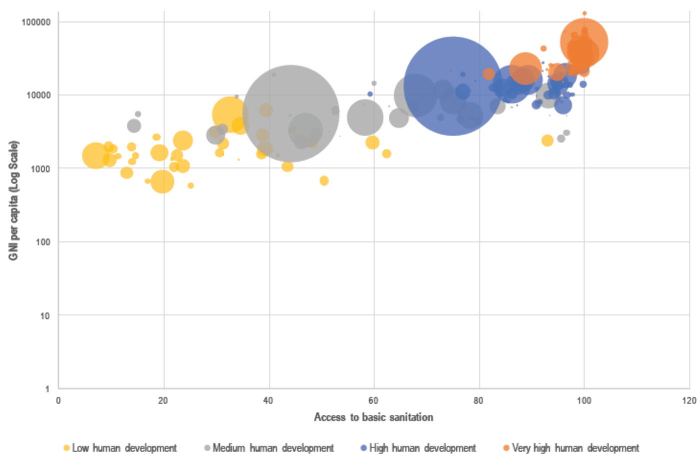


Figure 5 Access to basic sanitation and gross national income (GNI) per capita by HDI group (circle size is proportional to population)

Data source: WHO and UNICEF (2017b); World Bank (2017a).

The latest GLAAS report (WHO and UN-Water, 2017) shows that many countries are failing to implement policies that sufficiently target the most vulnerable people. While 74 per cent of countries had policies and plans to target poor populations with both water and sanitation services, only 55 per cent and 47 per cent were monitoring their progress in providing drinking water and sanitation services, respectively (Figure 6). Fewer countries still had financial measures in place to target these populations, at 27 per cent and 19 per cent for drinking water and sanitation services, respectively.

	World Bank income group	Number of countries	GOVERNANCE Policies and plans have specific measures to reach poor populations	MONITORING Progress in extending service provision to poor populations is tracked and reported	FINANCE Specific measures in the financing plan to target resources to poor populations are consistently applied
SANITATION	**All responding countries**	**74**	**74%**	**47%**	**19%**
	Low income	15	73%	33%	7%
	Lower middle income	29	66%	48%	10%
	Upper middle income	26	85%	58%	27%
WATER	**All responding countries**	**74**	**74%**	**55%**	**27%**
	Low income	15	73%	53%	20%
	Lower middle income	29	66%	48%	14%
	Upper middle income	26	85%	69%	38%

80–100%
60–79%
40–59%
0–39%

Figure 6 Percentage of countries implementing measures to extend services to poor populations by World Bank income group

Source: WHO and UN-Water (2017).

Inequalities in the water sector exist among and within countries, between rural and urban communities, within urban communities and also among sociocultural environments, as outlined below.

1. Among and within countries

There is a marked difference between fragile and non-fragile States, in both basic drinking water and sanitation services (Figure 7).

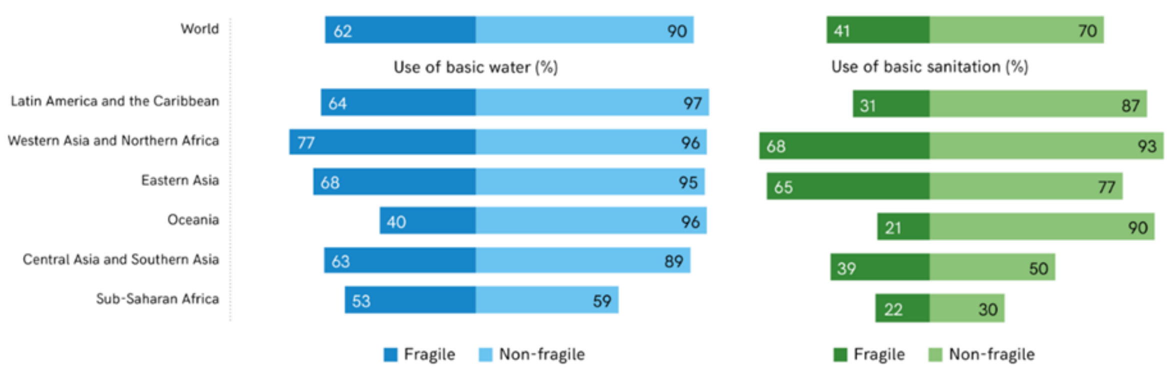


Figure 7 Proportion of population using basic drinking water (left) and sanitation (right) services in fragile and non-fragile States in 2015

Source: WHO and UNICEF (2017a).

Inequalities can be hidden in global data. Disaggregating data to national and subnational levels can highlight ‘hot-spots’ where inequalities are most acute. For example, Angola, which has a relatively high coverage of basic drinking water compared to other countries in sub-Saharan Africa, has a 40 per cent gap between urban and rural areas and a 65 per cent gap between the richest and poorest people. In the best-performing subnational region in Panama, 95 per cent of the population uses basic sanitation, compared to just 1 per cent in the worst-performing subnational region. In Tunisia, coverage of basic handwashing facilities exceeds 80 per cent in all except the poorest wealth group, which lags behind at 54 per cent. Although Bangladesh is close to eliminating open defecation, the problem is now concentrated among the lowest wealth group and two subnational regions (WHO and UNICEF, 2017a).

Inequalities are found in all countries, and the differences in basic service coverage among the different wealth groups provides a useful measure of the gap between rich and poor people (Figure 8).

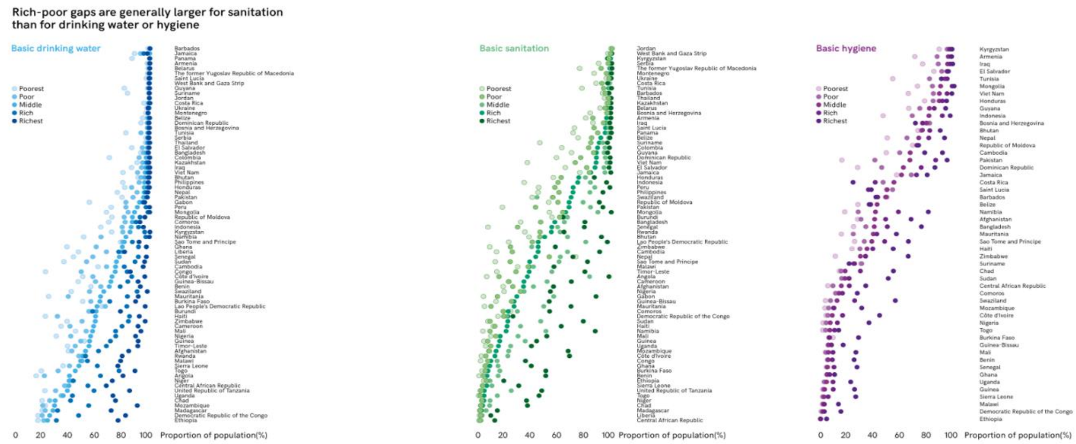


Figure 8 Use of basic drinking water, sanitation and hygiene by national wealth group, 2010–2014

Source: WHO and UNICEF (2017a).

2. Between urban and rural populations

Rural communities lag behind the urban sector in providing access to basic water and sanitation facilities, although there is good progress at the global level. Some 159 million people still collected drinking water from distant surface water sources, mostly rural communities in Central and Southern Asia and sub-Saharan Africa, in 2015. A similar global picture is evident for sanitation, where 892 million people still defecated in the open, with the majority again residing in rural communities (WHO and UNICEF, 2017a). The World Bank's WASH Poverty Diagnostics Initiative graphically shows these differences (Figure 9).

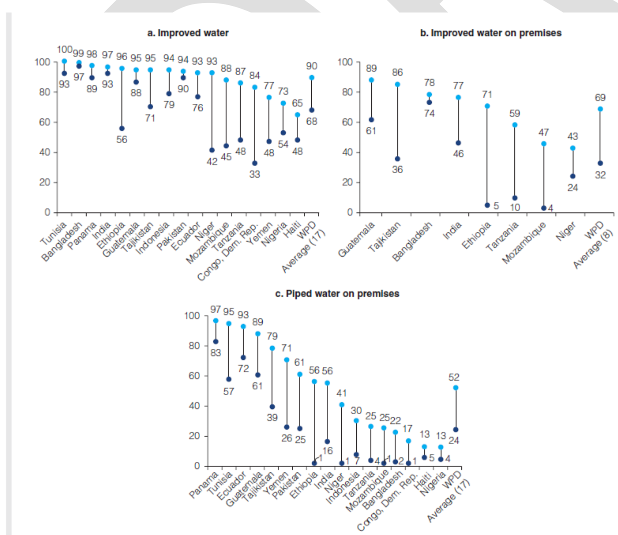


Figure 9 Use of improved water in urban and rural areas for selected countries

Source: Andres and others (2017).

3. Within urban areas

Water and sanitation inequalities are not just rural/urban issues. Slums can proliferate where urban growth is not well-managed and development is unplanned. They become disadvantaged with few formal services because access to services is cumbersome, expensive and insecure. The proportion of the urban population in developing countries living in slums (households that lack one or more of the basic needs of water, sanitation, sufficient living area or house durability) decreased by 9 per cent to 30 per cent between 2000 and 2014. However, the absolute number of slum dwellers has continued to grow, from 689 million in 1990 to 881 million in 2014. This occurred mainly in middle- and low-income countries. The proportion of urban population living in slums increased from 21 per cent in 2000 to 25 per cent in 2014 in Western Asia. The challenge remains critical in sub-Saharan Africa, where nearly 60 per cent of the urban population still lived in slums in 2014 (UN-Habitat, 2016) (Figure 10).

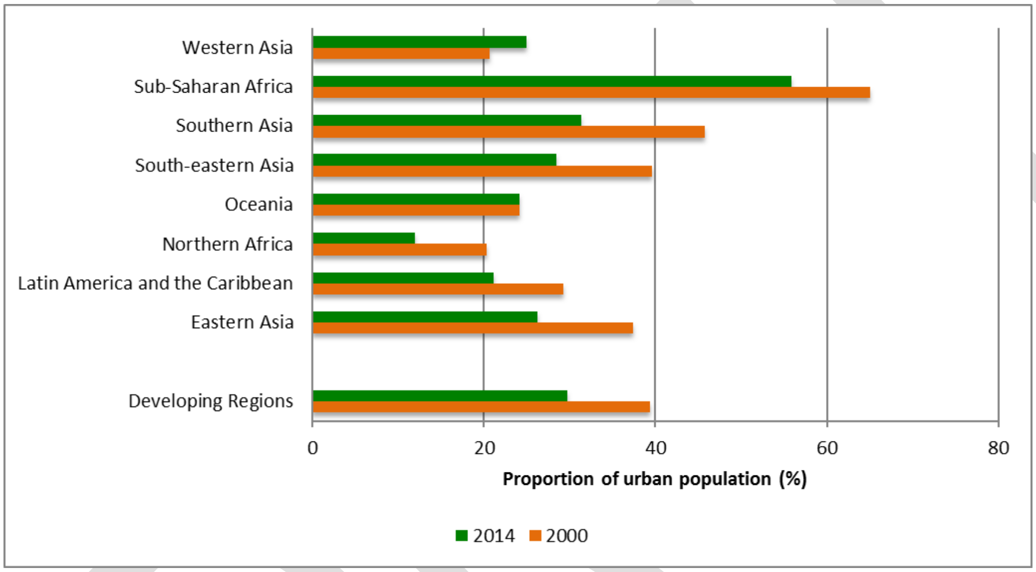


Figure 10 Percentage of urban population living in slums (population living in households that lack either improved water, improved sanitation, sufficient living area (more than three persons per room) or durable housing) in 2000 and 2014

Source: UN-Habitat (2016).

There are economies of scale that benefit densely populated urban communities, but in many low-income countries, these systems tend not to cater for everyone. Slum areas can be overlooked for political or other reasons, because of the perceived risk of damage to infrastructure or simply because these areas are recent additions to a city. However, slum dwellers should not be excluded from formal water services based on economic criteria, as they tend to pay the most for a lower quality service (UNDP, 2006). Poor communities can be reliable paying customers when given the opportunity to enjoy formal piped services under the same conditions as wealthier urban dwellers.

Sanitation-related disease is a concern in densely populated areas. The urban poor are two to three times less likely to access any type of improved sanitation than their wealthier neighbours (World Bank, 2017b). Diarrhoeal disease prevalence in slum areas may be as high as in rural villages (UN-Habitat, 2006). Investments in small-scale and decentralized water and sanitation solutions could improve access and lower costs for rural communities. Solutions like community-based sanitation such as EcoSan technologies are now being adopted in many countries. These can also provide other benefits by creating local jobs and helping to protect the environment.

4. Among sociocultural environments

Ethnicity is important in determining access to water and sanitation. For example, only 33 per cent of indigenous populations has access to improved sanitation in Guatemala, compared to 70 per cent of non-indigenous populations (World Bank, 2017b).

Remnants of the previously legal caste system can have an effect on sanitation in India. A child born into one of the lowest castes is three times more likely to live in a household where members defecate in the open than a child born into one of the higher castes (World Bank, 2017b).

Some 370 million indigenous peoples live in 70 countries across all inhabited continents. They comprise more than 15 per cent of the world's poor, although they account for less than 5 per cent of the world's population. Indigenous peoples can play a crucial role in managing natural resources, as indigenous lands and territories contain some 80 per cent of the planet's biodiversity (IFAD, 2012).

D. Means of implementation

Agenda 2030 has a strong focus on MoI, including the specific goal SDG 17, which offers an enabling framework for implementation of the SDGs. Within SDG 6, there are also MoI targets specific to the goal (6.a and 6.b).

The important MoI for water and sanitation comprises governance, finance, capacity development and data monitoring. They are interlinked, and effective policies in each activity are mutually reinforcing. They are all essential elements in meeting the SDG 6 targets. For example, SDG target 6.1 on access to safe drinking water requires: finance for water treatment technologies; trained staff to design, operate and maintain facilities; data monitoring for evidence-based decision-making; and good governance and accountable institutions with clear roles and responsibilities.

1. Governance

The *Ministerial Declaration of The Hague on Water Security in the 21st Century* referred to improving governance as one of the main challenges to increasing water security and suggested "governing water wisely" (WWC, 2000). GWP also emphasized that "the world water crisis is mainly a crisis of governance" (GWP, 2000). *The United Nations World Water Development Report* (WWAP, 2006) and the *Human Development Report* (UNDP, 2006) highlighted the importance of governance and actors working together, stating that "scarcity at the heart of the global water crisis is rooted in power, poverty and inequality, not in physical availability." These affirm that governance and politics play a powerful role in a country's development, in shaping policies and determining the way in which they are implemented. Assessing and improving governance are therefore essential steps in developing programmes that aim to achieve the SDG 6 targets.

Good governance is one of the key pillars of SDGs. It is addressed through SDG 16 (Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable institutions at all levels). It is also addressed through SDG targets 17.13–17.17, which relate to elements such as policy coherence, multi-stakeholder partnerships and effective institutions.

Development actors have increasingly emphasized the importance of good governance for sustainable development. The term "governance" covers a wide set of actors that create development outcomes. This is partly as a reaction to experience in many countries where governments alone were not able to deliver on various development needs. The original perception of governments as providers of services and development has shifted to that of enablers or providers of conditions enabling sustainable development. Environmental imperatives have forced governments and society to engage more in how resources are used and disposed of after use.

Pressures on water resources have intensified such that debate on water allocation has shifted from a technical/physical one of how to abstract and use available water resources to a political and governance focus about "who should get how much water" (Chartres and Varma, 2011; Niasse, 2017). The result is that water scarcity has stimulated water policy and water law reforms in many countries.

Good governance is the main theme of the collaborative behaviours developed in 2014 by the Sanitation and Water for All (SWA) global platform (Box 18). SWA is a partnership of over 50 governments, 25 external support agencies, and numerous civil society organizations, academic partners and private sector organizations. This can improve long-term performance and sustainability in the WASH sector.

Box 18 SWA collaborative behaviours

SWA identified four collaborative behaviours that could improve long-term sector performance and sustainability, if jointly adopted by governments and development partners:

- Enhance government leadership of sector planning processes
- Strengthen and use country systems
- Use one information and mutual accountability platform built around a multi-stakeholder, government-led cycle of planning, monitoring and learning
- Build sustainable water and sanitation sector financing strategies that incorporate data on taxes, tariffs and transfers, as well as estimates for non-tariff household expenditure

Adopting these behaviours can improve accountability and produce better results.

Nine indicators were developed to monitor the collaborative behaviours, to improve long-term sector performance and sustainability in the WASH sector. These draw on the success from the health sector and International Health Partnership indicators. The data required for the indicators come from published data and existing monitoring initiatives, such as OECD, GLAAS and World Bank assessments. The following key principles helped to drive indicator development:

- Focus on the core element(s) of each behaviour. It is impossible to cover everything with these indicators, although the behaviours can be complex, and so it is important to concentrate on the central issues.
- Encourage the WASH sector to measure aspects that have not been measured before. The core elements of the behaviours are difficult to monitor, but this should not prevent the sector from attempting to do so.
- Leverage existing monitoring initiatives and adapt tools accordingly in the future. Monitoring behaviours should not put an additional burden on countries for data collection.

Source: SWA (2018).

(a) Governance functions

Governance involves core functions such as formulating policy and developing legal frameworks, planning, coordination, funding and financing (section 4.2), capacity development (section 4.3), data monitoring (section 4.4) and regulation. Many of these functions are performed by governments. A line ministry tasked with water resources management or providing water and sanitation services would engage in these core water governance functions. However, in the spirit of “governance” going beyond “government”, the core functions need to take into account cooperation with other stakeholders, including the private sector.

(i) Policy and institutional arrangements

A key governance function is policy formulation and engagement with stakeholders to express priorities. These may be translated into national legislation, sector regulation and/or institutional arrangements that identify actors and responsibilities.

Seventy per cent of the 74 responding countries to the 2011/2012 GLAAS survey had water and sanitation policies in place (WHO and UN-Water, 2012). The 2014 survey showed this increased to 80 per cent of 93 respondents (WHO and UN-Water, 2014).

There was a wave of water policy and water law reforms, in response to water scarcity. Most of the 134 countries that contributed to a 2012 IWRM survey initiated or made changes in their water policies (79 per cent) or their water laws (82 per cent) (UNEP, 2012). The reforms also embodied many of the normative provisions found in the 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes and the 1997 United Nations Convention on Non-Navigational Uses of Transboundary Watercourses (Niasse, 2017).

(ii) Planning and coordination

Planning is increasingly becoming participatory in policy processes, together with stakeholder involvement. Conventional planning has become “strategic” planning, suggesting a focus on goals and visions. Participatory, bottom-up and dynamic processes are used, instead of top-down, centralized decision-making with a narrow focus on problems at hand. Planning processes are iterative rather than linear, and there is increased focus on risk. Water planners are beginning to take drought and flood risk fully on board to prepare for what may happen in the future.

Twenty-nine per cent of countries reported having national water plans in place that were costed, funded, implemented and regularly reviewed in the 2013/2014 GLAAS survey. The values were 23 per cent for sanitation and 20 per cent for hygiene (WHO and UN-Water, 2014).

Coordination has become an increasingly important governance and government function. All 73 countries reported having a coordination mechanism in place in the 2013/2014 GLAAS survey. This included all ministries and government agencies that influenced WASH service delivery plus non-governmental stakeholders (WHO and UN-Water, 2014).

(iii) Regulation and licensing

Regulation, licensing water abstraction and disposal, and providing services are operational extensions to the legislative system. They are a prerogative for the public sector, including line ministries and regulators. An important role for regulators is monitoring performance or benchmarking operators, to enhance capacity and instil competitive pressure to comply with higher performance standards.

However, customer service and performance reviews showed low levels of information made available to the public, despite the opportunity for transparency. The levels of customer satisfaction reviews were lower than for performance reviews. Urban drinking water providers appeared to perform better than their rural sanitation counterparts. However, all sectors lag behind desirable levels of release and transparency of reviews, thus highlighting this need significant improvement (WHO and UN-Water, 2014).

A GLAAS country survey in 2016/2017 showed that about 70 per cent of countries reported legally binding national standards for quality of service for both drinking water and sanitation/wastewater (Figure 11).

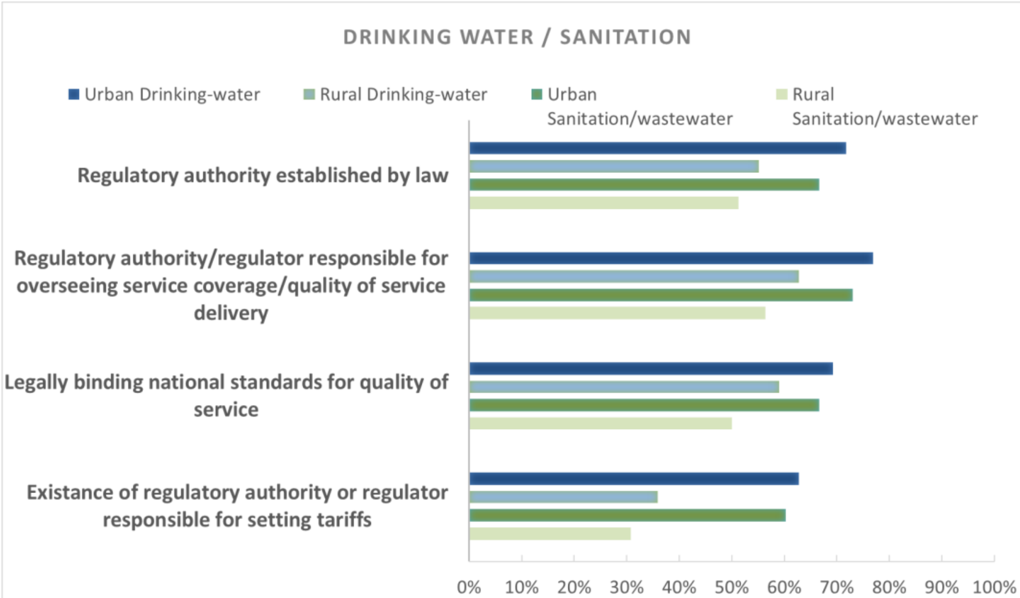


Figure 11 Percentage of countries with policies, regulations and standards

Source: WHO and UN-Water (2017).

(b) Principles of good governance

OECD defines water governance as the "range of political, institutional and administrative rules, practices and processes (formal and informal) through which decisions are taken and implemented, stakeholders can articulate their interests and have their concerns considered, and decision makers are held accountable for water management" (OECD, 2015). Good governance comprises many elements, but the following three principles stand out: (1) effective, responsive and accountable state institutions, (2) openness and transparency and (3) participation in decision-making.

(i) Effective, responsive and accountable institutions

Governments and bodies are responsible and accountable for their actions to implement SDGs. Institutions that respond to change and are accountable to citizens and other stakeholders are needed urgently. They should have vision, develop long-term sectoral plans matched with financing strategies, set targets and take actions. Most countries now have WASH policies/plans, but less than one third reported having plans that are costed, implemented and regularly reviewed (Figure 12).

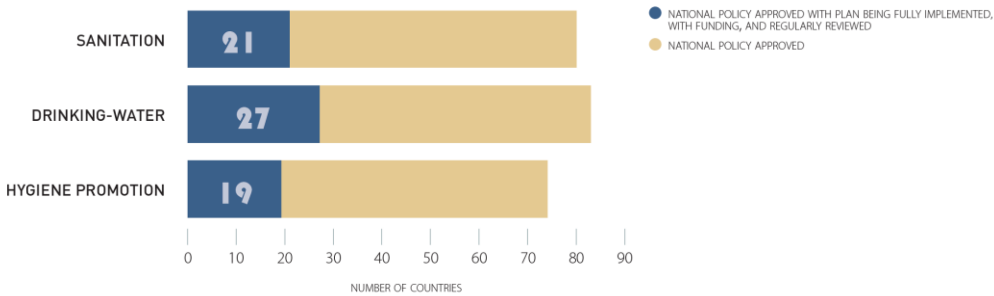


Figure 12 Number of countries with approved national WASH policies communicated through a public formal announcement (n = 93)
Source: WHO and UN-Water (2014).

Mutual accountability among all stakeholders is essential. This includes accountability between governments and the people they serve and accountability among government institutions, civil society and development partners. See Box 19 for an example of the power of accountability.

Institutions with roles and responsibilities for providing services and implementing SDGs must be accountable to the people they serve. This works together with the need to be open and transparent, and the importance of data monitoring. "Accountability in the WASH sector is the democratic principle whereby elected officials and those in charge of providing access to water supply and sanitation services account for their actions and answer to those they serve" (UNDP WGF and UNICEF, 2015). Accountability has several dimensions, including social accountability, where individuals and communities can hold service providers and governments to account, and financial, administrative and political accountability.

Figure 13 shows a simple framework for accountability where relationships exist among governments, service providers and communities/users, bolstered if necessary, by external agencies. Regulation, licensing and enforcing standards are also a key part of the accountability framework.

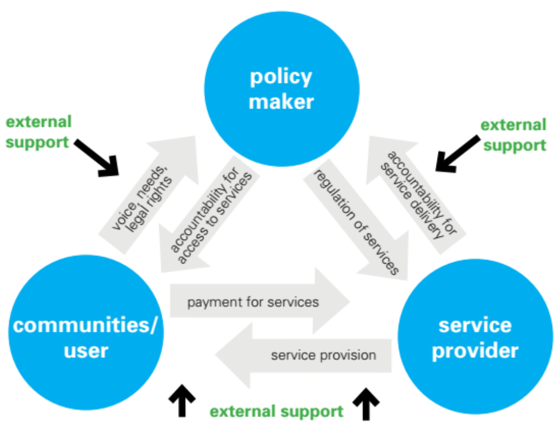


Figure 13 Framework for accountability

Source: UNDP GWF and UNICEF (2015a).

Box 19 Power of accountability

An example of the power of accountability comes from the Johannesburg Water customer care programme. The water utility faced customer payment problems when services and service levels did not meet community expectations.

Johannesburg Water responded by offering customers two call-in centres, two walk-in contact centres and contact by mail and email, to address the issue. The utility has benefited enormously from maintaining good customer care and relations. Customers are more likely to inform it of service failures that can be rectified quickly when the utility responds swiftly and provides feedback. Customers are therefore satisfied and more willing to pay for services. This increases cost recovery and the ability of Johannesburg Water to further invest in services.

Source: UNDP GWF and UNICEF (2015b)

(ii) Openness and transparency

Openness and transparency involve providing information to stakeholders. The information may be on service levels, leakage rates, non-revenue water, water quality, environmental impacts, tariffs and financial surpluses, strategies and plans. They may also concern promoting transparency in procurement, and ensuring that governments, service providers and communities get value for money and reduce corruption.

Openness and transparency require regulatory frameworks built upon legal and institutional structures. In countries where transparency is high, utilities can be required by law to publish information on their performance across a wide range of parameters. Data reporting infrastructure, in the form of information technology, and sufficient human resources may also be required.

Applying openness and transparency in practise depends on the availability and quality of data monitoring.

(iii) Participation in decision-making

A principle of good governance is that citizens and communities have a voice and a role in decision-making. This can range from token participation by being informed, through to active control of the decision-making processes. Participation can include voting for representatives at the local and national levels, participating in stakeholder events and forums, and playing a role in community or catchment committees. Box 20 provides an example of participation in decision-making through the use of participatory budgeting in Brazil.

Box 20 Decision-making by participatory budgeting in Brazil

The Municipal Department of Water and Sewerage in Porto Alegre supplies water and sanitation services and is supported through a progressive tariff that generates a surplus of 5-15 per cent annually. Citizens use participatory mechanisms to propose and vote on how to use this surplus to make new investments. They are also represented on a citizen's board that oversees the public utility and its contractors, thus promoting accountability.

The Municipal Department of Water and Sewerage has kept up with population growth and expanded services significantly since citizen participation has increased. The percentage of dwellings with access to treated water rose from 94.7 per cent in 1989 to 99.5 per cent in 2002, and the proportion with access to the municipal sewer network grew from 46 per cent in 1989 to 84 per cent in 2002.

Source: TNI and CEO (2005).-

Participation and multi-stakeholder engagement are important parts of policy processes. The importance of having a transparent, universal and neutral platform for government and citizen groups to mobilize available resources and seek alternative means of ensuring improved water services has also proven to be essential and complementary to local government support. The value of capacity becomes an important element in how policies are created and carried out. Box 21 shows an example of a partnership for water and sanitation in Pakistan.

Box 21 Partnership for water and sanitation in Pakistan

The Karachi Water Partnership was established as a neutral, multi-stakeholder group unified by a common aim to promote government–citizen collaboration for improved water resources management in the city. The multiple water management issues confronting the 18 million inhabitants of Karachi were unlikely to be solved without the active contribution of all concerned.

The partnership has proven to be key for developing change in the management of water and sanitation in Karachi. It was mandated to act through signing seven memorandums of understanding with city-based institutions, including the City District Government of Karachi and the Karachi Water and Sewerage Board. More than 300 partners have joined the partnership since its launch, with each one signing a pledge to conserve and better manage water and sewage in homes, in places of work and study, and in public spaces. Water supply and sanitation facilities were provided for over 400 teachers and 8,500 school children in 55 schools, and US$70,000 was raised to create and support the partnership.

At the neighbourhood level, the Orangi Pilot Project provided a model for communities to organize themselves around sewer lanes, as part of work on low-cost sanitation, housing, health, education and credit for microenterprise. Extensive mapping was used to disentangle land ownership, which can cause personal risks in a situation of high demand for land.

The achievements of local Women and Water Networks has highlighted the role that women play in catalysing change within communities. Establishment of such networks was recognized as a prerequisite for advancing work at the district level.

Source: GWP and Orangi Pilot Project.

2. Finance

Greater levels of finance and new financing paradigms are necessary to provide opportunities for making rapid progress in the future, while needs in the water sector remain high. The current financial resources available to countries are inadequate to achieve SDG 6. The 2016/2017 GLAAS survey reported 80 per cent of the 70 respondent countries had insufficient finance to meet their national WASH targets, which in many cases are less ambitious than the related SDG targets (WHO and UN-Water, 2017). The World Bank estimated the annual capital costs of meeting SDG targets 6.1 and 6.2 as US$114 billion per year (Hutton and Varughese, 2016). This figure excludes operation and maintenance, monitoring, institutional support, sector strengthening and human resources. The focus on capital expenditure and ignoring current expenditure has been referred to as a “systems blindness” (Fonseca and Pories, 2017).

Investments in WASH bring social and environmental benefits, as do investments in other water and water-using sectors. Estimates of the annual costs of damage from flooding, inadequate WASH and water scarcity amount to US$500 billion per year (Sadoff and others, 2015). This figure would be much higher if environmental costs could be valued and considered. The benefits of investing in the water sector should reduce these costs and promote growth, which can then provide revenue supporting further investment, thus creating a virtuous circle.

Bridging the finance gap necessitates improving the efficiency of existing financial resources, while increasing the role of innovative sources of financing, such as commercial and blended finance. The Addis Ababa Action Agenda (adopted in 2015) states the need for a new framework to finance sustainable development. It asks countries to mobilize domestic public resources, and to promote domestic and international businesses to raise private finance for investment in ways that further sustainable development (United Nations, 2015).

The role of ODA is critical. It must be targeted where it can be most effective and used to catalyse additional funding sources through the power of blended finance. Mobilizing private and business finance will require measures to improve the attractiveness of water and sanitation sectors to investors

(a) Current status

Funding for water and sanitation typically comes from three sources: tariffs, taxes and transfers, known as the "three Ts". Detailed data from 25 countries showed these three elements constitute 92 per cent of the combined annual WASH expenditure of US$43 billion (Figure 14). The other major source of financing is repayable or commercial finance. This source is significantly underused, and there is much potential for it to expand (WHO and UN-Water, 2017).

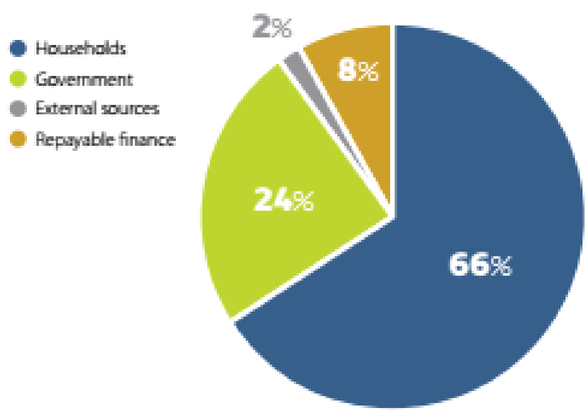


Figure 14 Sources of annual financing for WASH services in 25 countries

Source: WHO and UN-Water (2017).

Tariffs are typically the largest source of funding. They include user fees and household investments, covering self-supply solutions, such as well and water tanks, and household sanitation. Sixty-six per cent of financing came from household sources, although this varied considerably among countries. Tariffs do not support cost recovery in many cases. Tariff revenues were sufficient to cover most of the operation and maintenance costs in fewer than half the countries surveyed. Cost recovery from tariffs was lower in rural areas than in urban areas.

Taxes include all funding from public budgets allocated by governments (at the central or local levels) for investment, subsidies and general sector funding. Taxes form most non-household sources of WASH finance. Government budgets increased annually at an average of 4.9 per cent after inflation between 2013 and 2016 (WHO and UN-Water, 2017).

Transfers involve financing from overseas in the form of official development finance (ODF), contributions from NGOs and remittances. ODF consists of concessional financing through grants or loans (ODA), or through non-concessional financing or other official flows (excluding export credits). This is typically the smallest component of funding in the water and sanitation sector, although external support is a major contributor to

WASH in some countries and could potentially play a role in catalysing new forms of finance. ODA for water- and sanitation-related activities is the subject of SDG target 6.a (WHO and UN-Water, 2017).

ODF commitments for all sectors rose from US$104 billion to US$263 billion between 2000 and 2016 (quoted in 2015 constant prices). ODF commitments to the water sector have increased in recent years, although they are decreasing as a percentage of the total. However, they dropped from US$18.2 billion to US$14.5 billion between 2015 and 2016. ODA and ODF disbursements have also increased, and currently stand at US$13.0 billion (Figure 15). Most disbursements came from ODA (67.9 per cent) in 2016. Equity investments and private grants were a small proportion of the total (0.51 per cent). ODA targeted at the water sector has shifted away from grants towards concessional loans since 2005. The percentage of disbursed concessional loans from ODA increased from 39 to 60 per cent in 2016 (OECD, 2017).

While ODF investments in the water sector remain uncertain and are a small part of the overall funding total, some countries still rely on external funds, with 11 countries receiving more than 20 per cent of their WASH financing from these external sources (WHO and UN-Water, 2017).

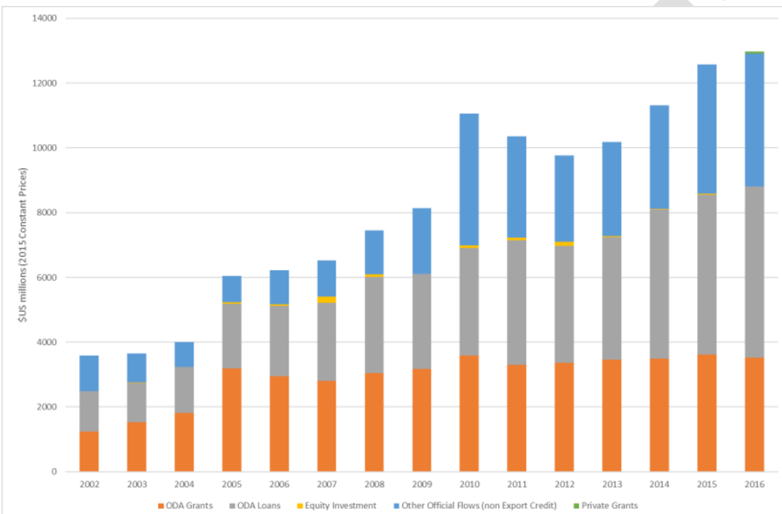


Figure 15 ODF disbursements to the water sector by year

Source: OECD (2017).

Assessment of IWRM implementation indicated that the finance component lagged other aspects such as policies, institutions and management instruments and was constraining the achievement of SDG 6. National budgets for investments in water resources infrastructure and recurrent costs of water resources management were either insufficient or not fully disbursed.

Development partners have identified three main financial challenges in the WASH sector (Fonseca and Pories, 2017):

- **Lack of finance for strengthening the enabling environment,** including systems that support existing infrastructure and service delivery. The focus is on capital investments in new infrastructure, including pipelines, wells, water storage facilities and latrines.
- **Untapped use of repayable finance,** including microfinance and blended finance. Only 8 per cent of funding came from repayable finance, rather than the three Ts. The water sector is often not seen as attractive to investors because of inadequate tariffs to cover all recurrent costs, low tariff collection rates, low revenue streams, weak regulatory frameworks and poor sector leadership.

- **Inequalities in services provision.** Resources are not adequately targeted, and areas such as sanitation are commonly overlooked. Affordability remains a problem. The poor and vulnerable are often unable to access services. It is paradoxical that the poor often pay more per volume of water for a low-quality service than the wealthy who are connected to a utility network with a continuous water supply (UNDP, 2006). WHO/UNICEF JMP found that countries had made progress towards the MDGs without significantly reducing inequalities in 2015 (WHO and UNICEF, 2015). Few countries are consistently applying financial measures to target resources to poor populations (WHO and UN-Water, 2017).

(b) Accelerating progress

The challenge of financing SDG 6 presents opportunities for new and innovative actions that fall broadly into two categories:

- **Use existing resources more efficiently and effectively.** Despite the problems, annual budgets and resources in the water sector are already substantial and amount to US$85 billion from 57 responding countries (WHO and UN-Water, 2017). Existing resources must be used to target areas such as institutional strengthening, which can translate capital investments into effective service delivery. They should also be used to target vulnerable populations.
- **Mobilize repayable finance.** A paradigm shift is needed that increases the uptake of innovative financing mechanisms. These include repayable finance in the form of microfinance, blended finance and commercial finance. Action is needed to make the water and sanitation sectors more attractive to private finance.

The World Bank stated that these actions are self-reinforcing in the WASH sector. Improving the use of existing resources, when coupled with reforms, should lead to increased efficiencies, improved services and increased creditworthiness. This can lead to increased access to repayable and commercial financing, which can then be invested in further service improvements, thus continuing the cycle (World Bank, 2017c).

Sector reforms may be needed to use existing resources more efficiently and effectively. Better financial planning and budgeting should be strategic and consultative. Only about one third of countries (35 per cent) reported the use of sector development or action plans to identify future investment needs or strategies for future financing according to the latest GLAAS survey (WHO and UN-Water, 2017). Existing budgets can be better allocated more equitably or to areas where the pay-off may be greater. Tariffs and subsidies can be better designed and collected to increase cost recovery and improve services, thus increasing willingness to pay for services. Improving commercial and technical efficiencies should result in better service provision and reduce costs.

The key opportunity arising from sectoral reform and the effective use of existing resources is the potential to use public funding to leverage repayable finance in the form of blended finance or microfinance, and ultimately more sustainable commercial finance. Commercial finance comes in many forms, including bank loans, equity and bonds. There are many benefits of raising commercial finance in the WASH sector, including longer term sustainability, faster access to finance and lower transaction costs.

Blended finance is the strategic use of public taxes, development grants and concessional loans to mobilize private capital flows to emerging and frontier markets. Blended finance can offer more affordable access, while enticing lenders into the market. It can operate through subsidizing loans, providing guarantees, supporting grace periods and extending loan repayment schedules.

Microfinance is a strategy for increasing the use of repayable finance in the sector. It enables households to take out small loans to provide capital for investments such as water connections and toilet facilities. These loans offer low interest rates that can be paid back over time and provide a catalyst for the private component of blended finance. Microfinance has been shown to work when combined with government subsidies to increase access to water and sanitation (e.g. through the Clean India Campaign). The role of business in supporting the water and sanitation sector should not be limited to large companies, as small-scale entrepreneurs also have a role to play.

The model of using existing resources more efficiently and improving performance can lead to increased creditworthiness and access to commercial finance, thus further improving service delivery (Figure 16).

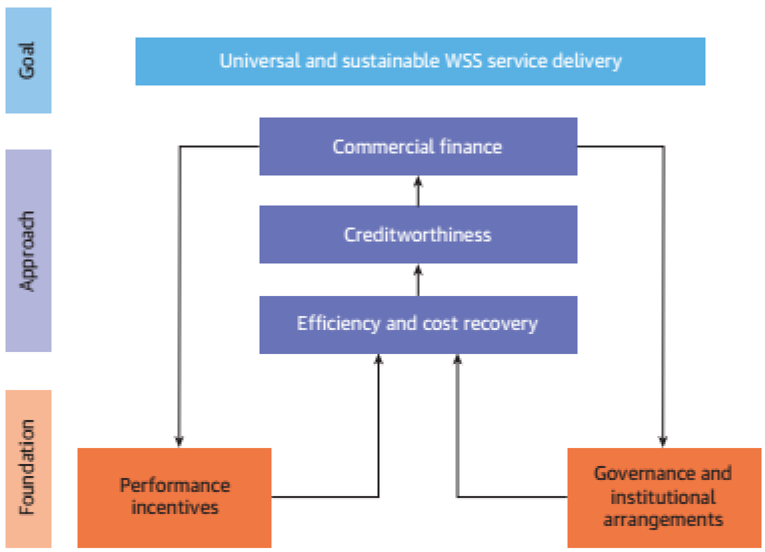


Figure 16 Cycle of water sector reform

Source: World Bank (2017c).

Action is also needed to extend the value of water beyond the cost of accessing it, to include its economic and social value. OECD has developed a framework and four principles to improve the way water is valued (OECD, 2012):

- The polluter pays principle creates conditions under which pollution is a costly activity. This either influences behaviour to reduce pollution or generates revenues to alleviate pollution and compensate for welfare loss. It internalizes the external costs of pollution.
- The beneficiary pays principle enables the financial burden of water resources management to be shared. It takes into account the high opportunity cost related to using public funds for providing private goods that users can ill-afford. A requisite is that private benefits attached to water resources management are inventoried and valued, beneficiaries are identified and mechanisms are set to harness them.
- Equity is a feature of many policy frameworks for water management. It is often invoked to address affordability or competitiveness issues, when water bills, driven by the first two principles, may be disproportionate with user capacity to pay.
- Coherence among policies that affect water resources can usefully be considered a fourth principle. Agriculture, land-use or energy policies can severely increase the cost of water management. Factoring water and reforming allocation of public moneys into these policies can be more cost-effective than mobilizing additional funding in the water sector.

An example of this principle is the approach to the water–energy–food nexus, which highlights the interconnectedness of water and its role in food production and energy generation. Recognizing these connections allows for a fuller understanding of the trade-offs that exist in water resources management.

3. Capacity development

Strong formal and informal institutions and human resources underpin good water governance. However, there is an acute lack of capacity, which is constraining the development and management of water resources in all its facets in most developing countries, particularly across sub-Saharan Africa and South and South-eastern Asia. Every investment in water infrastructure is at risk and may even be ineffective if not accompanied with capacity-development programmes to ensure proper management and maintenance. This is not a new phenomenon. It has been a leading concern and constraint to water-related development for many decades. Too little capacity has been developed, and what has been done has not always resolved the problem. SDG target 6.a specifically references capacity-building; however, there is no indicator to monitor it explicitly.

Knowledge and capacity development (KCD) goes beyond the need to strengthen the capacity of individuals, which is often interpreted as education and training. Individuals need these, but they also need much more. They must acquire skills, knowledge and attitudes, and be empowered to solve problems, which technical training alone cannot provide.

KCD includes building organizations in which individuals work together within established rules to provide regulations, incentives, agreements, rights and finance for service provision. Organizations can also provide the additional capacities that individuals need, but the rules are often missing, or they are not adhered to because of corruption or nepotism.

Another element of capacity development is an enabling socioeconomic environment, which provides a broad context within which water for people, for industry and for the environment can flourish. This is essentially the responsibility of governments in their role of enabler or provider of conditions for sustainable development.

Human resource shortages are reported in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, management of floods and droughts, and utilizing recycling and reuse technologies. Nearly half of the 74 responding countries in the 2011/2012 GLAAS survey were unable to state how many staff were working in the water sector (WHO and UN-Water, 2012). Only one third of the 94 countries surveyed had comprehensive human resource strategies for urban and rural areas for drinking water, sanitation and hygiene in the next reporting cycle (Figure 17) (WHO and UN-Water, 2014). WASH activities that benefit most from increased human resources are monitoring and evaluation, national and local planning, and operation and maintenance.

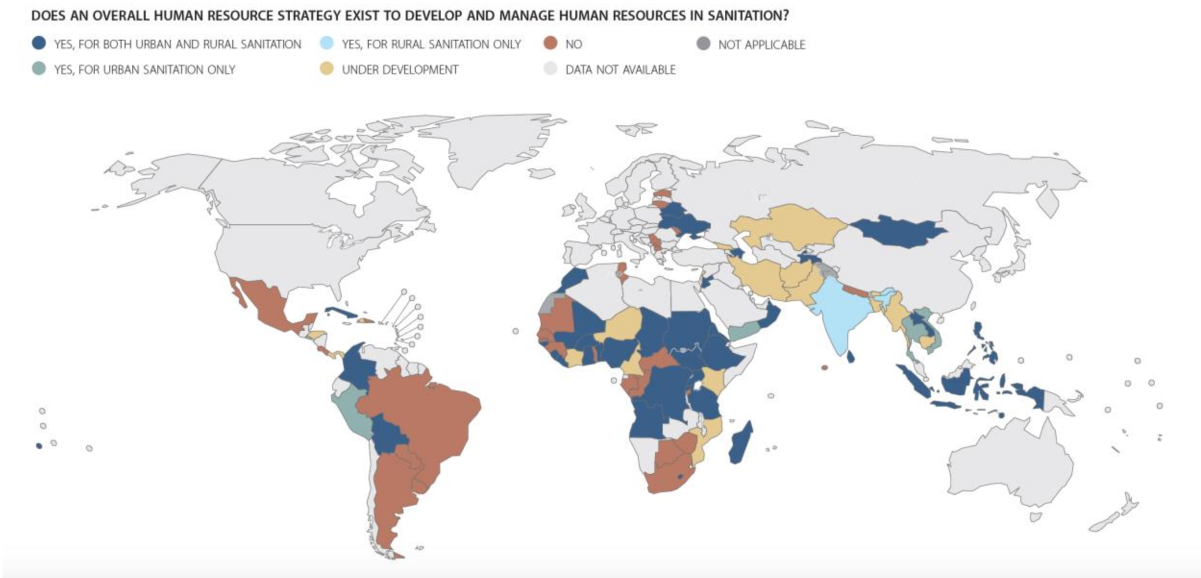


Figure 17 Human resource strategies in sanitation, disaggregated for urban and rural areas (*n* = 94)

Source: WHO and UN-Water (2014).

Similar human resources deficiencies also occur in the agriculture sector. Skills and experience are lacking in irrigated farming and in water conservation for rain-fed farming (FAO, 2004). The increasing involvement of the private sector in agriculture and irrigation is creating new demands for more-responsive government agencies. Skills such as organizing stakeholders and openly providing information, as well as those for contracting and tendering, are increasingly sought in government agencies, as the role of governments changes from provider to enabler. A lack of qualified professionals and technicians weakens the institutions that provide governance. Several countries are now producing national capacity-development strategies for the water sector (WWAP, 2016). However, the big challenge is implementation.

Education and training provide a vital basis for building much-needed human capacity in the water and water-using sectors. Education and vocational training programmes are viewed as conditions enabling the achievement of SDG 6. The expertise required in the water sector at all levels of education, in numerous agencies, communities, schools and private companies, is extremely broad.

The need for comprehensive capacity-development programmes to create a cadre of specialists and technicians working in the water sector is well recognized. However, funds are often allocated for developing infrastructure rather than people. The former produces something that can be seen, whereas the latter is mostly invisible.

KCD is an intrinsically slow and complex process. Yet, water donors are usually more interested in quick performance results as an indication of KCD effectiveness. There are methods for rapidly increasing vocational skills to meet specific shortages using short-term programmes of two to four years. However, it takes many years to strengthen institutional capacity with experienced and effective professionals and technicians that can plan and enable progress towards SDG 6. The answer lies in long-term commitment and support for KCD (Mvurliwenande and others, 2017).

4. Data monitoring

"We cannot plan and manage what we do not measure and monitor" is a statement that few would disagree with. Data monitoring provides the foundation for good governance. It is not possible to plan, manage and evaluate water resources and water allocations without available data. Data underpin the governance elements of accountability, transparency and participation, and enable progress to be monitored and service providers, governments and development partners to be held accountable.

Public debate without data is poorly informed, and stakeholders have no basis for challenging factually incorrect or biased positions. Reliable and consistent data are essential to stimulate political commitment, inform policy-making and decision-making, and trigger well-placed investments towards health, environment and economic gains. Data monitoring also requires a political commitment to transparency. This means sharing data within and among countries, which can be especially sensitive in the case of transboundary watercourses and waterbodies.

(a) National level monitoring

National processes on monitoring are at the centre of achieving the SDGs. Although it applies to all countries, the 2030 Agenda must consider "different national realities, capacities and levels of development and respect national policies and priorities" for its successful implementation (United Nations, General Assembly, 2015, para. 5). It is important to acknowledge and support countries in adapting SDGs to their reality and aspirations in setting nationally relevant steps for achieving SDG targets that align with their development status and strategies. Additional or locally more applicable indicators and meaningful numerical values, which can be adjusted over time, are useful in achieving these targets. Box 22 provides an example of a national level data system in Brazil.

Box 22 The National Water Resources Information System in Brazil

The National Water Resources Information System is a large database on water in Brazil. It consists of a set of processes for collecting, organizing and transmitting data and information. The system consolidates water status data from all over Brazil, including reservoir levels, river stream-flows and water quality, as well as information on water users, including urban supply systems, irrigation networks and industries. This means that the quantity of available water is known, together with its quality and the purposes for which it is used. This information is vital for efficient water management.

The Brazilian National Water Agency is responsible for coordinating the system and complying with the principles of decentralized data and information uptake and production, unified system coordination and guaranteed access by society.

Information is stored in a database and disclosed in the form of interactive maps. All data in the system are publicly available and may be accessed free of charge by anyone. There is a metadata portal linked to the system that was set up to organize and systematize geospatial information produced and used by the Brazilian National Water Agency, to ensure it is disseminated and accessible via the Internet.

Thirty-eight interactive maps were available in 2016, produced from 144 geoservice layers and associated with 200 different metadata. The system provides input for actions and studies in Brazil, including preparing for environmental economic water accounts and SDGs, especially SDG 6.

Source: ANA (n.d.)

National data help governments make evidence-based decisions and are the foundation of global monitoring efforts. In the 2016/2017 GLAAS survey, nearly 70 per cent of countries indicated data were available and used for decisions on allocating resources for sanitation and drinking water (Figure 18) (WHO and UN-Water, 2017). This increased from the 2013/2014 survey, which reported that data were available, analysed and used for resource allocation decisions in 48 per cent of countries for drinking water and 31 per cent for sanitation (WHO and UN-Water, 2014).

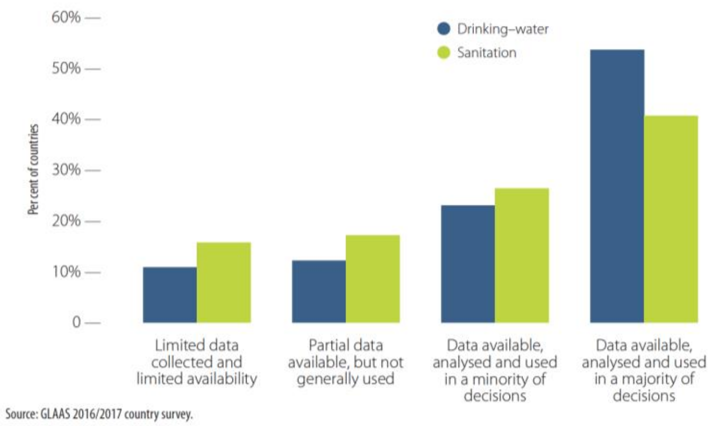


Figure 18 Data collected and used to inform decisions on resource allocations (*n* = 65)

Source: WHO and UN-Water (2017).

Countries reported that monitoring and surveillance systems were usually insufficient in 2014 (WHO and UN-Water, 2014) (Figure 19). It is therefore crucial that national monitoring systems be strengthened and supported. Development partners should work within national monitoring systems and align regional and global initiatives to what is already taking place at the national level, rather than adding additional monitoring burdens on Member States. National monitoring systems can and should feed into regional and global monitoring systems.

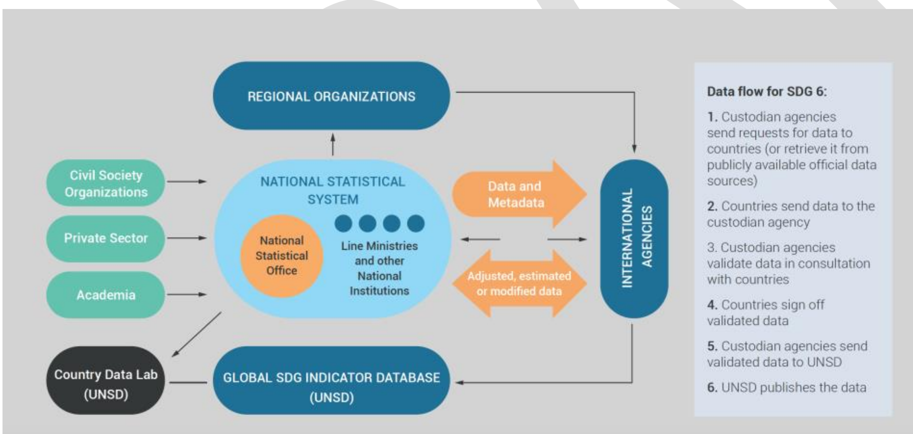


Figure 19 Data flow in SDG reporting, highlighting the central role of the national statistical system

Source: United Nations (n.d.).

(b) Regional and global level monitoring

Regional and global monitoring initiatives are key elements of the data monitoring landscape. The Pan-African Monitoring and Reporting System[21] is an example that highlights harmonized monitoring and reporting of water and sanitation indicators for the whole of Africa while linking with other global monitoring and reporting processes. The African Ministers' Council on Water, which leads the Pan-African monitoring initiative, has

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[21] http://www.africawat-sanreports.org.

worked closely with all the national governments involved, and also with international organizations, to ensure alignment among the different levels.

The capacity of countries to report on the global SDG 6 indicators varied (Figure 20). Incorporating the global SDG indicator framework into national monitoring systems is an ongoing process. Resources and capacity-building are required to close data gaps and harmonize reporting, although a lot of water and sanitation data exist at the country level. Less than half of Member States currently have comparable data on progress towards each of the global SDG 6 targets. The average Member State reported on one third of all the global indicators for SDG 6, and only 6 per cent reported on more than eight indicators. This represents a major knowledge gap (Box 23).

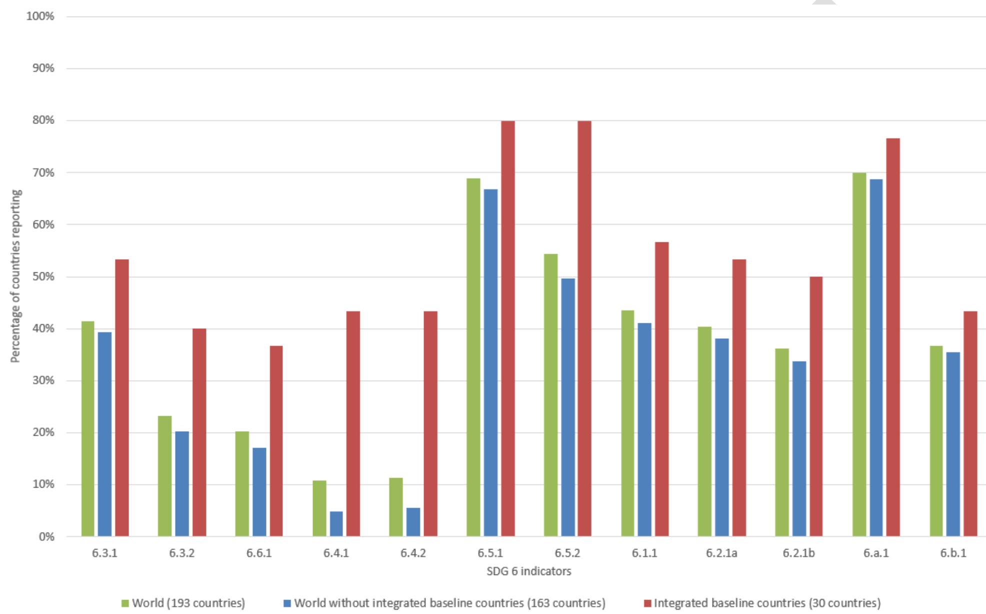

Figure 20 Proportion of countries reporting on SDG 6 indicators, 2016–2018

Source: WHO and UNICEF JMP; GEMI; GLAAS.

There is still much work to be done to ensure availability of timely and good quality data on all the global SDG 6 indicators. Institutional capacity-building and integration across stakeholders need to be intensified to make monitoring more effective and efficient, as well as to harmonize reporting requirements at global, regional and national levels. International collaboration and partnerships can support data collection, analysis and use.

Box 23 Accounting for water

Water accounting is about quantifying water resources and uses, much like financial accounting provides information on income and expenditure. Given that water is a precious and limited resource, it is paradoxical that accounting for water receives so little attention. The current lack of nationally and internationally accepted water accounting methods is a serious drawback to sound water resources planning and water allocation.

Many developing countries are data poor. Government line departments rarely have access to a common information base when attempting to align water development plans. Different countries in the same river basin often use different databases and systems of measurement, which can seriously hinder effective transboundary water management.

FAO is currently working towards establishing an accepted system of water accounting. This will go beyond data collection and provide a scientific and transparent basis for evidence-informed strategy development, operational decision-making, and targeted communication or awareness-raising programmes.

Modern technologies can also help to relieve the burden of data acquisition. These include the use of Earth observations, mobile and basin/field hydrometric sources and information from different water-using disciplines. Research is needed to map alternative ways of acquiring data, establish common water metrics and develop methods that better capture the connections among water users, support SDG monitoring and investigate early warning systems for emerging water risks.

Sources: FAO (2017); FAO and WWC (2018).

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Abbreviations and acronyms used in chapter III (in addition to those already used in chapters I and II)

GWP	Global Water Partnership
KCD	knowledge and capacity development
ODF	official development finance
SWA	Sanitation and Water for All

IV. Beyond SDG 6: Connections across the 2030 Agenda

A. Introduction

This chapter looks beyond SDG 6 and explores how the goal connects with other SDGs and how it can bring immense benefits for sustainable development. It reviews the evidence available that establishes key connections among water resources management and sanitation and other goals, highlighting some possible trade-offs that need to be addressed to avoid achieving one goal at the expense of realizing others.

A coordinated and integrated approach to the 2030 Agenda can make implementing and monitoring SDG-related national development plans more cost-effective. It will help to maximize synergies and reduce the risks that actions taken to meet one goal will undermine other goals. It will also ensure appropriate timing and sequencing of policy and institutional reforms and public investments so that limited resources are used more efficiently and sustainably.

There are many ways to examine the linkages among water and the other SDGs. Overlaps are inevitable regardless of the methodology. They are complex because of the myriad ways in which water pervades all aspects of life. This chapter therefore focuses on those linkages where maximum benefit can be derived in terms of water for people, for a healthy environment and for the economy.

Progress on SDG 6 will be impossible without progress on the other goals and vice versa. This reflects the integrated, indivisible and interlinked nature of all SDGs. Water and sanitation have a particular role to play in the 2030 Agenda, because of their centrality to each of the three dimensions that cut across all of the SDGs (society, economy and environment). In society they are a prerequisite to meeting basic human rights, dignity and needs; in the economy water is a limiting factor in all productive activities such as agriculture, industry and energy; and in the environment water is needed for the proper functioning of all ecosystems and their inhabitants, including human.

A previous UN-Water publication explored many of these complex interlinkages and trade-offs and highlighted the importance of mainstreaming water into policies and plans of other sectors, as well as how managing interlinkages supports the three sustainable development dimensions (Figure 21) (UN-Water, 2016).

Figure 21 SDG 6 interlinks the three dimensions of sustainable development

Source: UN-Water (2016).

SDGs with specific references to water include SDG 3 (good health and well-being), SDG 4 (quality education), SDG 11 (sustainable cities and water communities), SDG 12 (responsible consumption and production) and SDG 15 (life on land). The SDGs up for review by HLPF in 2018 are also linked to water (Box 24) and reflect many well-known and understood interdependencies and development trade-offs, such as: the nexus among water, energy and food; those between water and industrial production; and those between water and land ecosystems. This offers an opportunity to focus on links that are now important because of recent events and the effects of climate change, such as between water and cities like in Cape Town, South Africa (Box 35).

Box 24 Transitioning towards sustainable and resilient societies: water and the other SDGs under review at HLPF 2018

SDG 6 is inextricably linked to the other SDGs being reviewed at the annual HLPF in July 2018. The following is a brief overview of some of the linkages and main messages.

SDG 6 ↔ SDG 7: Water and energy are mutually dependent, with all energy forms requiring water to varying degrees. In turn, water management, including treatment and pumping, requires energy (see "Water in society")

SDG 6 ↔ SDG 11: Cities and human settlements provide basic services to their inhabitants, including drinking water and sanitation. Cities are also increasingly playing a role in the management of water-related ecosystems, including floods and droughts (see "Water in society").

SDG 6 ↔ SDG 12: Water is an integral part of consumption and production cycles of food, energy, goods and services. Managing these processes sustainably is important in protecting the quantity and quality of water resources and using them more efficiently (see "Water and the environment").

SDG 6 ↔ SDG 15: Water and land management go hand in hand, with activities taking place on land (including agriculture) using and potentially polluting water resources. Fresh water is also known as terrestrial water, and water is an indivisible part of what is known as the landscape approach. Water is also needed for all the world's ecosystems to function properly, including those on water, land and in seas (see "Water and the environment").

SDG 6 ↔ SDG 17: The MoI SDG is key to success of the 2030 Agenda, and includes partnerships, finance, technology, capacity-building, data acquisition and monitoring, and governance, all essential for SDG 6 achievement (chapter III).

B. Water and society

The transformative vision and ambition of Member States to end poverty and hunger everywhere, to combat inequalities within and among countries, to build peaceful, just and inclusive societies, and to protect human rights everywhere is at the heart of the 2030 Agenda. The human rights to safe drinking water and sanitation are explicitly mentioned in the Agenda and are fundamental to providing basic human needs and services (United Nations, General Assembly, 2015). This section discusses the linkages among WASH in human health, food security (combating hunger) and well-being, with a view towards building peaceful and just societies and reducing inequalities.

1. Water, sanitation, hygiene and health

Safe drinking water and adequate sanitation and hygiene are fundamental to protecting health, and directly contribute to achieving SDG 3. WASH-related disease is closely linked to poverty and disproportionately affects vulnerable communities that do not have access even to basic water, sanitation and hygiene services. Adequate universal access to WASH is essential for ending preventable deaths from diarrhoea and other water-related diseases, and for improving nutrition, health service delivery, social well-being and economic productivity. Investing in WASH has an impact: it has been estimated that every US$1 invested in WASH yields a US$5 return in health and economic benefits (Hutton, 2004).

2. Diarrhoea

Inadequate WASH is a key contributor to diarrhoeal disease, the second leading cause of death in children under the age of five worldwide (WHO, 2017a). The most severe threat posed by diarrhoea is dehydration, but diarrhoea is also a leading cause of malnutrition. Poor drinking water, sanitation and hygiene access directly account for 882,000 diarrhoeal deaths every year (Prüss-Ustün and others, 2014).

Cholera is an acute diarrhoeal disease and can kill within hours if left untreated (WHO, 2017b). It still affects more than 40 countries, resulting in an estimated 2.9 million cases and 95,000 deaths per year worldwide (Ali and others, 2015). An estimated 40–80 million people in Africa live in cholera “hotspots” (Figure 22) (Ali, 2017; GTFCC, 2017; Lessler and others, 2018). This includes populations living in crowded unsanitary peri-urban slums and refugee camps, as well as in rural areas along rivers and lake shores where basic water and sanitation services are lacking.

Humanitarian crises due to natural disasters and conflicts increase the risk of epidemics. Households living in cholera-affected countries tend to have the lowest access to basic water and sanitation services (Figure 23).

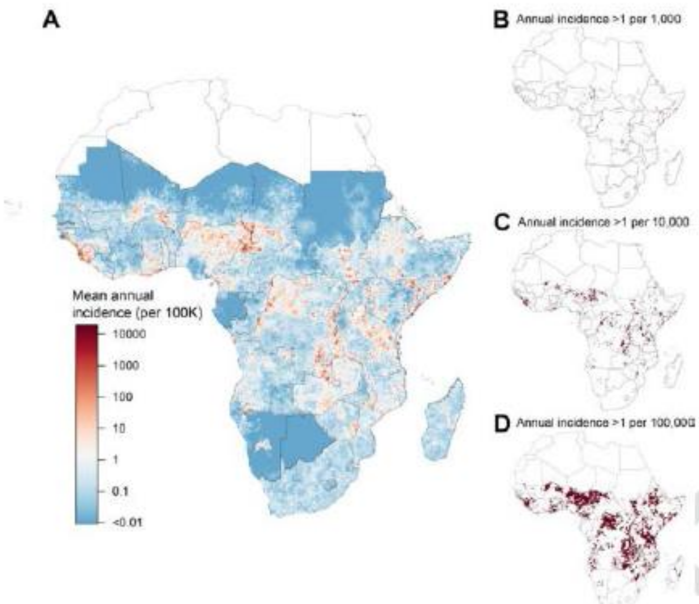


Figure 22 Map of cholera "hotspots", 2010–2016

Source: Lessler and others (2018).

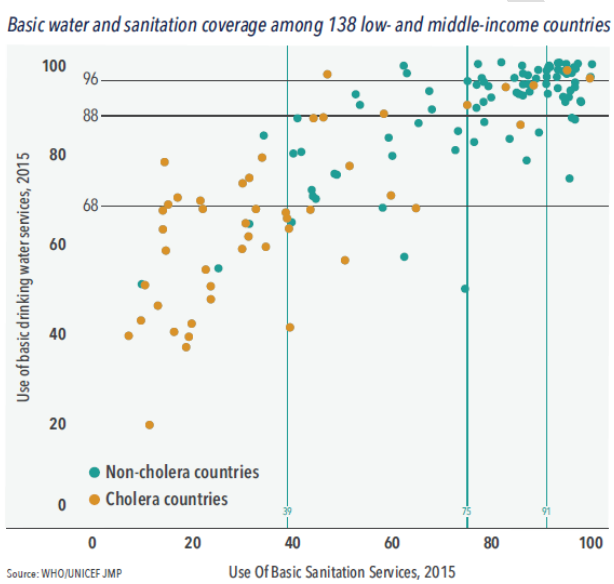


Figure 23 Basic access to water and sanitation in cholera and non-cholera endemic countries, 2015

Source: GTFCC (2017).

3. Neglected tropical diseases

Poor access to WASH is key contributor to neglected tropical diseases (NTDs). These diseases affect over 1 billion people worldwide in 149 countries and cost developing economies billions of United States dollars a year (WHO, n.d.). People living in areas endemic to NTDs are often the poorest, most marginalized and vulnerable in society. Reducing inequalities is at the core of the SDG agenda. The WASH sector has a clear role to play in preventing and managing disease by providing WASH services for populations most at risk.

Untreated excreta in the environment contributes to the spread of disease, including certain NTDs. For example, trachoma is the leading cause of preventable blindness worldwide and is responsible for the blindness or visual impairment of 1.9 million people in 41 countries (WHO, 2017c). It results from a bacterial infection transmitted through eye-seeking flies breeding in faeces. Other NTDs such as soil-transmitted helminthiases and schistosomiases, linked to open defecation or practices such as reuse of untreated wastewater and faecal sludge for food production, contribute to poor physical growth and cognitive development among children and iron-deficiency anaemia. One quarter of the world's population is estimated to be infected by soil-transmitted helminth infections, and 218 million are estimated to require preventive treatment for schistosomiasis (WHO, 2018a).

4. Other water- and sanitation-related diseases

Other water- and sanitation-related diseases are linked to poor water management. Wastewater and inadequate drainage provide ideal breeding grounds for mosquitoes (known as disease vectors), which transmit malaria, dengue, chikungunya and zika. More than 400,000 people annually still die from malaria, most of them children under the age of five (WHO, 2018b). Diseases such as dengue, chikungunya and West Nile virus are now emerging in countries where they were previously unknown.

5. Chemical contamination in water and wastewater

Access to safe sources of water protects from harmful levels of chemical contaminants including arsenic and fluoride, which pose significant health concerns. Long-term exposure to inorganic arsenic in water that is used for drinking, cooking and food preparation causes chronic arsenic poisoning, leading to skin lesions and cancers. Arsenic in groundwater is widespread and significant in some regions. It is estimated that between 19 million and 39 million people in Bangladesh are at risk of exposure to arsenic concentrations higher than WHO guideline values (UNICEF, 2015a).

Exposure to hazardous chemicals in wastewater may also pose risks to public health, particularly downstream of industrial activities such as mining and manufacturing. Chemical pollution from industry and agriculture should be minimized at source, in line with SDG target 6.3.

6. WASH in health-care settings

Maintaining a sanitary environment in health centres is essential for quality and equity in universal health coverage and in infection prevention and control strategies. However, one fifth of health-care facilities lacks basic sanitation and one third lacks access to safe drinking water and water and soap for handwashing, in low- and middle-income countries (WHO and UNICEF, 2015). Health-care facilities with unsanitary environments expose patients and staff to infections.

Infections associated with health care affect hundreds of millions of patients every year, with 15 per cent of patients estimated to develop one or more infections during a hospital stay (Allegranzi and others, 2010). Infection rates are especially high in newborns. Sepsis and other severe infections are major killers, and are estimated to cause 430,000 deaths annually, largely in low resource settings (Oza and others, 2015).

Health-care facilities that do not have adequate water and sanitation for infection prevention and control can contribute to antimicrobial resistance. The same applies to intensive livestock facilities and antibiotic manufacturing industries that do not adequately manage their wastewater. Such resistance can have devastating health consequences and increase treatment costs. The WASH and health sectors must work together to address this immense challenge and attain the goal of universal access to basic water and sanitation in all settings, including health-care facilities.

7. WASH and education

Improving access to WASH facilities in schools can improve the health, attendance and welfare of students and teachers, and can therefore contribute to better educational outcomes for all. WASH in schools is particularly important for girls and young women, as is providing privacy for menstrual hygiene management. Primary and secondary pupils are well placed to start learning about safe water and sanitation through school curriculum. Pupils and their families can then begin to understand the links among water, health and nutrition. (See also “Water and the economy”).

In 2013, only 52 per cent of primary schools in the 49 LDCs had adequate access to water supplies, and only 51 per cent had adequate sanitation. These compared to global figures for primary schools of 71 per cent and 69 per cent respectively (UNICEF, 2015b). Only 11 LDCs were able to provide information on school hygiene and access to basic handwashing facilities. Just 10 per cent of schools had access to such facilities in Burundi (UNICEF, 2015b). Girls’ enrolment increased more than boys following the construction of school latrines in India (Adukia, 2014). Clean and well-maintained primary school toilets were more important than the number of toilets for improving attendance in Kenya (Dreibelbis and others, 2013).

Education can also encourage households to treat water so it is suitable for drinking. Reports suggest the incidence of diarrhoea fell by 30 per cent in low- and lower middle-income countries when women completed secondary education (UNESCO, 2014). Water purification increased by 9 per cent in urban India when most adults completed primary education and by 22 per cent when they completed secondary education (Jalan and others, 2009).

8. Water and gender

Eliminating persistent gender inequality in many LDCs has the potential to improve family health and well-being, increase household food security and alleviate poverty. Women are predominantly caretakers of domestic water, collecting water for household use and using water for irrigated agriculture (FAO, 2017a). Many women in poor households bear the burden of retrieving water from distant sources and often have little option but to use polluted wastewater for domestic purposes. Their role in societies and within their families means they are critically exposed to unsafe water and are most affected by the lack of adequate sanitation facilities and/or sufficient wastewater treatment. This exposure occurs within the home and in gardens where water and wastewater are used for irrigating vegetables.

However, women usually still have less influence than men about how water, sanitation and wastewater services and infrastructure are designed and managed. Women and girls continue to bear the work burden of most household water-related tasks. Some 263 million people in 2015 spent over 30 minutes per trip collecting water from sources outside the home, often over long distances (Figure 24) (WHO and UNICEF, 2017a).

Water is heavy. Carrying it consumes time and valuable personal energy that can prevent girls from attending school. Women and girls are responsible for water collection in 8 out of 10 households where water is not accessible in the home across 61 countries (WHO and UNICEF, 2017a). Bringing water sources closer to people reduces the time needed to collect water and makes more time available for educational activities, especially for females (UNESCO, 2015). Paths to water sources that are long and through remote areas put women and girls at risk of sexual and other physical violence. This is especially prevalent in fragile countries (World Bank, 2018).

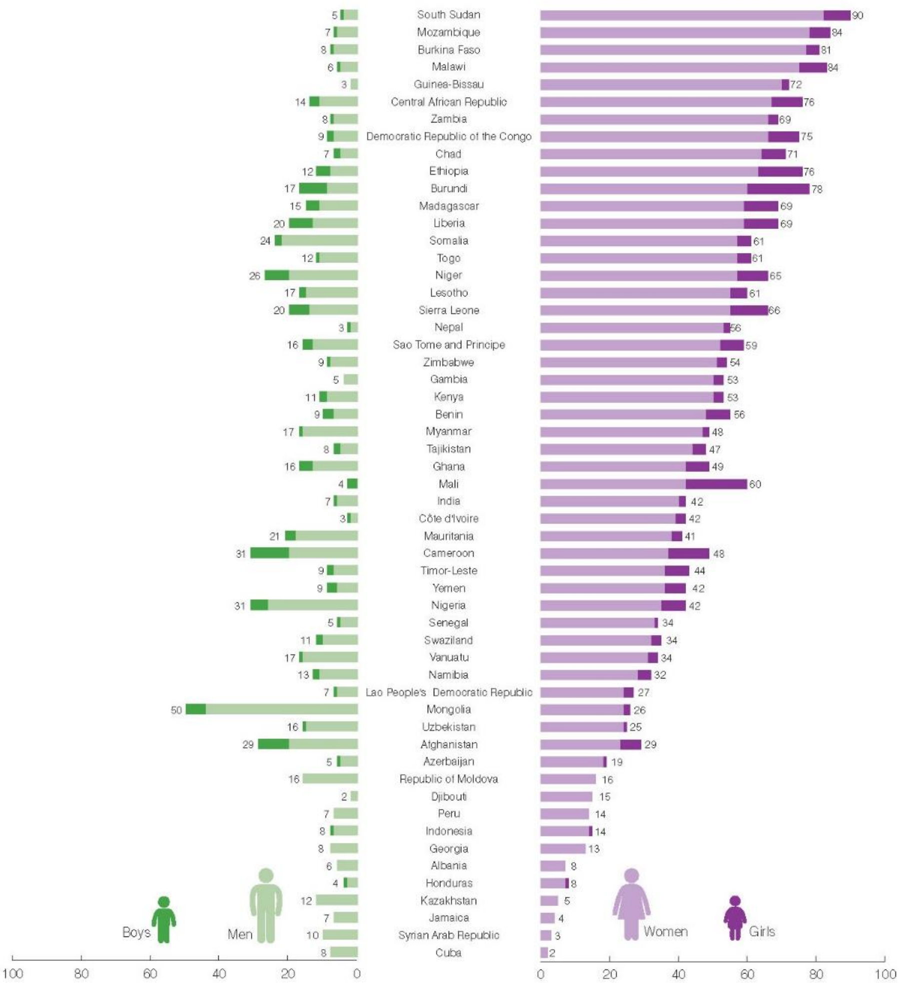


Figure 24 Primary responsibility for water collection in rural areas, by gender and age (per cent)

Source: WHO and UNICEF (2017a).

Gender inequalities and the lack of water and sanitation have important implications for girls' education. Girls in the sixth grade in Panama are 6–10 per cent more likely to have missed at least one day of school during the past six months than their male peers. In Zambia, improved water and sanitation in schools reduced repetition and dropout rates for girls. Adequate sanitation provision has an even stronger impact than water supply (Agol and Harvey, forthcoming).

People with disabilities face significant barriers, regardless of gender. Even where households have access to improved water and sanitation facilities, certain household members may not be able to access those without assistance. Some 24 per cent of households in Tajikistan reported having at least one member with one or more functional disabilities who were unable to access the main drinking water source without assistance. Sixty-seven per cent of respondents in Nigeria believed that people with disabilities face challenges in accessing and using toilets, and 51 per cent believe the needs of disabled people are not considered when designing toilets (UNICEF, 2017).

Social stigma may also impede certain people from using private or shared facilities. This may include people who transgress their gender roles, or where taboos prevent certain family members from using the same facility. Taboos around menstruation may also prevent women and girls from using the regular water and sanitation facilities (WaterAid, n.d.).

Women supply 43 per cent of all agricultural labour in low- and middle-income countries. This figure reaches more than 50 per cent in sub-Saharan Africa, especially where poverty is persistent, and women have few other employment opportunities. Many women now head or manage farms and households across this region, as men have left and migrated to cities in search of employment (FAO, 2011a).

However, women still face barriers such as lack of access to land ownership and water, agricultural inputs, services, markets, economic opportunities and participation in decision-making processes. Local norms and beliefs often affect their land rights, work stability, the type of activities in which they can participate and access to agricultural inputs. The result is that women's agricultural productivity is 20–30 per cent lower than male farmers (FAO, 2017a). Such inequalities threaten agricultural production and household food security. Agriculture and water resources plans must include measures to reduce gender inequality.

Women's poorer access to secure agricultural land tenure rights explains their limited access to water for productive use, which is intrinsically linked to access to land (Wahaj and Hartl, 2007). Gender inequality in water use in agriculture remains a reflection of inequalities in land titling (Figure 25).

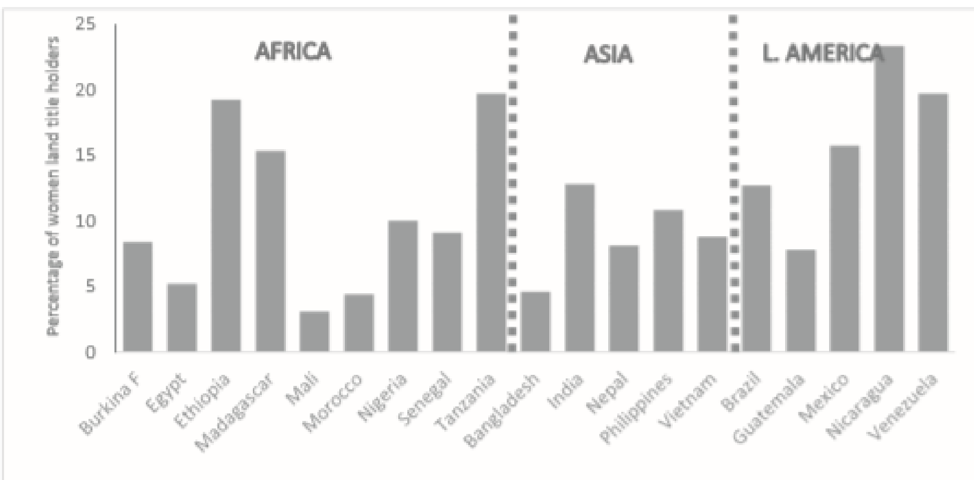


Figure 25 Proportion of women (per cent) among total number of land title holders in selected countries

Source: De Schutter (2010).

Addressing gender inequality can create many benefits. Women need much greater engagement in decision-making on WASH infrastructure and services. They also need to be asked about location, design and management of water points and toilet facilities. Women and men need to be equally represented on WASH committees and service providers, and a concerted effort is required to promote more women in leadership positions. National and local governments therefore need to integrate gender issues into their policymaking and decision-making and enable women to have an effective "voice" and to engage in meaningful participation.

9. Water, nutrition and hunger

SDG 2 aims to end hunger, achieve food security and improved nutrition, and promote sustainable agriculture. All these issues are intrinsically related to water (HLPE, 2015). Water availability for agricultural activities is an essential component for achieving SDG 2, as most water withdrawals are for agriculture (FAO, 2016a). (see "Water and the environment for details on the connections among agricultural production, water stress and water-use efficiency)

Malnutrition is a problem in both developing and developed countries, but for different reasons. Annual estimates of food losses and waste are: 30 per cent of cereals, 20 per cent of dairy products, 35 per cent of fish and seafood, 45 per cent of fruits and vegetables, 20 per cent of meat, 20 per cent of oilseeds and pulses, and 45 per cent of roots and tubers (FAO, 2015a). Most food losses in LDCs occur on farms due to inadequate pest and disease control, and poor harvesting, storage and transportation. Food waste occurs in rich countries along supply chains and rots in the bins of consumers and retailers (FAO, n.d.b). All this is contradictory to both SDG 2 and SDG 12, which promote sustainable production and consumption.

Water footprints are often used to highlight the large amount of water consumed in producing food, but care is needed as the water source used is just as important as the amount used (Box 25). Reducing food losses and wastage, particularly when the food is grown under irrigation with water pumped from rivers and groundwater, can result in water savings. Reducing food losses could have a significant impact on the livelihoods of many smallholder farmers in LDCs, given that they live on the margins of food insecurity (FAO, 2011b; 2015b).

Box 25 "Water footprints" in food – a useful concept linking diets with water[22]

Over the past 40 years, nutrition has shifted from "traditional diets" (plant based, and high in cereal and fibre) towards "Western-style" diets (high-calorie foods, livestock products, processed foods, fast foods and bottled soft drinks) particularly in richer countries.

Water footprints seek to quantify the amount of "blue" and "green" water resources required to produce food. The average European diet consumes 3,653 litres per person per day (Vanham and others, 2013). This is considerably more than the average 120 litres per day that a citizen of the European Union uses for drinking, cooking, washing and flushing.

Significant proportions of the European Union population are overweight or obese and citizens are encouraged to eat less meat, sugar, crop oils and animal fats, all of which have large water footprints. They should eat more fruit and vegetables, which are less water intensive to produce, according to dietary guidelines. Such a healthy diet could reduce the region's water footprint.

A shift to a healthy diet has three major benefits: (1) citizens increase their life quality and expectancy, (2) water can be saved and (3) health-care systems can save money, as the mounting impact of malnutrition on public health and economic development costs US$3.5 trillion per year (WHO, 2016).

However, decisions should not only be based water consumption, but additionally on the sustainability of these water uses. It is for example important to assess whether the water abstracted from rivers or groundwater (”blue” water) to produce these food products, contributes to local water stress, and what else would happen to the land and water used for food production.

Source: Joint Research Centre.

[22] Joint Research Centre, Author D. Vanham with input from Jan Wollgast.

Food insecurity[23] occurs when people lack secure access to sufficient amounts of safe and nutritious food for normal growth and development and an active and healthy life. World hunger is rising again, after a prolonged period of decline. Some 815 million people were undernourished in 2016, an increase from 777 million in 2015. Data from 150 countries between 2014 and 2016 revealed that 9.1 per cent of the world's population suffered from severe food insecurity, corresponding to 667 million people (FAO and others, 2017).

Sub-Saharan Africa experiences the highest level of food insecurity, which affects almost 30 per cent of the population. Other food-insecure regions include Southern Asia (12.9 per cent), Northern Africa (12.2 per cent) and Western Asia (9.8 per cent). Food security has worsened in areas of conflict and fragility, and is often compounded by droughts or floods. Yemen's economic crisis was further aggravated by natural hazards in 2016, including flooding caused by unusually high rains and tropical cyclones. Prolonged severe droughts in Aleppo, Idlib and Homs (in Syria) were one of the drivers of conflict and migration. The El Niño phenomenon reinforced droughts in Burundi, Democratic Republic of the Congo and Somalia (FAO and others, 2017).

Hunger and food security are intrinsically related, and water plays an important role in this process. The availability of water for agricultural activities can actively slow down the achievement of SDG 2. The global hunger index (Figure 26) describes the relative national progress on reducing hunger over the 25 year period from 1992 to 2017. Countries in green are high-achieving "frontier" countries that have made greater progress than other countries at a similar level in 1992. Closer examination of their economic, social, governance, environmental, cultural and other political elements can help to understand the important contributing factors to reducing hunger. Countries in red are underachieving. They are lagging behind and have made relatively weak progress on reducing hunger compared to other countries with similar levels in 1992.

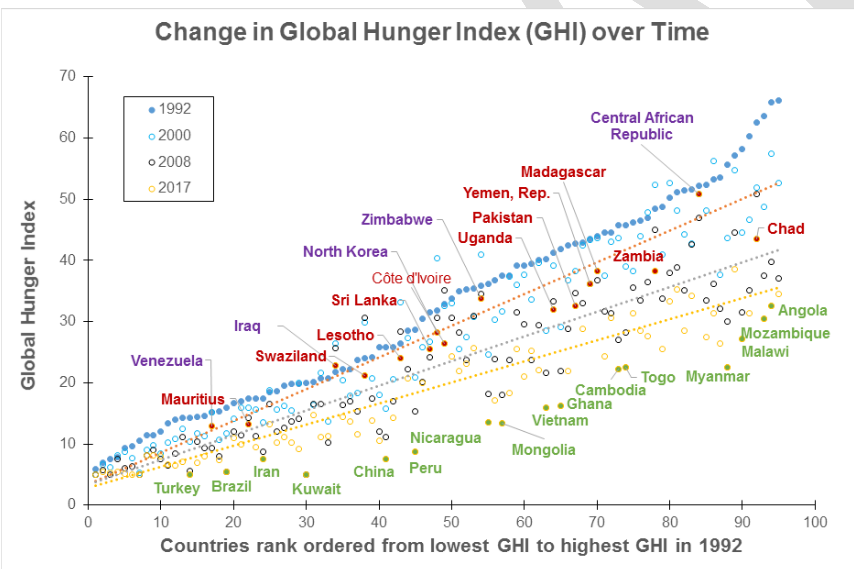


Figure 26 Change in global hunger index over time

Source:von Grebmer and others (2015 and 2017)..

10. WASH and undernutrition

Access to WASH is crucial for reducing infections that exacerbate undernutrition. Poor WASH contributes to undernutrition by causing frequent parasite infections and episodes of diarrhoea, which can result in enteric

[23] Defined as prevalence of moderate or severe food insecurity in the population, based on the food insecurity experience scale.

dysfunction though chronic ingestion of pathogens. Undernutrition is both a rural and an urban health issue. It is endemic among the poor in sub-Saharan Africa and Asia, where many people live in insanitary environments and do not get enough calories, protein and micronutrients in their diet. Almost 23 per cent of children under the age of five was stunted and 7.7 per cent was wasted in 2016 (UNICEF and others, 2017).

Overcoming child and maternal undernutrition remains one of the most pressing global challenges to sustainable development. An estimated 45 per cent of all under-five deaths globally is due to undernutrition. Nutritional deficiencies from conception to the age of two can result in disease and death or have long-term consequences on cognitive and social abilities, school performance and work productivity in adulthood. Severe anaemia during pregnancy increases the risk of pre-term delivery and low birth weight (Black and others, 2013). The burden of undernutrition on countries is enormous. The estimated annual economic costs are US$2.1 trillion (FAO, 2013a).

Improving WASH services can contribute to reducing stunting for children under the age of five. However, the causes of childhood stunting are complex and include many other factors such as access to adequate food and health care, which are all influenced by economic development (Figure 27). A multi-sectoral approach to addressing undernutrition, which incorporates both nutrition-specific and nutrition-sensitive interventions, including WASH, is needed.

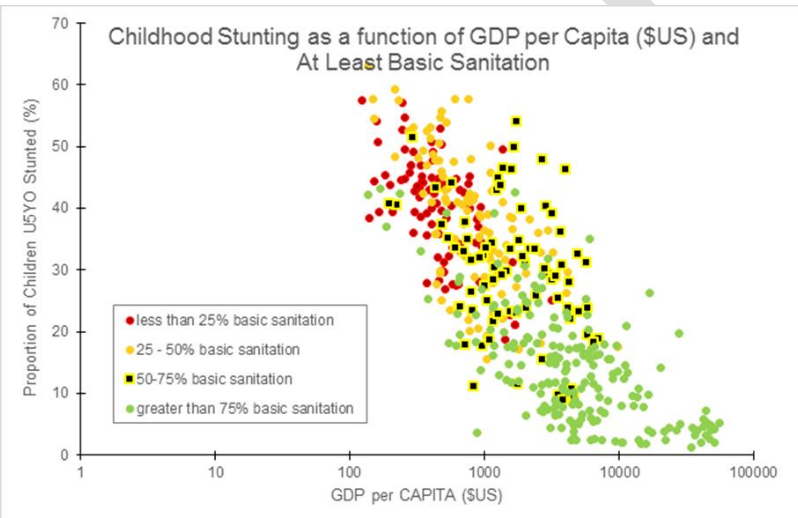


Figure 27 Childhood (under five years old) stunting as a function of per capita GDP and at least basic sanitation (per cent)

11. WASH and urban/rural inequalities

There is good progress globally in providing access to basic WASH facilities, but inequalities still remain. Rural communities lag behind the urban sector in both drinking water and sanitation access (Figure 28). Some 159 million people in 2015 still collected drinking water from distant surface water sources, mostly rural communities in Central and Southern Asia and sub-Saharan Africa. A similar global picture is evident for sanitation where 892 million people still defecated in the open, with most residing in rural communities (WHO and UNICEF, 2017b). If the targets for WASH are to be achieved by 2030, inequalities must be reduced, and rates of progress must increase substantially for those furthest behind, including those in rural areas, and communities where NTDs are endemic and "hotspots" where outbreaks of diseases such as cholera recur.

Figure 28 World water and sanitation ladders for national, rural and urban populations

Source: WHO and UNICEF JMP, https://washdata.org/.

C. Water and the environment

Water-related ecosystems including wetlands, rivers, aquifers and lakes sustain a high level of biodiversity and life (Dudgeon and others, 2005). They are vital for ensuring a range of benefits and services such as drinking water, water for food and energy, humidity, habitats for aquatic life, and natural solutions for water purification and climate resilience. Water-related ecosystems can contribute to addressing competing demands, mitigating risks and promoting stability and trust-building measures, if they are managed well. They are therefore essential for sustainable development, peace, security and human well-being.

However, water-related ecosystems are increasingly under threat, relying on sufficient water quantity and quality to maintain their full functionality. These ecosystems are enduring the effects from human activities such as pollution, infrastructure development and resource extraction, in addition to the growing demand for freshwater supplies for agriculture, energy and human settlements. Competition among uses and users of fresh water exacerbates these challenges and calls for improved water governance. Degradation of water-related ecosystems and competition for scarce water resources can cause conflict, displacement and migration. Furthermore, the effects of climate change are altering the hydrological cycle, resulting in more frequent and severe extreme events and disasters such as droughts and floods.

1. Water quality and pollution

Worsening water quality and pathogenic, organic and salinity pollution in the world's freshwater bodies, emanating from a variety of sources, including a lack of properly managed sanitation, and industrial and agricultural runoff, are widespread and growing concerns (UNEP, 2016). Intensification of food production is also a leading cause of water quality degradation. Examples of the agricultural impact of water quality are given in Table 4. Poor water quality degrades freshwater habitats (lakes and rivers) and coastal areas, and affects fisher communities, influencing both biodiversity and food security (SDG 2). Hydroelectric dams become less effective when eroded sediments reduce reservoir storage (Brodowin, 2013; Stickler and others, 2013). The cumulative impact and trade-offs among ecosystem services are not always foreseen and may have a delayed impact downstream.

The linkages among the state of water resources and pressures driving the provision of water-related benefits to people can be difficult to measure. Global data on potential water pollutants and water quality metrics are mixed and vary in scale and resolution. Hydrological models for assessing water quality offer a useful tool to combine a number of data layers. Modelled global water quality as a percentage of water that may be polluted from urban, industrial, agricultural, road surfaces, oil and gas, and mining sources for 2010 showed notable "hotspots" such as in the Middle East, Sahel and India (Figure 29) (UNEP, 2016).

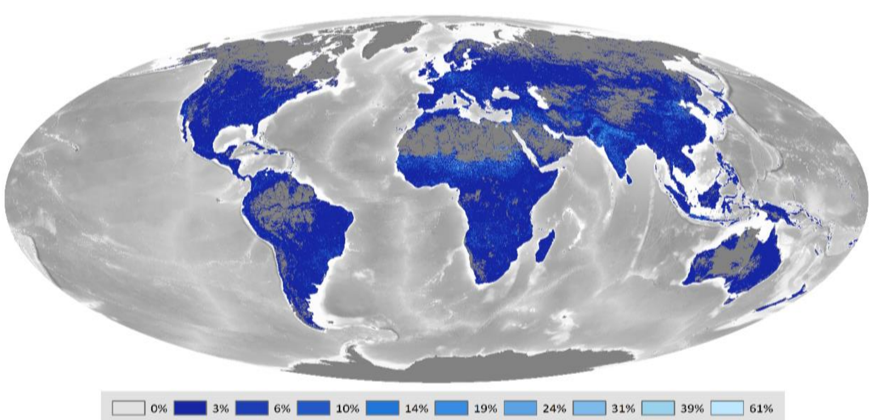


Figure 29 Modelled human impact on water quality in 2010

Sources: Mulligan (2009); WaterWorld Version 2 (2017).

Table 4 Agricultural impact on water quality

Agricultural activity	Impact	
	Surface water	Groundwater
Tillage/ploughing	Sediment/turbidity: sediments carry phosphorus and pesticides are adsorbed to sediment particles; siltation of river beds and loss of habitat, spawning ground, etc.	Possibly reduced groundwater recharge under certain circumstances
Fertilization	Runoff of nutrients, especially phosphorus, leads to eutrophication causing taste and odour in public water supply, and excess algae growth leading to deoxygenation of water and fish mortality	Leaching of nitrate to groundwater; excessive levels are a threat to public health
Manure spreading	Carried out as a fertilization activity; spreading on frozen ground results in high levels of contamination of receiving waters by pathogens, metals, phosphorus and nitrogen, leading to eutrophication and potential contamination	Contamination of groundwater, especially by nitrogen
Pesticides	Runoff of pesticides leads to contamination of surface water and biota; dysfunction of ecological system in surface waters by loss of top predators due to growth inhibition and reproductive failure; public health impact from eating contaminated fish. Pesticides are carried as dust by wind over very long distances and contaminate aquatic systems thousands of miles away (e.g. tropical/subtropical pesticides found in Arctic mammals)	Some pesticides may leach into groundwater causing human health problems from contaminated wells
Feedlots/animal corrals	Contamination of surface water with many pathogens (bacteria, viruses, etc.) leads to chronic public health problems; there is also contamination by metals contained in urine and faeces	Potential leaching of nitrogen, metals, etc., to groundwater
Irrigation	Runoff of salts leads to salinization of surface waters; runoff of fertilizers and pesticides to surface waters with ecological damage, bioaccumulation in edible fish species, etc.; high levels of trace elements such as selenium can occur with serious ecological damage and potential human health impact	Enrichment of groundwater with salts and nutrients (especially nitrate)
Clear cutting	Erosion of land leads to high levels of turbidity in rivers, siltation of bottom habitat, etc.; disruption and change of hydrologic regime, often with loss of perennial streams, causes public health problems due to loss of potable water	Disruption of hydrologic regime, often with increased surface runoff and decreased groundwater recharge; affects surface water by decreasing flow in dry periods, concentrating nutrients and contaminants in surface water
Silviculture	Broad range of effects: pesticide runoff and contamination of surface water and fish; erosion and sedimentation problems	
Aquaculture	Release of pesticides (e.g. tributyltin) and high levels of nutrients to surface water and groundwater through feed and faeces leads to serious eutrophication	Groundwater pumping to reduce the salinity of pond water (e.g. coastal zone of Mekong Delta) can lead to saline intrusion

Deforestation can reduce soil quality, which may lead to increased surface water runoff and sedimentation in waterways (Asghari and others, 2016), and erosion and land-slides. Such changes can overwhelm the capacity of downstream natural ecosystems, directly affect water quality in lakes, rivers and streams, and cause coastal eutrophication and poor ocean health.

Chemical contamination is another concern. Access to safe sources of water protects from harmful levels of chemical contaminants including naturally occurring arsenic and fluoride, which pose significant health concerns. Arsenic contamination of groundwater is widespread, and there are several regions where this is significant in drinking water. Testing for contaminants such as arsenic and fluoride will help to better characterize exposure and inform policies and programming to mitigate health risks.

Integrated monitoring and management of land and water resources is complex, with watershed-wide approaches needed (FAO, 2018). Box 26 exemplifies how surface water pollution is dealt with in the Netherlands.

Box 26 Surface water pollution in the Netherlands[24]

About 43 per cent of the grassland and 82 per cent of the maize land in the Netherlands was mostly saturated in nutrients due to overfertilization in 1990 (Breeuwsma and Silva, 1992). Nutrient concentrations in surface waters therefore consistently exceeded water quality standards (Oenema and Roest, 1998; Oenema and others, 2007). The Dutch Manure Law entered into force in 1986 in recognition of this problem, and the European Nitrates Directive was adopted in 1991, resulting in measures that included a ban on applying fertilizers outside the growing season and an annual maximum limit of 170 kg of nitrogen/hectare applied (European Commission, 1991).

Nutrient pollution rates in the Netherlands are still falling now, but many open surface waters routinely fail to meet environmental quality standards (Rozemeijer and others, 2014). A study by Rozemeijer and others (2014) showed that even though phosphorus concentrations were reduced by 0.02 mg/l per decade, 76 per cent of 167 rivers where agricultural fertilizers were the main cause of pollution still did not meet water quality standards.

With the recent growth of the livestock sector due to dismantling the milk quota, the Dutch Government has introduced a new and firmer "phosphate decree" to limit the national dairy population. The amount of phosphate that farmers can produce may not exceed the 2015 reported amounts under the new decree. This resembles the policies on carbon dioxide emission rights, in that phosphate rights may be traded among farmers.

The case of the Netherlands demonstrates the long-lasting impact that soil phosphorus pollution may have on surface water quality, and the extent of policy, regulation and economic restrictions necessary to prevent further deterioration of the environment.

2. Water-, land- and nature-based solutions

Terrestrial and freshwater ecosystems are symbiotic. Land-based ecosystems depend on freshwater resources in sufficient quantity and quality. In turn, activities on land, including how land is used, influence water availability and quality for people, industry and ecosystems.

Interest is growing in nature-based solutions (NBSs), which use or mimic natural processes to enhance water availability (e.g. soil moisture retention or groundwater recharge), improve water quality (e.g. natural and

[24] Contributed by: Dirk Jan Kok (TU Delft).

constructed wetlands, riparian buffer strips), and reduce risks associated with water-related disasters and climate change (e.g. floodplain restoration or green roofs) (SDGs 11 and 13) (Box 27) (WWAP and UN-Water, 2018).

Box 27 Nature-based solutions for water

NBSs provide a means of conserving or rehabilitating natural ecosystems and/or enhancing or creating natural processes in modified or artificial ecosystems. They can be applied at micro (e.g. a dry toilet) or macro (e.g. landscape) scales.

NBSs include green infrastructure that can substitute, augment or work in parallel with grey infrastructure in a cost-effective manner. The goal is to find the most appropriate blend of green and grey infrastructure that maximizes benefits and system efficiency while minimizing costs and trade-offs.

However, despite a long history and growing experience in the application of NBSs, there are still many cases where water resources policy and management ignore NBS options – even where they are obvious and proven and effective. Water management remains heavily dominated by traditional, human-built ("grey") infrastructure, and the potential for NBSs remains underutilized. Evidence suggests that this is still well below 5 per cent of total investment in water resources management infrastructure, despite rapidly growing investments in NBSs.

NBSs are essential for achieving SDG 6 and other water-related targets, but they can also help support progress on other aspects of the 2030 Agenda through generating social, economic and environmental co-benefits, including human health (SDG 3), food (SDG 2) and energy (SDG 7) security, sustainable economic growth, livelihoods and decent jobs (SDG 8), ecosystem rehabilitation and maintenance, and biodiversity (SDG 15).

Although NBSs are not a panacea, they will play an important role in moving towards a circular economy and in building a more equitable future for all.

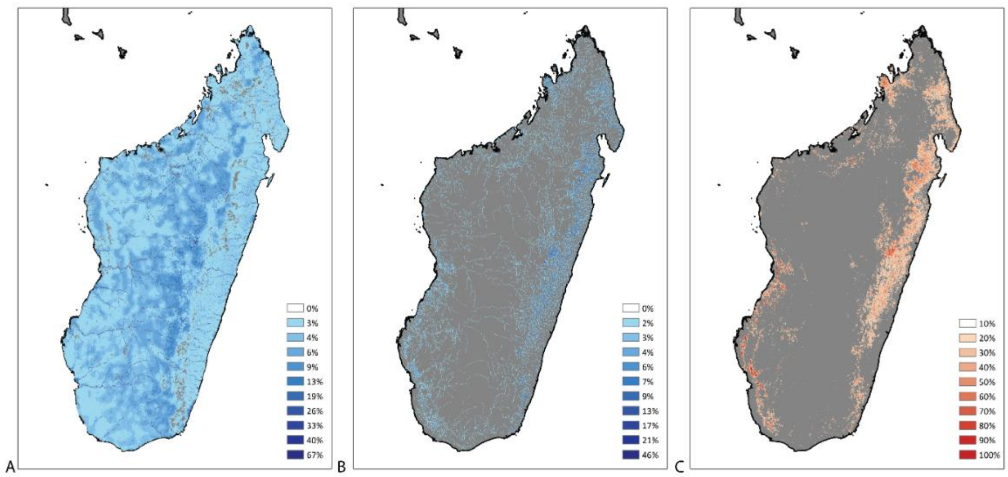
Source: WWAP and UN-Water (2018).

Forest catchments, which provide much of the world's fresh water, are a key provider of NBSs. Some 28 per cent of global forest ecosystems, covering 4,800 million km^2, purify and supply 60–80 per cent of the freshwater needs of more than half of the world's population, including 1.7 billion people living in a third of the world's largest cities (Liniger and Weingartner, 1998; UN-Habitat, 2003).

When land/forest is converted to agriculture and settlements, the capacity of forest ecosystems to produce fresh water is reduced at the same time as the demand for water increases to service human and agricultural needs. This affects water quality. Global forest cover decreased from 31.7 per cent in 1990 to 30.7 per cent in 2015 (FAO, 2016b), mostly due to agriculture and infrastructure development. Box 28 demonstrates the effect of deforestation on water quality in Madagascar.

Box 28 Effect of deforestation on water quality in Madagascar

Deforestation is the most important environmental problem in Madagascar, particularly along the east coast and the northeast (Ministère de l'Agriculture, 2015). The WaterWorld model[a] (Mulligan, 2013) was used to show water quality changes between 2000 and 2010 because of forest loss, using remotely sensed data (Hansen and others, 2013).



Modelled water quality and potential changes in water quality as a result of deforestation in Madagascar. (A) Baseline percentage human impact on water quality for 2010, (B) percentage increase in potential pollution resulting from forest loss and (C) percentage forest loss from 2000 to 2010 (Hansen/UMD/Google/USGS/NASA)

Modelled results show that on an average, 3.3 per cent of all water resources was polluted by human activities. The effects are low, but are widespread and affect 75 per cent of the population. Some 1,320,000 people (7.3 per cent of the population in 2010) were living in areas where more than 25 per cent of water is polluted. About 250,000 people are in areas with severely polluted water (>50 per cent of the human footprint index).

Most widespread pollution is low and comes from subsistence agriculture in this area, which makes little use of chemical fertilizers and pesticides. However, untreated municipal wastewater, waste disposal sites and industrial discharges are major point sources of surface water and groundwater pollution in urban areas (Heathwaite, 2010; Ministère de l'Environnement et des Forêts, 2012; NGWA, 2012).

Some 22 per cent of cultivated land is irrigated and accounts for 96 per cent of the total water withdrawal. Converting forest land to agriculture may increase water withdrawal (FAO, 2016a). Deforestation correlates with an average increase of 0.2 per cent in potential water pollution, which could affect 2.2 million people (12.2 per cent of the population). Pollution entering the ocean may also damage coastal habitats such as coral and seagrass, thus affecting fisheries.

[a] The WaterWorld model is a hydrological model that assesses surface water contamination resulting from human activities such as deforestation. The output is the human footprint on water quality indicator (Mulligan, 2009).

Protecting forest catchments and encouraging sustainable land management practices, such as buffer strips along waterways and conservation agriculture, can reduce the impact on water quality (Chase and others, 2016). Some 125 million hectares of conservation agriculture had been introduced by 2011, mostly in Argentina, Australia, Brazil, Canada and the United States (Abell and others, 2017).

Protected areas are helping to guarantee access to safe water supplies and sustain aquatic ecosystems in many parts of the world (Box 29).

Box 29 Protected areas can sustain water supplies and aquatic ecosystems

Protected areas are one of the most effective tools for maintaining ecosystems in a natural state. They help to maintain water services vital to human welfare and support the rich diversity of aquatic species found in rivers, lakes and wetland ecosystems.

Protecting, restoring and sustaining mountain ecosystems, "the water towers of the world", are particularly important contributors to water security. People and industries downstream rely on protected mountain ecosystems as a source of fresh water for domestic and economic activities, including small- and large-scale irrigation, hydropower and various industries (IUCN, 2012).

About 23 per cent of mountain areas sustains downstream water supplies globally, and another 30 per cent supports supplies to some extent (Viviroli and others, 2007; Egan and Price, 2017). Protected areas provide drinking water for a third of the world's 105 largest cities. In Ecuador, 80 per cent of Quito's 1.5 million residents get drinking water from two protected areas in the Andes; in the Dominican Republic, the Madre de las Aguas Conservation Area protects the source of 17 rivers that provide water for domestic use and irrigation for over half the country's population (UNEP-WCMC and IUCN, 2016).

Many protected areas need an integrated approach to multi-sectoral ecosystem management, both within countries and where resources are shared among two or more countries with riparian rights to resources. An integrated approach can help to secure high-quality water supplies and address problems of scarcity and excess, which are likely to increase as populations increase and the climate changes.

3. Water and food production

Agriculture exists within a symbiosis of land and water that requires both sufficient quantity and quality and, as FAO (1990) makes quite clear, "appropriate steps must be taken to ensure that agricultural activities do not adversely affect water quality so that subsequent uses of water for different purposes are not impaired."

Agriculture and food production are both a leading cause[25] and a victim of water pollution, in addition to accounting for most water withdrawals worldwide. Except for water lost through evapotranspiration from crops, water is recycled to surface water and groundwater, resulting in pollution. But agriculture and food production are also victims, as they use wastewater and polluted surface and groundwater which contaminate crops and transmit disease to consumers and farmworkers.

Water withdrawals

Agriculture accounts for 69 per cent of annual water withdrawals globally from renewable water resources and accounts for 40 per cent of the world food and fibre produced. The remaining 30 per cent accounts for municipal (approximately 12 per cent) and industrial use, including energy (approximately 19 per cent). Most

[25]Conventionally, in most countries, all types of agricultural practices and land use, including animal feeding operations (feed lots), are treated as a non-point sources. The main characteristics of non-point sources are that they respond to hydrological conditions, are not easily measured or controlled directly (and therefore are difficult to regulate), and focus on land and related management practices. Control of point sources in those countries having effective control programmes is carried out by effluent treatment according to regulations, usually under a system of discharge permits. In comparison, control of non-point sources, especially in agriculture, has been by education, promotion of appropriate management practices and modification of land use." (Ongley, 1996)

agricultural withdrawals are for irrigated farming, but this varies among regions depending on climate and the prominence of irrigated farming in the economy. Agricultural withdrawals vary regionally from more than 80 per cent of total withdrawals in Africa and Asia to just over 20 per cent in Europe (FAO, 2016a).

Agriculture has intensified in recent years, and production has increased to meet the food demands from a growing population with changing diets. This has occurred in both commercial and traditional farming, and has led to increases in water consumption and also in waterborne pollution loads. These increases then affect water availability, as well as ecosystems and human health.

Figure 30 compares global water withdrawal over time in three sectors: agriculture (including irrigation, livestock watering and cleaning, aquaculture), industry and municipalities. Note that all withdrawals are not the same in that agriculture consumes water, whereas industry and municipalities only use water that is increasingly recycled for other purposes.

Population growth over time is also included in the figure. Population has increased 4.4-fold over the last century, while water withdrawals increased 7.3-fold over the same period. While world population is still growing linearly, the increase in water withdrawals has slowed down over the last few decades.

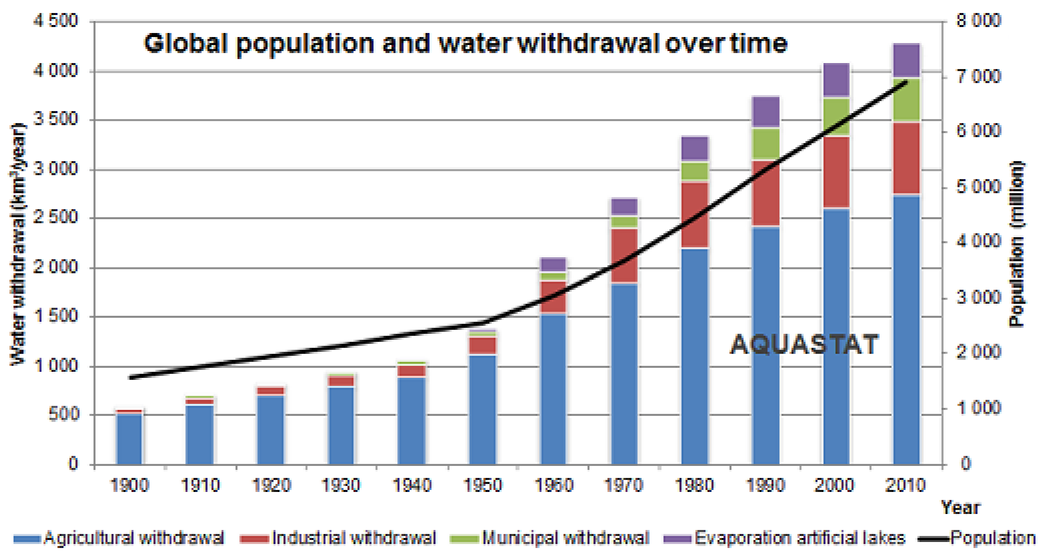


Figure 30 Water withdrawal and global population over time in agriculture, industry and municipalities, 1900–2010

Source: FAO (2016a).

However, it is a misconception to regard agricultural water consumption as being dependent primarily on water withdrawals (so-called "blue water"). Approximately 80 per cent of global cropland is rain-fed, and some 60 per cent of the world's food is produced on rain-fed land – by consuming rainfall which has infiltrated into the soil (so-called "green water") (Falkenmark and Rockström, 2004). Green water is also important on irrigated land, as blue water is supplied only to supplement inadequate rainfall to ensure a viable economic crop. Hence, global agricultural water consumption is much greater than suggested by the above withdrawal figures that refer only to blue water.

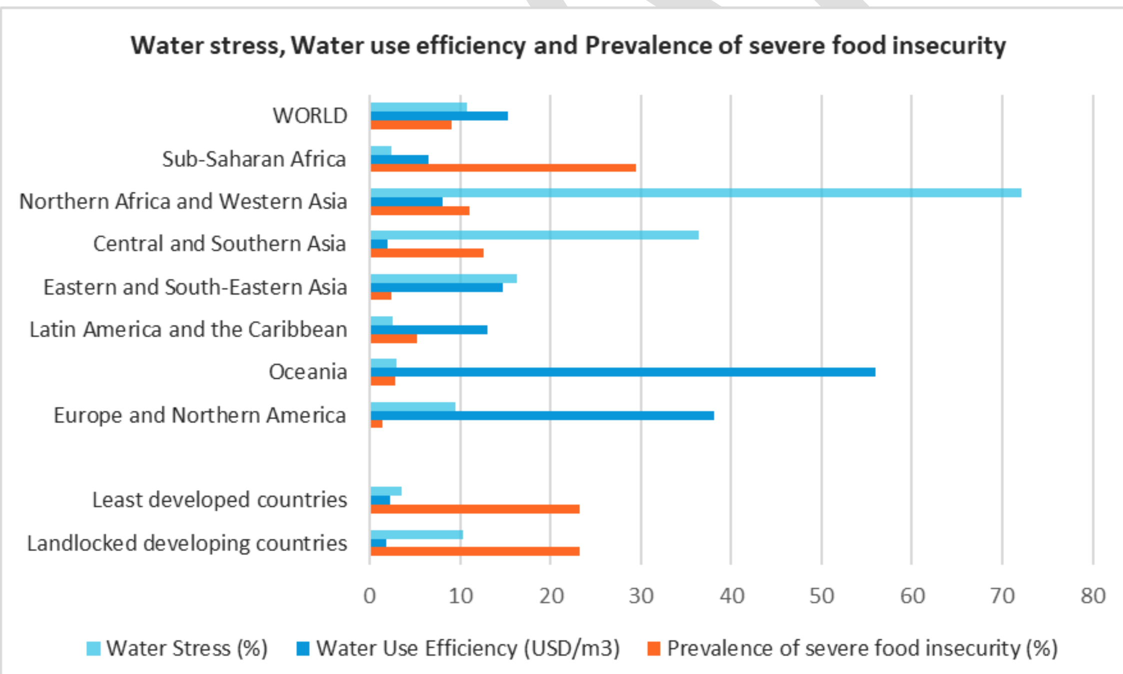
The area equipped for irrigation globally has more than doubled, from 1.4 million km^2 in 1961 to 3.2 million km^2 in 2012 (FAO, 2016a). Livestock has more than tripled from 7.3 billion units in 1970 to 24.2 billion units in 2011 (FAO, n.d.c). Aquaculture, especially inland fed aquaculture, particularly in Asia, has grown more than twentyfold since the 1980s (FAO, 2012).

Insecure access to water for agriculture is a major constraint on poverty reduction, especially in rural areas. Water is one of the most important production assets for millions of smallholder farmers who live in water-scarce countries. Securing access, controlling and managing water is key to enhancing their livelihoods. Local interventions in water management can contribute to rapidly improving the livelihoods of the rural poor and helping to eradicate extreme poverty and food insecurity. Interventions will need to focus on substantially increasing the effective use of available resources in areas of scarcity (IFAD and FAO, 2009).

Most countries need to improve water management, for both irrigated and rainfed farming, to improve effective water use and overcome water shortage and scarcity, especially those countries facing high water stress. Farm water management practices that encourage infiltration and reduce evaporation from soil, crops and open water bodies can reduce water consumption. Water storage can play an important role, as can transporting water in pipelines rather than open canals and on-farm technologies that help to reduce water wastage during irrigation.

4. Water stress and food insecurity

Water stress[26] (scarcity) is linked to hunger and food insecurity. Regions with high levels of water stress include Northern Africa and Western Asia (79 per cent), and Central and Southern Asia (66 per cent) (Figure 31). Both regions also show high prevalence of severe food insecurity. But while water stress is only 3 per cent in sub-Saharan Africa, the region has a high prevalence of severe food insecurity (29 per cent). This is due partly to unevenly distributed water resources that are poorly managed, lack investment and are affected by conflict and natural hazards such as droughts and floods (FAO, 2016a).



[26] Water stress is defined as "The symptoms of water scarcity or shortage, e.g. widespread, frequent and serious restrictions on use, growing conflict between users and competition for water, declining standards of reliability and service, harvest failures and food insecurity" (FAO, n.d.c).

Figure 31 Water-use efficiency (indicator 6.4.1), water stress (indicator 6.4.2) and prevalence of severe food insecurity

Source: FAO (2016a).

Countries need to improve water productivity and water-use efficiency to overcome water shortage and scarcity, especially those countries that face high water stress. Figure 32 shows a strong negative correlation between water productivity in agriculture and water stress in countries. This figure excludes high-income developed countries, as they have higher levels of productivity in addition to smaller agricultural sectors.

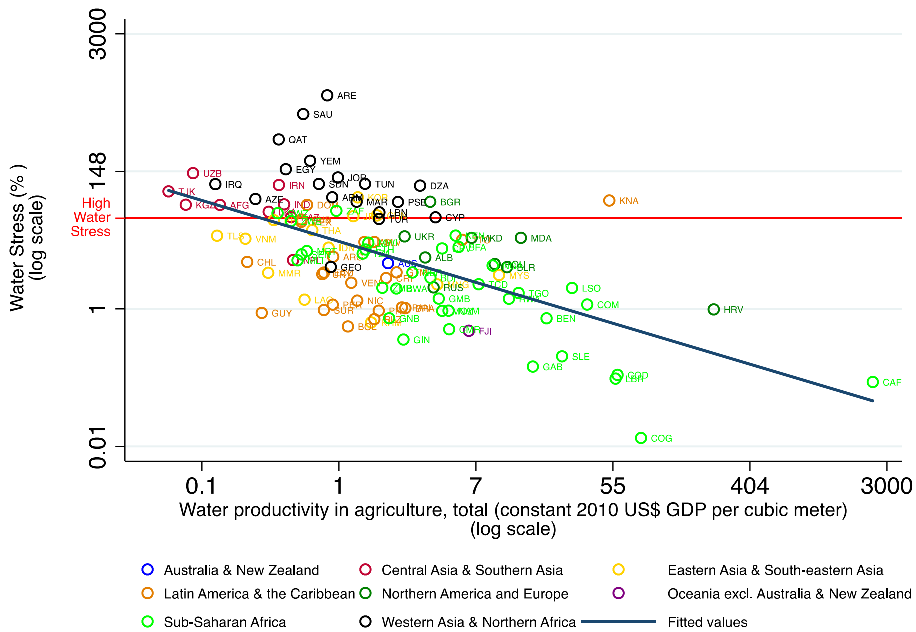


Figure 32 Water stress and water productivity in agriculture, 2002–2014

Source: FAO (2016a) and World bank (2018).

There are many small areas of land in urban and peri-urban areas producing high-value fruit, vegetables and animals for the urban market. They are usually irrigated, often using untreated wastewater, which causes health risks. National data do not normally include such activities, but they are an important source of food for urban dwellers. The global area is estimated to be 11 per cent of all irrigated croplands with a cropping intensity of 1.48.[27] Rain-fed peri-urban agriculture comprises about 4.7 per cent of rain-fed croplands with a cropping intensity of 1.03 (Thebo and others, 2014).

Water withdrawal ratios vary among regions, ranging from 91 per cent, 7 per cent and 2 per cent for agricultural, municipal and industrial water withdrawal, respectively, in South Asia to 5 per cent, 23 per cent and 73 per cent, respectively, in Western Europe (FAO, 2016a). The importance of agricultural water withdrawals is highly dependent on the climate and the prominence of agriculture in the economy. Figure 33

[27] The fraction of the cultivated area that is harvested. The cropping intensity may exceed 100 per cent where more than one crop cycle is permitted each year on the same area.

shows water withdrawal ratios by continent, where the agricultural share varies from more than 80 per cent in Africa and Asia to just over 20 per cent in Europe.

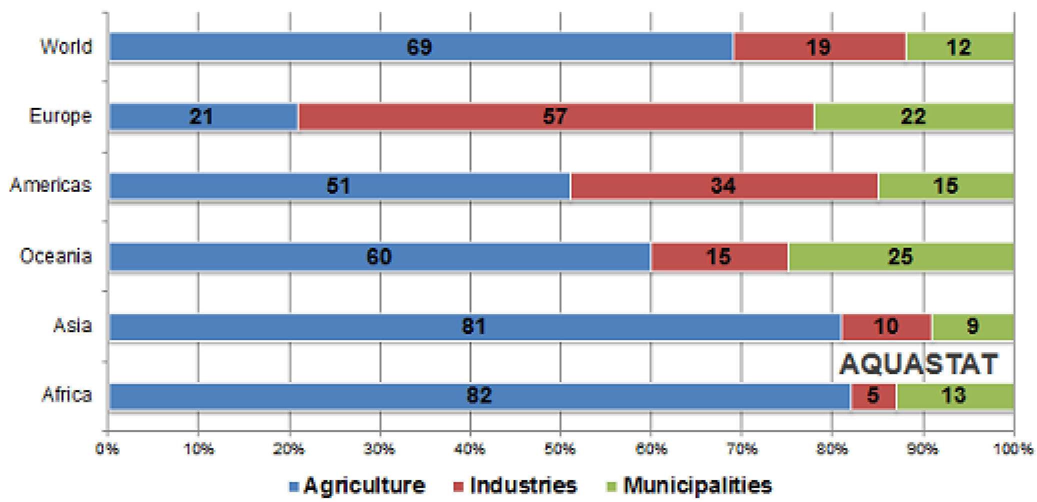


Figure 33 Water withdrawal ratios by continent

Source: FAO (2016a).

An important option for making water savings is reducing food loss and waste (Box 30).

Box 30 Reducing food loss and waste reduces agricultural water consumption

One third of food produced for human consumption – equivalent to 1.3 billion tonnes and valued at US$1 trillion – is lost or wasted worldwide each year, mostly in the industrialized world (FAO, 2011b). Food is spoiled during harvest, storage and transporting, it is wasted along supply chains and also rots in the bins of consumers and retailers (FAO, n.d.b). This is contradictory to SDG 12, which promotes sustainable production and consumption.

The global food loss index measures the total losses of agricultural commodities from production to retail and includes losses on farm, during transportation, in storage and during processing. Annual estimates of global food losses and waste are 30 per cent of cereals, 20 per cent of dairy products, 35 per cent of fish and seafood, 45 per cent of fruits and vegetables, 20 per cent of meat, 20 per cent of oilseeds and pulses, and 45 per cent of roots and tubers (FAO, 2015a).

All the resources consumed to produce this food, including considerable amounts of water, are wasted. Notably, the carbon footprint of food waste was estimated at 3.3 billion tonnes of greenhouse gases, making food wastage the third highest greenhouse gas emitter (FAO, 2013b). Reducing losses and waste can significantly reduce water consumption on farms and along the food value chains. Water can then be released for more productive purposes instead, thus having a significant impact on food security, economies and the environment, especially water withdrawals. This links directly to sustainable consumption (SDG 12) and helps to halve per capita food waste (target 12.3).

A reduction in food losses could have an immediate and significant impact on the livelihoods of smallholder farmers, where food is lost primarily due to infrastructure or capacity gaps, given that many such farmers in developing countries live on the margins of food insecurity (FAO, 2011b; 2015b).

5. Water, cooperation and peace

Countries with a high-water stress in the Middle East, such as Jordan, Lebanon and Turkey, have witnessed recent significant influxes of refugees. This pressure has added to the demands on water resources in the region, where existing resources are often poorly managed and overexploited.

Unemployment across the Arab world has worsened in recent years as rural incomes have fallen due to droughts, land degradation and groundwater depletion, resulting in low agricultural productivity. Inadequate and unreliable water supply has contributed to agricultural job losses, fuelling rural to urban migration and the expansion of informal settlements and social unrest (WWAP, 2016).

The loss of agricultural jobs jeopardizes agricultural livelihoods and economic opportunities in drier regions, which rely primarily on agriculture for employment. This particularly affects younger generations and vulnerable members of society. Some 70 per cent of the population is mostly young and dependent on a single agriculture/livelihood in the drylands of Africa (WWAP, 2017). See Box 31 for an example in the Lake Chad basin of Africa.

Box 31 Degradation, armed conflict and displacement of people in the Lake Chad basin

The Lake Chad region is one of the poorest areas in Africa, where poverty especially affects women. The riparian countries have high gender inequality rates where women have much lower access to education, information, agricultural extension services and credit.

Lake Chad has rich biodiversity, and some 2 million people living on its banks and islands rely on the ecosystem services it provides, such as for fishing, agriculture and livestock farming. A further 50 million people live in the Lake Chad basin.

The basin has changed significantly over the past 30 years, due primarily to variations in rainfall and reduced flows into the lake, resulting from dam building on feeder rivers and irrigation development. Water levels have fallen and the lake's area shrunk by per cent from 1963 to 1998.[a] This has led to the loss of globally significant biodiversity and degraded ecosystems (IUCN, 2008). Erosion, desertification, deforestation and climate change have added to the basin's vulnerability.

Armed conflict has affected the area for many years, and the increase in terrorist activity has attracted mainly young vulnerable people (non-educated, jobless and poor fringes of the population) (International Crisis Group, 2016).

Mass displacement of people and their livestock has taken place due to the combined effects of ecosystem degradation, war and political crises. The decrease in natural resources has also generated recurring social conflicts, especially among farmers, herders and fishers.

[a] The lake's surface area was approximately 25,000 km^2 in 1963, but in 1985, it did not exceed 2,500 km^2 and reached less than 2,000 km^2 in the 2010s, according to the database on global natural resources by UN Environment.

Good water management can support socioeconomic development, and bring peace and security to countries and across countries that share freshwater ecosystems, particularly those under threat (Box 32). Holistic, integrated and sustainable water management also serves to eradicate poverty, promote human health, food and energy production, and provide sustainable livelihood conditions for vulnerable groups. Box 33 provides an example in the Senegal River basin.

Box 32 Water and peace

Peace and development are inextricably linked. The Charter of the United Nations reflects this close connection with great clarity. Peace is more than the mere absence of war; it requires sustainable development. Development requires actors to cooperate and resolve their tensions without resorting to force. Any conflict limits development and prevents achievement of the SDGs. This is regardless of whether the conflict is in the form of local tension, at the social or political level, or at the transboundary level.

Competition over water can be a source of tension and a contributing factor to violent conflict. Water is seldom the only driver of conflict, but it is often among the important contributing factors. It is increasingly being used as a weapon of war in the armed conflicts of our era; water resources and installations are all too frequent objects of armed action. This is a practice that violates International Humanitarian Law.

The Global High-Level Panel on Water and Peace analysed these problems and made a number of recommendations. These were addressed towards nations, the United Nations Security Council, and other United Nations entities, international bodies and non-state actors. The Panel also emphasized that water cooperation must be used as an instrument of peace. Reducing tensions and addressing important challenges around water is a necessity for reducing the risk of conflict.

Water is a powerful tool for promoting cooperation. Water is vital and unique, and it has no substitute. It offers powerful incentives for cooperation of all stakeholders. Transboundary water cooperation is an important example and demonstrates a long history (in all regions of the world) of collaboration rather than conflict.

These experiences create an important message. The more equitable an international water agreement, the more effective and stable cooperation becomes. Sharing benefits around water and creating river basin water user associations are incentives for cooperation and entry points for dialogue, peace and stability. The problem today is that there are too few such arrangements.

Water cooperation is necessary at all levels: local, intersectoral, national, basin and international. Sharing water data and strengthening transparency is essential for success. Global monitoring of developments relating to water quantity and quality needs to be strengthened. Financial incentives for improved water cooperation must be implemented. Water diplomacy must be strengthened, as it represents a major contribution to maintaining international peace and security.

Source: Global High-Level Panel on Water and Peace (2017).

Box 33 Senegal River Basin Development Authority

The Senegal River basin is characterized by high water variability between the dry and rainy seasons. Several droughts drastically disrupted the local population in the region during the 1970s. Three countries bordering the Senegal River (Mali, Mauritania and Senegal) developed a close framework of cooperation through establishment of the Senegal River Basin Development Authority (Organisation pour la Mise en Valeur du fleuve Sénégal, OMVS) in 1972. They were joined by Guinea in 2006.

These four countries were the first African States to adopt specific legal instruments for joint work on an international watercourse from 1978. These instruments adopted under OMVS represent an example of cooperation in the use of shared water resource.

OMVS was subsequently the driving force for the construction of the Diama and Manantali dams, completed in 1986 and 1988, respectively. These waterworks, which were subject to a common and indivisible ownership regime among the riparian States, play a significant role in strengthening cooperation in the Senegal River basin. OMVS has made it possible to contain tensions among riparian States on several occasions owing to its solid and permanent characteristics.

Incidents along the Senegal River border occurred between Senegal and Mauritania during the period 1989–1991. The escalation of violence was swift and caused many deaths on both sides of the border. Diplomatic relations between the two countries were cut off for two years. OMVS continued to function during this period, serving as the only communication framework between the two States. OMVS held a Council of Ministers meeting in Nouakchott, Mauritania, as soon as relations thawed and even before formal resumption of diplomatic relations. Diplomatic relations were then restored.

This example illustrates the resilience of a basin organization to conflicts (even armed ones) that can break out among the residents of an international river and the contribution that a solid framework of cooperation in the field of water can bring for development and peace in a region.

Source: Geneva Water Hub.

6. Water and marine ecosystems

Rivers and streams connect precipitation falling on mountain and forest catchment areas to coastal and marine ecosystems. Much of the pollution affecting oceans and coastal zones comes from human activities and poorly managed land-use practices. Agricultural activities can lead to nutrient runoff into watercourses, and indirectly through infiltration into groundwater.

Discharging untreated or poorly treated industrial and domestic wastewaters into watercourses or directly into the sea pollutes rivers and the marine environment. This also applies to solid waste dumped at or near coastal areas, which eventually ends up in the sea (Corcoran and others, 2010). Reducing pollution and minimizing dumping of hazardous materials into upstream ecosystems will benefit marine environments and reduce the impact on coastal ecosystems.

Primary microplastics enter oceans mostly from vehicle tyre dust and paints washed into drainage systems during rainstorms (UNEP, 2016). Secondary microplastics reach oceans from the breakdown of larger plastic waste that originates from mismanaged solid waste along coasts and rivers (Sherrington, 2016). Fishery and aquaculture also contribute to the dispersion of microplastics in the sea (FAO, 2017b).

Point source discharges from domestic and industrial wastewater into marine environments, especially along densely populated coasts, leads to the presence of pathogens and elevated levels of hazardous substances such as heavy metals, persistent organic pollutants and pharmaceuticals (WWAP, 2017). Point and non-point land-based pollution sources need to be addressed to reduce pollution in coastal areas.

Global nitrogen flows have increased significantly over the last century in response to agricultural intensification, elevated levels of atmospheric deposition and an increase in per capita wastewater loads due to changing diets. Scientists have counted more than 400 so-called "dead zones" in coastal waters around the world where excess nutrients lead to areas of low to no oxygen that can kill fish and other marine life (Diaz and Rosenberg, 2008; WWAP, 2017). Harmful algal blooms, artificially fuelled by fertilizer runoff, release toxins in the water that can poison molluscs and fish (Shwartz, 2005).

Nitrogen concentrations in surface waters are often persistent, and a considerable time lag exists between ecological responses and improvements in water quality. This is often attributed to releases from legacy nitrogen stores in groundwater aquifers (Van Meter and others, 2017). As an example, the Baltic Sea has suffered eutrophication over the past century, which has been reflected in recurring algal blooms resulting from increased nutrient loading from 1965 onwards (Figure 34). This has remained high despite policy measures in the late 1970s to reduce incoming nutrient loads.

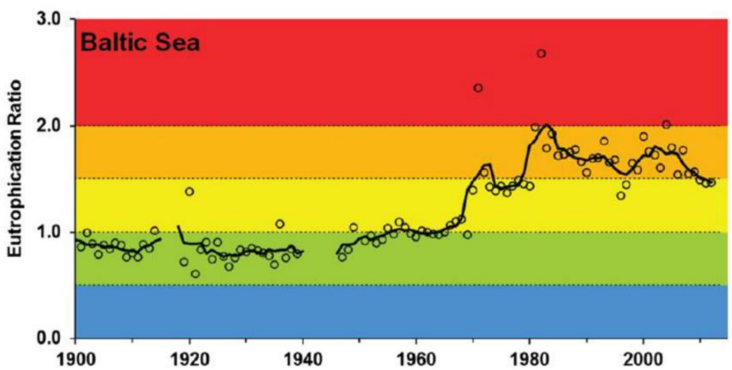


Figure 34 Eutrophication in the Baltic Sea, 1901–2012

Source: Andersen and others (2015).

Another example is the Gulf of Mexico, where 98 per cent of nitrogen discharged into it originated from non-point sources within the Mississippi River basin (Mitsch and others, 2001). Scientists demonstrated that agricultural runoff containing nitrogen fertilizer entering the Mississippi River played a pivotal role in creating the annual dead zone in the Gulf of Mexico (Shwartz, 2005).

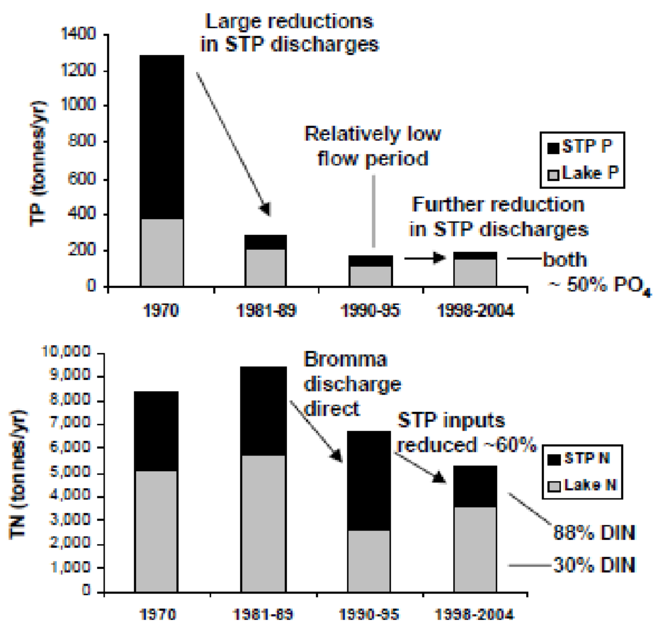
Some of the world's largest urban centres, home to more than 500 million people, are located along the coast or in river deltas (Allison and others, 2016). About 40 per cent of the global population live within 10 km of the coast, leading to mounting pressures on coastal ecosystems (CIESIN, 2006). Fish habitats are being destroyed near to densely populated cities such as in Karachi (Pakistan), which is close to the Arabian Sea. This affects the livelihoods of fishing communities, and communities suffer poor health because of the pollution (Jilani, 2017).

Box 34 shows an example of cleaning up the Stockholm archipelago.

Box 34 Cleaning up the Stockholm archipelago

Nitrogen and phosphorous inputs from land-based sources, from both diffuse and point sources, increased substantially above reference levels in the vulnerable coastal zone of the Stockholm archipelago (Boesch and others, 2006). Wastewater from approximately 200,000 people was discharged into the archipelago as early as 1900, and kept increasing until the early 1970s (Brattberg, 1986; Johansson and Wallström, 2001).

Sewage treatment plants using biological systems were built between 1968 and 1973 to remove organic pollution and phosphorus. Phosphorus limits were introduced, resulting in substantial reductions in algal biomass and cyanobacteria within 10–20 years. But legacy storage and internal nutrient loads still pose risks of eutrophication.



Nutrient loadings in the Stockholm Archipelago from Lake Mälaren and sewage treatment plants (STP), 1970–2004

Source: Boesch and others (2006).

7. Water-related disasters and climate change

Climate change is expected to have significant impacts on freshwater systems and their management. Most effects will be experienced through changes in the hydrological cycle, such as overall water availability, water quality and frequency of extreme weather events (e.g. floods and droughts). This cycle affects many water-using sectors including agriculture, energy, navigation, tourism and public health.

Water-related hazards account for a large part of disaster loss and impact (Figure 35). More than 1.6 million people died, and 5.5 billion people were affected by internationally reported natural hazards between 1990 and 2015. Water-related hazards accounted for 62 per cent of the deaths and 96 per cent of the people affected and 75 per cent of total damage costs amounting to US$2.5 trillion. Among water-related hazards, mortality was mainly attributed to storms (45 per cent), tsunami (28 per cent), people affected by floods (54 per cent) and people affected by droughts (31 per cent). Economic damage was largely due to storms (49 per cent) and floods (32 per cent) (CRED, n.d.).

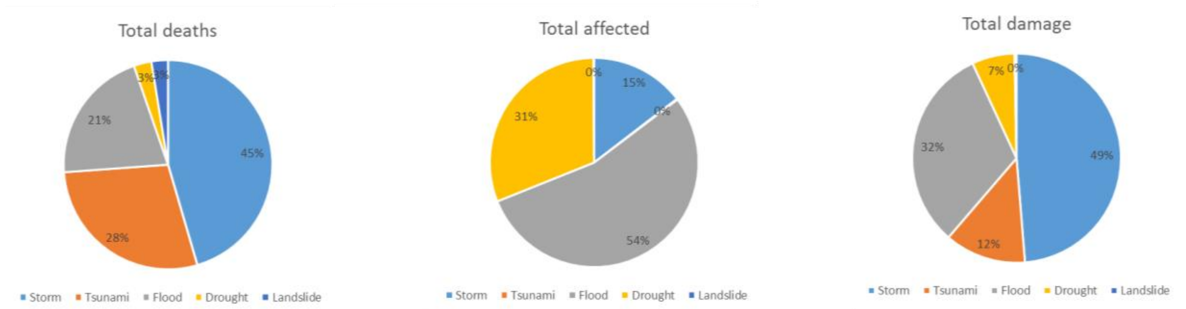


Figure 35 Disaster mortality (left), directly affected people (middle) and damage by water-related hazards (right), 1990–2015

Source: CRED (n.d.).

Concerns have grown about the increasing severity of droughts over the past decade. The Intergovernmental Panel on Climate Change stated in 2013 that the world had become more drought prone during the previous 25 years (IPCC, 2013). Droughts contribute to overall water scarcity, as they temporarily stress water supplies, and affect agriculture and aquatic ecosystems.

Although drought disasters account for less than 20 per cent of disaster occurrences in Africa, they represent more than 95 per cent of the death toll caused by disasters and more than 80 per cent of the number of people affected by disasters in Africa (WMO and GWP, 2014). Major droughts were found to reduce average per capita GDP growth by 0.5 per cent globally. A 50 per cent reduction in drought effects could lead to a 20 per cent increase in per capita GDP over a period of 30 years in vulnerable economies (Sadoff and others, 2015).

There is strong evidence that drought preparedness and risk mitigation help to lower the eventual drought relief costs (WMO and GWP, 2017). The effects of climate change are expected to accelerate over the course of this century. Not all the effects are negative, but climate change scenarios will need to be factored into decision-making processes.

Droughts differ from other natural hazards in several ways. First, they have slow onset and cessation characteristics, and their effects may linger for years after the event has ended. Droughts share with climate change the distinction of being a creeping phenomenon, creating a major challenge of recognition of potentially harmful societal changes (WMO and GWP, 2014). Moreover, a drought episode can be either briefly disrupted or ended by heavy torrential downpours that may cause additional harm due to flash flooding.

Second, the lack of a universal or standardized drought definition makes it more complicated to recognize both the occurrence and severity of a drought event and also to establish triggering mechanisms for managing societal impact. Drought definitions vary by regional and sectoral applications. Public sentiment to respond is often lacking, as the effects of droughts are not as visual as the effects of other natural hazards.

Third, drought effects do not affect infrastructure in contrast to floods, hurricanes and most other natural hazards). They usually affect large geographical areas. Thus, quantifying effects and providing disaster relief are far more difficult tasks for droughts than they are for other natural hazards (Wilhite, 2010). These drought characteristics make coordination of early warning, impact assessment and response difficult for scientists, natural resource managers and policymakers.

Recent advances in drought management include integrated approaches and risk reduction. These address multiple components of drought management through stakeholder engagement aimed at developing and implementing preparedness plans that build on the "three-pillar approach" incorporating: (1) comprehensive drought early warning systems, (2) vulnerability and impact assessments and (3) appropriate mitigation and response actions (Stefanski and Pischke, 2017; IDMP, n.d.).

Combined analysis of flood, population and economic data (CRED, n.d.; United Nations, Department of Economic and Social Affairs, Population Division, 2017; United Nations, Statistics Division, n.d.) suggests that economic flood damage grows more rapidly than population or economy. This may be, at least in part, attributed to climate change. The total economic damage has increased (6.6 per cent on average), while GDP between 1976 and 2015 grew at an average annual rate of 5 per cent. Flood occurrence has increased in countries of all income categories, and was, on average, four times higher than during 1976–1985, even in the latest period of 2006–2015 (Figure 36).

The world population grew an average of 1.1 per cent per year between 1976 and 2015. But the total population affected by floods rose by 2.7 per cent. Some 34 per cent of the global population was affected in some way by flooding between 2006 and 2015, and 21 per cent was in upper- to middle-income countries (Figure 37). The proportion of flood-affected population and economic damage relative to GDP has decreased since 2017 for all income regions, most likely due to nations adopting policies for flood management and reducing vulnerability.

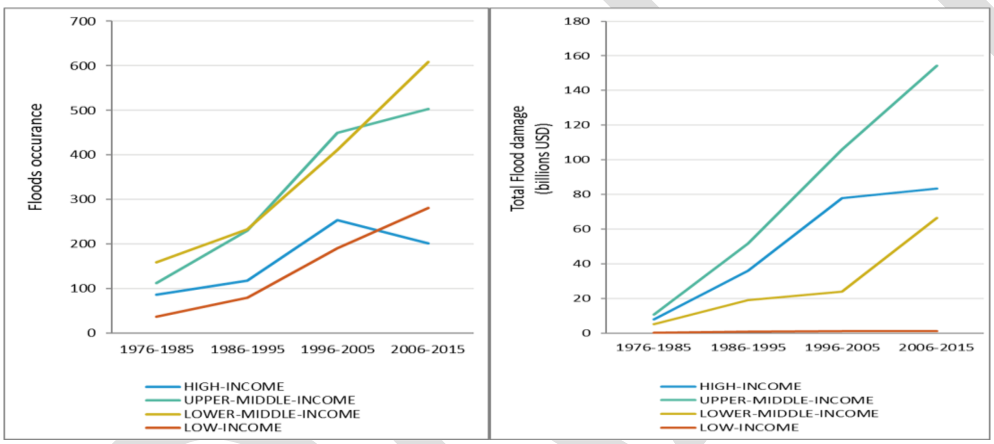


Figure 36 Flood occurrence (left) and economic damage (right) increase over time

Sources: CRED (n.d.); United Nations, Department of Economic and Social Affairs, Population Division (2017a); United Nations, Statistics Division (n.d.).

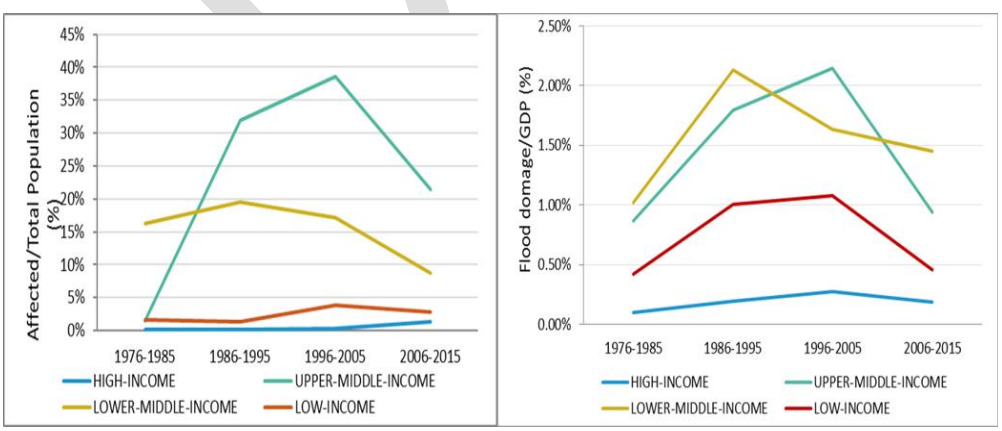


Figure 37 Percentage change in flood-affected population (left) and flood damage percentage of GDP (right) over time

Sources: CRED (n.d.); United Nations, Department of Economic and Social Affairs, Population Division (2017a); United Nations, Statistics Division (n.d.).

Although they may invest in flood management, developed countries are still vulnerable to floods, due to higher wealth concentration. The economic damage per capita due to flooding grew, while the population affected by floods decreased over the past 10 years (to 2017), demonstrating that development does not always help to reduce economic losses (Figure 38).

Global disaster risk is highly concentrated in low- and lower- to middle-income countries with rapid economic growth, where the exposure of people and assets to natural hazards is growing at a faster rate than risk-reducing capacities. Indirect damages that are particularly high in lower-income countries are not considered in Figure 38, as there are no estimates available. Examples of these include such issues as people not being able to go to work and school, and increased food prices due to disaster-induced poor harvest.

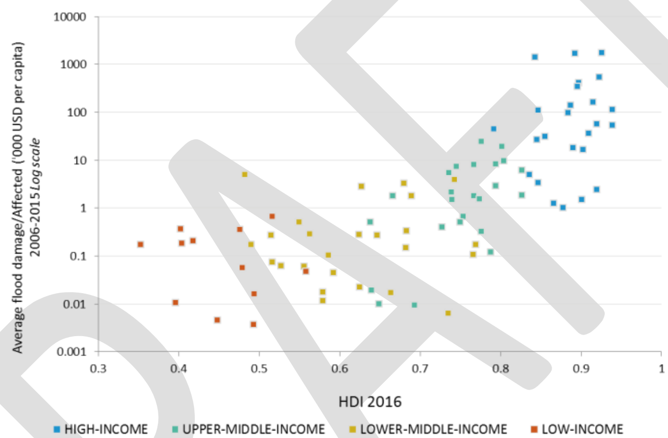


Figure 38 Relationship between flood damage per capita of affected population and HDI, 2016

The average annual loss due to potential occurrence of water-related disasters (e.g. tropical cyclones, riverine floods or tsunami) is estimated at US$181 billion in the built environment alone. As the distribution of average annual loss reflects the value and vulnerability of capital stock in hazard-prone areas, in absolute terms, average annual loss is globally concentrated in large, higher-income, hazard-exposed economies.

The average annual loss of water-related hazards in proportion to the value of their capital stock varies across regions, and is higher in Central Asia and Southern Asia, sub-Saharan Africa, and Latin America and the Caribbean (which is approximately double the global average). Low- and lower- to middle-income countries are three and four times the average, respectively. The disproportionately high risk of lower-income countries relative to the size of their economies has been recognized. For example, the average annual loss of water-related hazards in relation to GDP shows the highest concentrations of risk in many low and lower- to middle-income countries including LDCs, in particular small island developing States.

Successful disaster risk reduction in hazard-prone areas (most of which are in lower-income developing countries) is one of the key factors in eradicating poverty and promoting prosperity. It can prevent future disastrous events from pulling more people into poverty, destroying/disrupting livelihoods and assets, and impeding recovery.

The current international focus on mitigating the effects of climate change by strengthening resilience and adaptive capacity is also influencing desire among the international community to improve IWRM across the water and water-using sectors. There are 286 transboundary river basins globally, containing 60 per cent of available water resources, and serving almost 3 billion people in 153 countries. Add to these some 600 aquifers shared by two or more countries, all of which are vulnerable to climate change (De Stefano and others, 2009; 2012).

Climate change is being addressed in river basin management plans in transboundary basin, such as the Danube, Rhine, Mekong, Lake Victoria and Nile. This has led to the development of basin-wide adaptation strategies. The desire to mitigate the effects of climate change among shared water bodies offers an ideal entry point for cooperation in managing and sharing available water resources.

Nationally determined contributions (NDCs) are post-2020 climate actions that Member States of the United Nations intend to take under the Paris Agreement, which entered into force in 2016. More than 90 per cent of nationally determined contributions with an adaptation component refer to water (FWP, 2016). Thus, the target to integrate climate change measures into national policies, strategies and planning has a direct connection with water.

Many NDCs from water-poor regions propose increasing the efficiency of irrigation (more crop per drop) and harvesting and reusing rainwater at the household level (DIE, 2016). Some NDCs include measures for IWRM and for universal access to drinking water (SDG target 6.1). Rarely though do the NDCs mention climate initiatives involving sanitation provision, reducing water pollution or sustaining aquatic ecosystems. Yet significant funds committed through global climate financing processes (e.g. the Green Climate Fund) consider water issues as central. This reflects a connection with increased water and sanitation-related spending, water and sanitation partnerships and capacity-building.

8. Water challenges in cities

Some 54 per cent of the world's population (3.9 billion people) live in towns and cities, and this is expected to rise to 66 per cent by 2050 (United Nations, Department of Economic and Social Affairs, Population Division, 2014). Universal access to safe, affordable drinking water and basic sanitation has a direct effect on urban development, providing higher standards of living and health, and better conditions to the living environment in cities.

Pressures such as urbanization, climate change and deteriorating urban infrastructure are putting pressure on urban settlements. Rural communities also face many issues, from lack of access to water and sanitation to poor water quality. These pressures inhibit progress and are linked to poverty, gender equality, health and nutrition. Peri-urban areas and slums face unique problems where water and sanitation can play a central role in improving livelihoods. With a large proportion of the world already living in cities (predicted to grow), SDGs 11 and 6 will become increasingly symbiotic if they are to be realized.

Most future population growth will be in LDCs. Populations are still growing rapidly in Africa and Asia, and more people are migrating from rural areas into urban centres in search of better livelihoods. Africa's urban population is growing 3.9 percent annually. By 2030, Africa's urban population is forecast to rise to almost 50 percent of the population or some 654 million people (Jacobsen, 2013).

Cities are struggling to accommodate current populations and provide all necessary services including water supply and sanitation. Rapid growth will add further to the pressures on limited resources, increasing the demand for water as well as land and energy. Growth is mostly unplanned, and slums proliferate as disadvantaged people settle in less-costly areas with fewer formal services, all of which reinforce social and economic inequalities. The slum population in sub-Saharan Africa reached 200 million people in 2014 – some 56 per cent of the region's urban population (Bahri, 2015).

Climate change adds to the burden of urban water management. Rainfall patterns are changing and are less predictable, increasing the risk of droughts and floods. The changing urban landscape also alters local hydrology, reducing natural infiltration and increasing runoff and flood risks.

Box 35 Spotlight on water and cities: averting "Day Zero" in Cape Town, South Africa

Cape Town was at the centre of international attention in 2018 due to an impending "Day Zero" – the day the water taps to the city would run dry. This drastic situation has arisen because of a prolonged three year drought, which caused water storage levels in Cape Town's nearby dams to be at unsustainably low levels.

Cape Town is one of the world's first major cities to face such severe drought and water supply conditions. Water managers have taken emergency steps to conserve water and to increase the effectiveness of piped delivery of water to households. Incentives such as water rationing, penalties for overuse and closing down illegal boreholes have been used to reduce household water use. The authorities are now planning steps to improve water governance by coordinating water allocations across those sectors that are heavy water consumers (e.g. agriculture and industry).

The Cape region is a fruit-growing area that exports high-quality produce to Europe and other parts of Africa and is a key foreign exchange earner. It has seen valuable orchards decimated by droughts and lack of water for irrigation. This is an example of how droughts are not just a local issue. The lack of produce for export affects many other countries across the world that have come to depend on fruit from this region.

Limits and vulnerability arising from dependence on dam storage are evident. Local groundwater resources and desalination facilities are options for additional drinking water.

Many more cities across the world are already vulnerable to droughts. As cities grow, so too does their demand for food, energy and more water.

Source: UN Environment (2018).

Building sustainable cities and communities – The New Urban Agenda – will require US$7.5 trillion investment in water infrastructure by 2030 to meet existing deficiencies and cope with future demand. This is 15 per cent of the anticipated US$49 trillion investment in infrastructure needed globally to support economic development and provide essential services by 2030 (McKinsey Global Institute, 2016). Some 60 per cent of the investment is expected to be in emerging economies.

Access to piped water grew faster (3.1 per cent annually) than the rate of population increase (2.7 per cent annually) between 2000 and 2015, in 71 out of 121 countries (green countries in Figure 39). But the reverse was true in 42 countries (yellow). The population grew faster (2.7 per cent annually) than the rate of access to piped water (2.2 per cent annually). Six countries (red) experienced a reduction in piped water access (1.7 per cent annually) although their urban population grew (3.2 per cent annually). Four of these six countries were in sub-Saharan Africa.

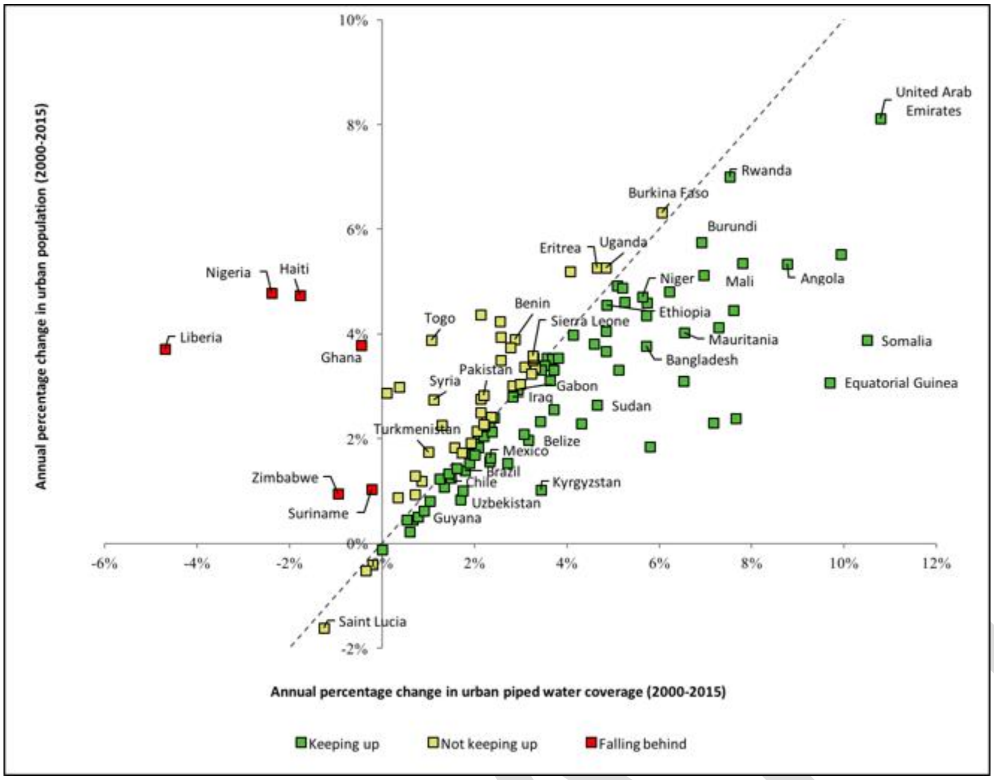


Figure 39 Annual urban population growth versus piped water coverage growth in urban areas, 2000–2015

Sources: WHO/UNICEF JMP database (piped water access growth); United Nations, Department of Economic and Social Affairs, Population Division (2014) (urban population growth).

A similar picture emerges for urban sanitation (Figure 40). Sixty-six out of 120 countries (green) experienced sewer access growth (2.9 per cent per year) between 2000 and 2015, which was greater than urban population growth (2.7 per cent per year). The reverse was true in 35 countries (yellow). The average increase in sewer access was 2.0 per cent per year, while the population grew at 3.1 per cent per year. The remaining 19 countries (red) experienced a decrease in sewer access of 5.5 per cent per year, while the population grew at 3.2 per cent per year. Thirteen out of the 19 countries were in sub-Saharan Africa.

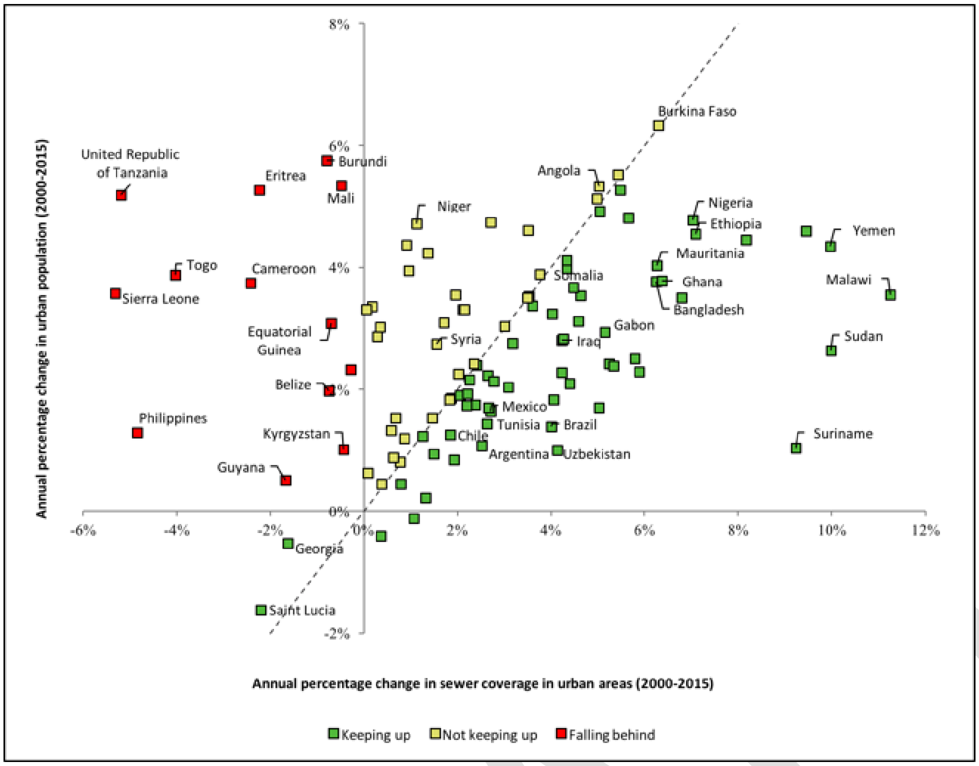


Figure 40 Urban population growth versus sewer coverage growth in urban areas, 2000–2015

Sources: WHO/UNICEF JMP database (sewer access growth); United Nations, Department of Economic and Social Affairs, Population Division (2014) (urban population growth).

Note: Green denotes “Keeping up” – countries where the increase of piped water access is higher than the urban growth rate. Yellow denotes “Not keeping up” – countries where the increase of piped water access is less than the urban growth rate. Red denotes “Falling behind” – countries where piped water access decreased while urban population continued to grow.

Population growth has outpaced growth in sewer connections in many countries. Sewers are not performing well in many cities. The gap is being filled by other improved forms of sanitation, such as septic tanks and improved latrines, and unimproved forms of sanitation. Septic tank access increased annually by 6.3 per cent between 2000 and 2015, while improved latrines and other improved types increased by 7.2 per cent.

D. Water and the economy

Water is embedded in all aspects of development and in sustaining economic growth in agriculture, industry and energy generation. The Stockholm Statement (2011) described water as the “bloodstream of the green economy”. Pressures are increasing as the demand for more resources continues. It is estimated that demand could outstrip supply by as much as 40 per cent by 2030, if the world continues to use water at current rates. This will put both water and food security at risk, constraining sustainable economic development (SOLAW, 2011).

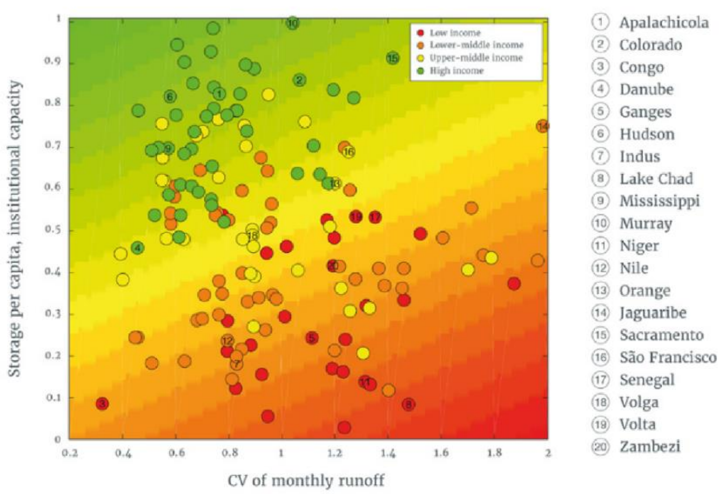
Economic growth is still a priority for most countries. SDGs cannot be met without growth, which tends to overshadow other issues. Unsustainable “borrowing” from water and land resources will not help to meet these targets. Climate change is focusing minds on sustainability and on the fact that natural resources of the future are being consumed to satisfy the economic demands of today. This is worse than the financial crisis because if resources are depleted beyond a sustainable level, there is no means of paying back the debt. "Quantitative easing", as practised in the financial world, is not an option for natural resources.

1. Water and economic growth

Water is well accepted as being important to economic growth, but this has not been proven. Recent studies undertaken by GWP, OECD and Oxford University (Sadoff and others, 2015) have helped to quantify and confirm this relationship. However, determining how water-related investments affect growth is fraught with difficulties because of the many pathways that lead to growth and the pervasive way in which water is an input into so many economic activities.

The empirical evidence gathered has led to findings confirming that water insecurity acts as a constraint to global economic growth. The studies stress the importance of investment in water security for development and the importance of development to enable investment in water security. Economic growth provides resources to invest in water management to reduce water-related risks. At the same time, economic growth may increase risks by increasing the value of exposed assets.

Data collected from large river basins across the world link economic growth to hydrological variability and to investment in risk mitigation (Figure 41). The wealthier basins (green dots clustered in the top left of the figure) feature "easy" hydrology[28] and large investments in water security. The poorer basins (red dots clustered in the lower right) have invested less in water security and many face "difficult" hydrology. Investment to transition from water insecurity to water security is greatest in those basins with highly variable hydrology – extremes of floods and droughts (Figure 42).



[28] "Easy" hydrology occurs when rainfall is more reliable, it is mostly within 15–20 per cent of long-term averages and its intensity is modest. In contrast, "difficult" hydrology affects most developing countries where rainfall is seasonal and intensive with variations exceeding 40–50 per cent of long-term averages, and there are extremes of floods and droughts that make infrastructure more expensive.

Figure 41 Economic growth, hydrological variability and investment in water security

Source: Hall and others (2014).

Note: The horizontal axis summarizes hydrological variability. The vertical axis is a composite indicator of investment in infrastructure and institutional capacity. Basins include those with populations over 2 million people and indicate high (green), middle (yellow) and low (red) levels of GDP per capita based on World Bank definitions.

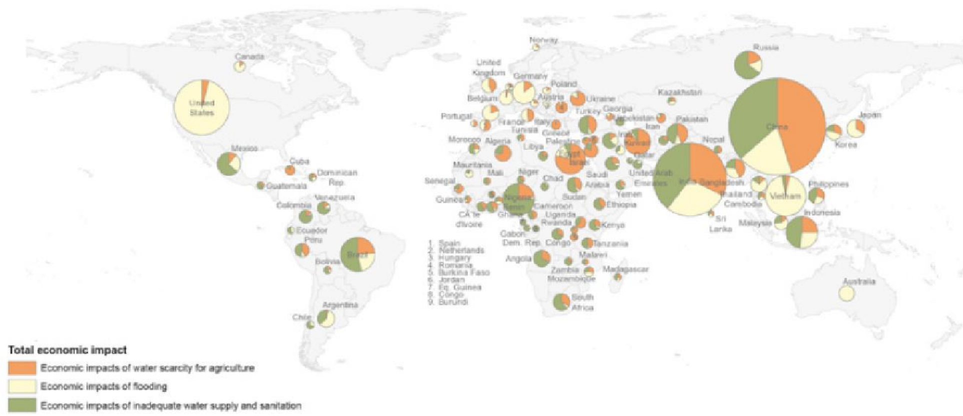


Figure 42 Relative economic impact of water insecurity

Source: Sadoff and others (2015).

Note: Three economic indicators were standardized to the same total economic impact globally: water scarcity to agriculture (brown), flood damage to property (yellow), and inadequate water supply and sanitation (green).

2. Water in the workplace

About 1.4 billion livelihoods globally are directly dependent on water (WWAP, 2016). This includes jobs in the food and beverage industry, the energy industry and the water industry. Millions of smallholder farmers in LDCs rely on water for irrigation and for livestock farming for their livelihoods. Access to water is therefore essential. So is access to improved drinking water and sanitation, which contributes to producing a healthy, educated and productive workforce – the foundation of economic growth and social development.

There is a dearth of information on the impact of access to water for food production on the livelihoods of smallholder farmers. But there is a wealth of information on productivity losses due to illness caused by poor sanitation and hygiene practices. Estimates suggest the cost to many countries can be up to 5 per cent of GDP (World Bank, 2017). The lack of sanitation holds back annual economic growth and productivity, equivalent to 6.3 per cent of GDP in Bangladesh, 6.4 per cent in India, 7.2 per cent in Cambodia, 2.4 per cent in Niger and 3.9 per cent in Pakistan. Hutton (2012) showed that US$260 billion was lost each year globally because of poor sanitation and unsafe water. Communicable disease, resulting from poor sanitation and hygiene practices, was responsible for 9 per cent of annual workplace deaths. This was lower than the 2002 value (17 per cent) (ILO, 2005).

There are regional disparities. In Africa, communicable diseases are the leading cause of occupational deaths, 91,158 people or 27.8 per cent (slightly less than in 2011), while in Europe and the Western Pacific Region, it is less than 5 per cent (Hämäläinen and others, 2017).

The workplace is an important part of people's lives in industrialized societies, and WASH can contribute significantly to occupational and general health (ILO, 2016). Access to improved WASH in employees' homes means that workers spend less time at home either sick or tending to ill children, and more time in the workplace, where they can contribute to business and earn money for their families (Schulte and Fenwick, 2017).

The private sector is beginning to monitor employee access to WASH. Approximately 49 per cent of companies responding to a water survey reported that they monitor employee access to WASH at more than 50 per cent of their facilities (CDP, 2017a). Improved sanitation gives every covered household an additional 1,000 hours a year to work, study and care for children (WWAP, 2009). Research on factories in Viet Nam (ILO, 2015a) showed that workers experienced greater satisfaction with water, air quality, toilets, canteens and health services; profitability increased, and absenteeism fell.

Enforcing policies for providing WASH can be made attractive by highlighting the increased productivity it can generate in workplaces and the costs it can prevent in public health. For instance, through the HERproject of Levi Strauss & Co., absenteeism among women fell by 55 per cent and staff turnover dropped from 50 per cent to 12 per cent. One of Levi's factory calculated a US$4 return for every US$1 invested (WaterAid and others, 2016). Similarly, investments into sanitation systems led to a 30–40 per cent reduction in the incidence of diarrhoea in one mining community at Newmont Mining, Ghana. This is a place where diarrhoeal diseases were the fourth-largest source of hospital admissions and the tenth-largest cause of death (CEO Water Mandate, 2017).

An example of intervention for menstruation management in Bangladesh is given in Box 36.

Box 36 Menstruation management in the workplace in Bangladesh

Some 80 per cent of factory workers are young women in Bangladesh. A study by Business for Social Responsibility concluded that 60 per cent were using rags from the factory floor as menstrual cloths. These cloths were chemically charged and often freshly dyed, and so infections were common. This resulted in 73 per cent of women missing work for an average of six days a month. Women had no safe place to purchase cloth or pads or to change or dispose of them. The six days lost is a huge economic challenge to them, to the employer and supply chain, especially when women are paid by the garment. An intervention to change this reportedly saw absenteeism drop to 3 per cent, resulting in significant economic gains for both the workers and the factory owner.

Source: WWAP (2016).

3. Water and human capacity

There has long been a dearth of experienced professionals and technicians in most developing countries, for planning and managing all aspects of water resources. This is a major constraint on sustainable growth and affects all aspects of life. On the supply side, there is often a lack of experienced teaching capacity and poorly equipped laboratories and facilities in tertiary education in many developing countries. An overly traditional curriculum, which is engineering and science oriented, may not address modern water issues such as management, the environment and socioeconomics. On the demand side, the water sector often lacks incentives to attract young professionals who prefer more lucrative and financially rewarding and progressive careers in the expanding private sector.

Participants in the International Conference on Water and the Environment in 1992 identified an acute lack of human capacity in the water sector, and later surveys revealed a worrying lack of awareness of this deficiency (IWA, 2014). Nearly half of the 74 countries surveyed for a global status update in 2011 were unable to state how many staff were working in the sector (WHO and UN-Water, 2012). Only one third of 94 countries surveyed had comprehensive human resource strategies for urban and rural areas for WASH services (WHO and UN-Water, 2014). This sector carries a stigma that makes it difficult to attract professionals, particularly those willing to work in rural areas (IWA, 2014).

Similar acute shortages of human resources are reported in the agricultural sector. Skills and experience are in short supply in irrigated farming and in water conservation for rain-fed farming, particularly in sub-Saharan Africa and South Asia (FAO, 2004). This shortage limits nations' ability to achieve water and food security goals in the face of climate change, which causes severe droughts and floods, often resulting in famine and the need for external emergency aid.

Education and vocational training programmes are viewed as conditions enabling the achievement of SDG 6. The expertise required in the water sector, at all levels of education, in numerous agencies, communities, schools and private companies, is crucial.

Tertiary education institutions have a responsibility to increase the capacity of qualified human resources, which are essential to achieving SDG 6 (Figure 43). They must provide knowledge and skills in water and sanitation, water for agriculture and energy, technologies, management techniques, planning and operational activities, policy development, promoting integrated approaches, educating teachers and communities, and stimulating innovation. Such institutions should support research and development and produce future generations of highly qualified personnel who are knowledgeable in water science, technology and management. Opportunities exist to improve education in developing countries by linking to online education that specifically targets the water sector.

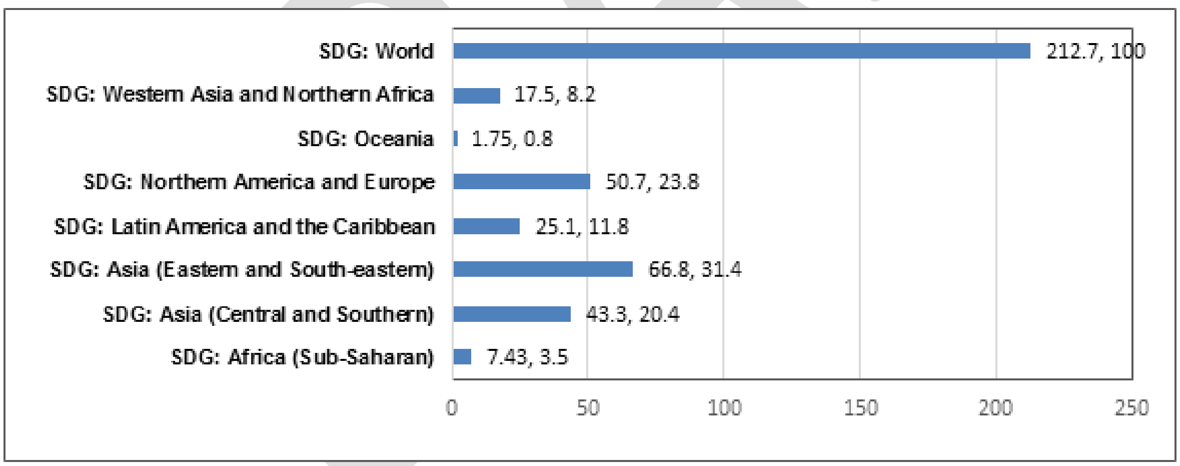


Figure 43 Students (millions, and percentage of global total) enrolled in tertiary education in SDG world regions in 2015

Source: UNESCO Institute for Statistics

Most water-related courses tend to be in engineering faculties and so they provide a proxy for water-related education activities. Water also now features in other programmes such as environmental and social sciences, but it is difficult to determine their true extent. Full-time undergraduate engineering programmes in 2014/2015 represented 7.1 per cent (458,643) of the global student enrolment (6,417,881). In these years, 106,658 Bachelor of Science degrees in engineering were awarded (Figure 44). A total of 48,550 students graduated in civil, chemical, mechanical and environmental engineering, which were courses most likely to offer significant water-related curriculum. Thus, 43 per cent of engineering graduates could potentially work in the water sector (Yoder, 2016).

Enrolment of women in tertiary science, technology, engineering and mathematics (STEM) subjects is still low. Only 26 per cent of students in engineering, manufacturing and construction-related studies and 38.7 per cent of students in natural sciences, mathematics, statistics, information and communication technologies were female (Joint UNESCO/OECD/Eurostat data collection; Fiske, 2012).

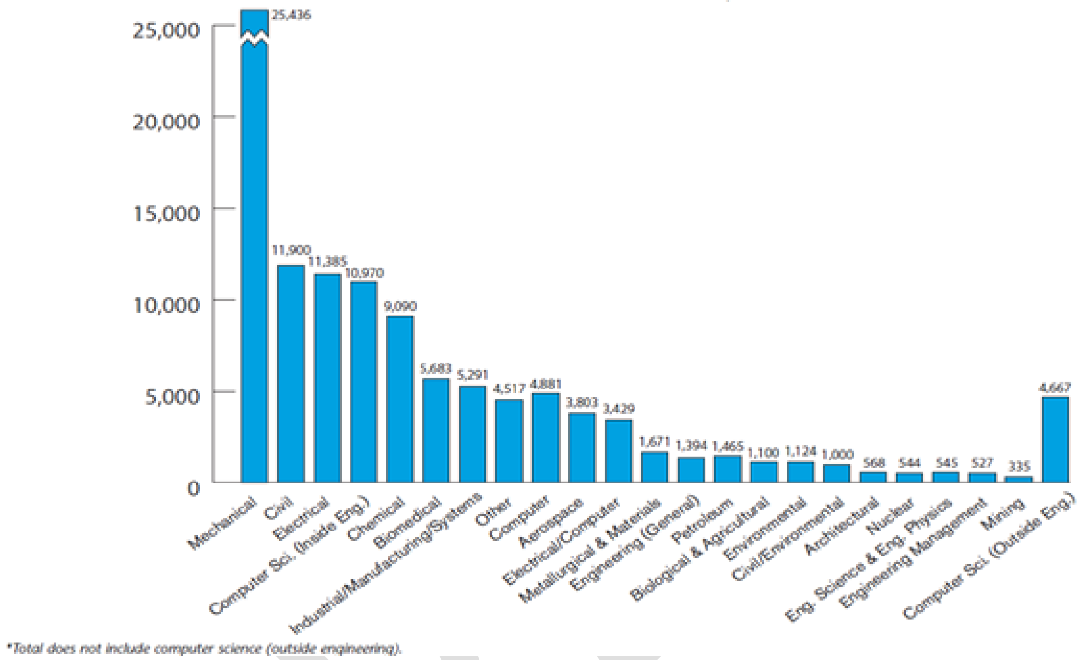


Figure 44 Bachelor of Science degrees awarded by engineering discipline in the United States of America in 2014/2015 (total = 106,658)

Source: Yoder (2016).

4. Water and the agricultural industry

Agriculture is not just the main consumer of water resources, it is also a major global industry, contributing to economic growth and employing some 30 per cent of the global workforce (ILO, 2015b; WWAP, 2016). In developed countries agriculture is treated like any other industrial business. IN the UK for example, only 1.5 per cent (476,000 people) of the nation's workforce is employed in agriculture producing about 60 per cent of food requirements and worth some US$13 6 million. But the wider agrifood industry, which relies on agriculture for its raw materials, employs 3.9 million people, 14 per cent of the workforce and is worth US$145 billion to the national economy. However, uncertainty over future water supplies for agriculture is leading to greater uncertainty among agrifood businesses based in this country and may act as a disincentive to future growth and investment (UK Water for Food Group, 2017).

Agriculture is the mainstay of economic growth in many LDCs. It relies on millions of smallholder producer farmers; more than 60 per cent of the workforce in sub-Saharan Africa is involved in agriculture-related activities (WWAP, 2016). Market structures are limited, and agrifood businesses and their value chains are still in their infancy. Thus, many farmers have little incentive to grow more food beyond the immediate needs of the family. Agricultural production and the economy largely depend on the vagaries of sparse and unreliable seasonal rainfall in sub-Saharan Africa. In Ethiopia and the United Republic of Tanzania, the rise and fall of annual GDP is closely correlated with rainfall, because their economies are strongly related to agriculture (WWAP, 2009). Irrigated agriculture is an option for some, but most countries face a combination of high hydrological variability, which brings extremes of floods and droughts, and a lack of investment in water infrastructure and good water governance to exploit and effectively control and manage renewable water resources.

International trading in food is common, as market forces seek to balance supply and demand for food and other agricultural products. In doing so they are also helping to balance the supply and demand for water through "virtual water" trading. Many water-stressed countries mitigate their food security risks by importing food from other countries. If food cannot be grown in-country because of insufficient water resources, it is imported from water-rich countries, which is like importing water (Box 37). This is an overly simplistic picture because many countries like to be self-sufficient for food dependence and are reluctant to become dependent on imports. Some also grow high-value crops for international markets as a means of earning foreign exchange. Both issues can and do lead to overexploitation of in-country water resources and unsustainable production.

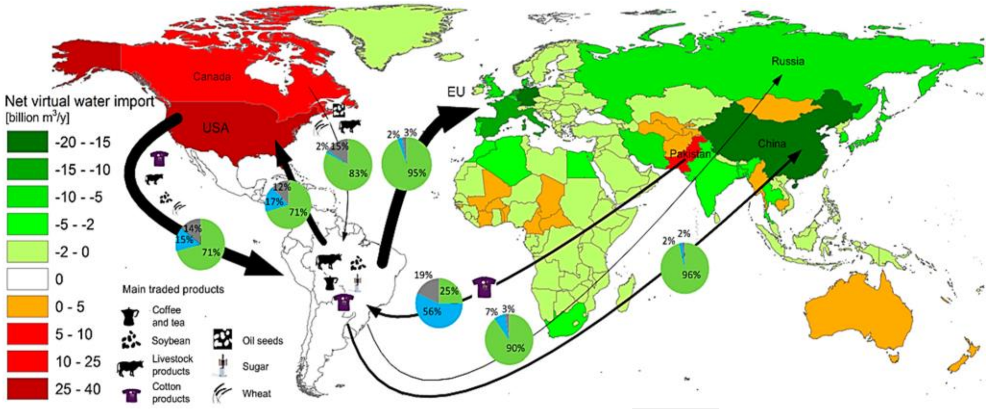
Box 37 Virtual water trading in Latin America and the Caribbean[29]

Latin America and the Caribbean is a relatively water rich region, with 34 per cent of the world's freshwater resources. Agriculture accounted for 68 per cent of withdrawals in 2001, 11 per cent for industrial use, and 21 per cent for domestic use. Abundant water and available arable land led to significant growth as an exporter of agricultural commodities to the world market. The growth in this sector improved the economic and social conditions of the region, while contributing to world food production. This then reduced the pressure on freshwater resources and food security in other countries. However, such development must be conducted in a sustainable manner, by considering the challenges present in the region.

Latin America and the Caribbean is a net virtual water exporter comprising five major products: soybean (36 per cent), coffee (14 per cent), cotton (10 per cent), livestock products (10 per cent) and sugarcane (8 per cent), all mostly with a water footprint based on rain-fed agriculture using "green" water. The main importers are USA (22 per cent), China (8 per cent), Germany (6 per cent), Netherlands (5 per cent), Italy (5 per cent), and Spain, France and Russian Federation (4 per cent each).

The region also imports a significant amount of virtual water from the rest of the world: cotton products (42 per cent) (mainly from the USA and Pakistan), wheat (12 per cent) (mainly from the USA and Canada) and livestock products (11 per cent) (mainly from the USA). About 54 per cent of virtual water imports go to Mexico. The international virtual water flows within the region are small compared to exchanges with the rest of the world. Most of the virtual water flows are related to crop products (88 per cent). Those related to trade in animal and industrial products contribute 9 per cent and 3 per cent, respectively. The virtual water flows within the region are mostly "green" water (88 per cent), while "blue" and "grey" water contribute 5 per cent and 7 per cent, respectively.

[29] Contribution: Andres Valerio Oviedo (UNESCO WWAP)



Net virtual water import related to import of agricultural and industrial products from Latin America and the Caribbean (green) and countries with net virtual water export due to agricultural and industrial exports to Latin America and the Caribbean (red) over the period 1996–2005 (only the largest gross virtual water flows (>10 billion m^3/year) are shown)

Source: Mekonnen and others (2015).

Box 38 Risks to agricultural supply chains

Water is an essential ingredient in products produced by global agrifood companies, the manufacturers and distributors of food and beverages. One of the most substantive water risks for companies in this sector lies within the agricultural supply chain.

A CDP water survey in 2017 showed that agrifood companies identified supply chain disruption as a serious risk. Many are already experiencing severe financial losses due to water scarcity. A food conglomerate reported losing US$25 million due to two consecutive dry years in the Pongola–Umzimkulu River basin in South Africa. A large South African retail firm reported that drought and unprecedented heat in the Breede–Gourits River basin affected irrigation rights, which this reduced crop yields and increased prices.

Leading companies are beginning to invest to mitigate these risks by engaging with suppliers, public policymakers and other stakeholders in river basins. One multinational flavourings company expects the prices of raw materials to rise by 10–20 per cent in the South Pacific Basin, where severe dry conditions have affected growing conditions. The company has therefore set up support projects for farmers to teach them good agricultural practices, including improving irrigation techniques. The company has also partnered with drip irrigation providers to subsidize and supply farmers with modern irrigation systems to reduce water wastage.

Sources: CDP (2017a; 2017b).

5. Water and the manufacturing sector

Industries bring together manufacturing and technically productive enterprises. Manufacturing industries are not water consumers like the agriculture sector. They tend to use and then discharge water, which is often of poorer quality. They do not always need large quantities of water or necessarily drinking water quality, yet CDP data show that 66 per cent of companies surveyed considered sufficient amounts of good-quality water to be "important" or "vital" for their direct operations (CDP, 2017b). The challenge is to balance industrial water needs, both in terms of quantity and quality, with those for people, agriculture, energy and the environment so that all can derive benefit from its use.

Industry accounts for up to 19 per cent of total water withdrawals globally, with substantial variation among countries and among the industrial, agricultural and municipal sectors (FAO, 2016a). Future economic growth and rising GDP will increase industrial water use (Ercin and Hoekstra, 2012). Global industrial water demand (not including electricity) is expected to increase by 55 per cent by 2050, partly as a result of a 400 per cent increase in manufacturing (OECD, 2012). Industrial water use is projected to increase from 300 km^3/year in 2010 to 550 km^3/year by the end of the twenty-first century (Wada and Bierkens, 2014). Figure 45 illustrates actual and projected water withdrawals for industry in comparison with agriculture and domestic water supply for different available data sets.

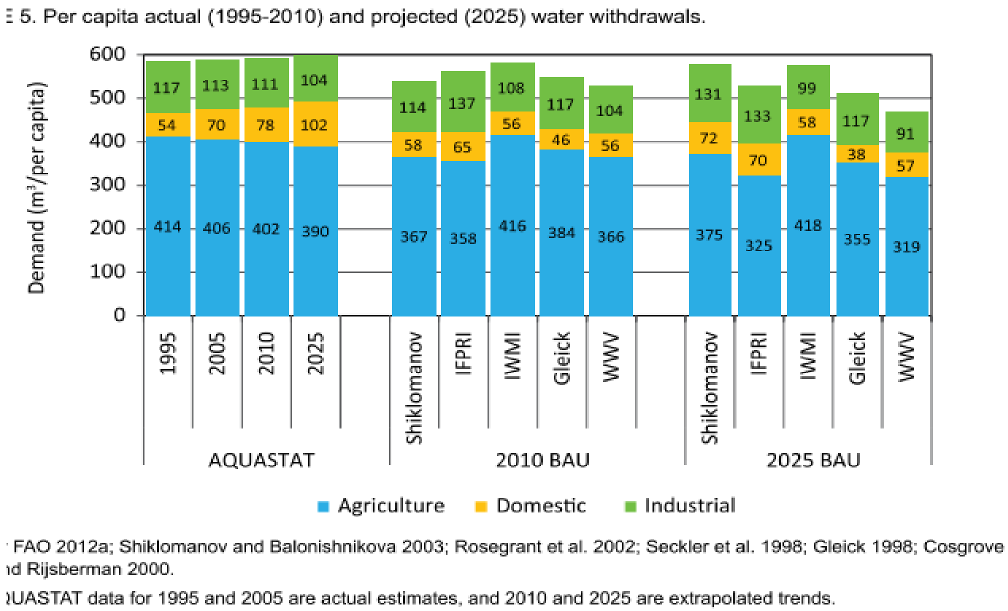


Figure 45 Per capita and sectoral actual and projected water withdrawals

Source: Amarasinghe and Smakhtin (2014).

Trends in water withdrawal vary regionally, within countries and within industries. Industrial water demand in Europe is decreasing; it has levelled in North America (Shiklomanov, 1998; WWAP, 2009), although total water use is much higher than in other regions. Demand continues to rise in Australia and Oceania, Asia, South America and Africa. The challenge is for developed nations to lower industrial water use and for developing countries to industrialize without substantially increasing water demand.

The main issue for industry is less about water quantity than the quality of water discharged after use. Most industrial processes degrade water quality. Industries in modern economies have statutory duties to clean up their effluents to national and international standards before discharging into receiving water bodies such as lakes, rivers or seas. The extent to which water is treated depends on the quantity and quality of the receiving water body and how the diluted water is to be used downstream.

Most industries in LDCs discharge untreated or partially treated effluent. Contaminants include metals and organic compounds, which can be toxic for people and animals (Palaniappan and others, 2010). The pollutants that are harmful to people and the environment in places where regulatory systems are ill-equipped to deal with them are of concern (UNESCO, 2015; Binz and others, 2012).

Industrial water pollution combined with sewage near coastal areas can have devastating effects on marine habitats and wildlife, and on human health and livelihoods (Palaniappan and others, 2010).

There are several obstacles that the private sector faces to prevent pollution (WWAP, 2017). There may not be effective or cost-effective replacements for toxins used in industrial processes. Costs may be greater than the economic benefits to be gained from switching to more sustainable technologies, and initial investments may be large and take a significant amount of time to pay back. Maintenance and energy use may increase. Timing and amount of water available may not meet actual needs when considering wastewater reuse (WWAP, 2017).

These obstacles are especially challenging for small- and medium-sized enterprises (SMEs), which may not have the capacity to make continuous improvements. SMEs deserve support for upgrading because, according to the United Nations World Water Assessment Programme, they "dominate sectors like textile, dry cleaning, metal finishing, printing, [and] food and beverage", all of which have significant water use and water impact (WWAP, 2017). There is no universal method to pollution prevention given these challenges (UNEP, 2016). There are still lessons to be shared across watersheds with similar industries or environmental problems, although solutions will be location and capacity specific.

Improving water efficiency and ensuring sustainable withdrawals will reduce water risk, but businesses face a variety of physical, reputational and regulatory water risks (Schulte and Morrison, 2014). Droughts and floods also bring risks. Investing in technologies can reduce water use and improve treatment. Industries were able to lower their water demand by 40–90 per cent when incentives were used (Asano and Visvanathan, 2011; WWAP, 2006). The market for industrial wastewater treatment technologies is projected to grow by 50 per cent between 2015 and 2020 (Global Water Intelligence, 2015).

There is a misconception that environmental quality and economic growth are conflicting, but environmental degradation does and will affect the worldwide economy, particularly in poor and vulnerable nations (Stern, 2004; Flörke and others, 2013). Poor water quality has a variety of economic effects, ranging from a direct impact on industry and livelihoods, to human health costs, loss of ecosystem services and the need for more wastewater treatment plants (Palaniappan and others, 2010).

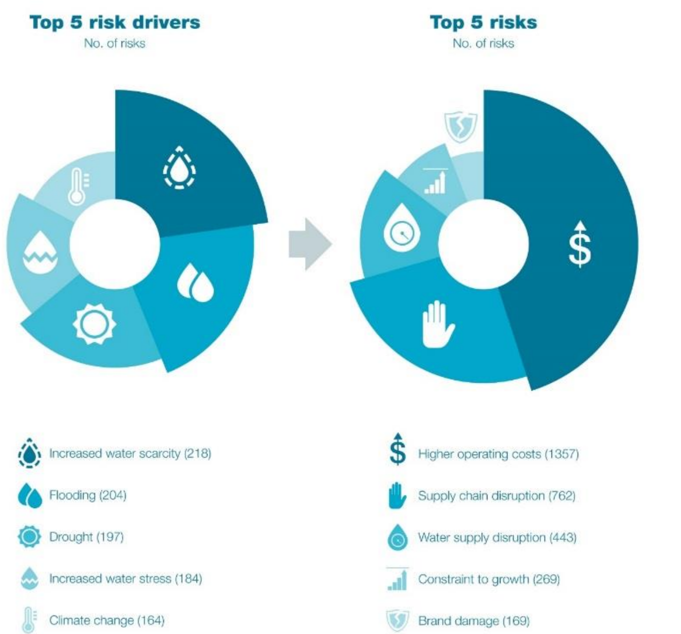
Global cost estimates of the impact of poor water quality on industry are not available. However, as an example, it was estimated that the industrial sector in China lost US$1.7 billion to water pollution in 1992 (Palaniappan and others, 2010). Just 12 companies reported US$24 million in financial impacts relating to declining water quality (Box 39) in a 2017 CDP survey. The economic effects related to human health of poor water quality range from loss in productivity to health-care costs. The annual cost of environmental degradation of water in Middle East and North Africa countries was shown to be 0.5–2.5 per cent of GDP (World Bank, 2007).

Therefore, it is wise to address water resource degradation resulting from industrial water use while encouraging economic growth. Each US$1 used to improve water supply and sanitation leads to an economy-wide return of US$4–14 (WWAP, 2009).

Box 39 Agrifood, energy and manufacturing companies disclosing water-related information

The CDP water programme was launched in 2009 to motivate companies to measure and disclose water-related information to their institutional investors. This was the first systemic linkage between water and financial information. CDP now holds the largest corporate water data set in the world and adds to it annually through its information request to companies, governments, cities, States and regions.

Water is fundamental to industry, and both quality and quantity matter. Some 66 per cent of companies surveyed in 2017 considered sufficient amounts of good-quality fresh water to be "important" or "vital" for their operations. But companies recognize that water supply and quality is by no means guaranteed. Over 3,700 corporate water risks were reported in 2017, with a variety of physical, regulatory and reputational drivers.



Top 5 water-related risks and risk drivers

Sources: CDP (2017a; 2017b).

Industries located next to each other on an eco-industrial park can exchange wastewater for reuse and share treatment technologies (and associated costs). For small- and medium-sized enterprises that may not have much capacity to pay for facility upgrades, eco-industrial parks are one way of taking advantage of shared systems.

Zero effluent discharge is the ultimate target for which businesses should aim. This requires that industries reduce their water withdrawal and polluted discharge, and that any effluent is recycled or sold to another user. One example is the Zero Discharge of Hazardous Chemicals Programme,[30] which is an initiative for the apparel, leather and footwear industries working to advance towards zero discharge of hazardous chemicals in the supply chain. Zero effluent discharge moves towards the "cradle-to-cradle" concept, in which natural resources are used and ideally reused continually (WWAP, 2006).

30 http://www.roadmaptozero.com/.

The CDP surveys reveal that the private sector faces water challenges and solutions that align with the 2030 Agenda (CDP, 2017a; 2017b). Therefore, engagement by the private sector in innovating and pursuing sustainable industrial processes is crucial. Technological improvements translate to increased water productivity and decreased water use in production (Ercin and Hoekstra, 2012). These will become even more important as developing countries industrialize, and industrial water uses and discharge increase in "business as usual" scenarios.

The food and beverage industry is proactive in good water management and is one of the top three industrial water markets (Box 40) (Global Water Intelligence, 2012; McGregor, 2015).

Box 40 Food and beverage industry

Water stewardship is becoming an increasingly important element of corporate sustainability. Many leading food and beverage corporations feature facets of water stewardship in their sustainability reports. Major companies acknowledge that physical and reputational water risks motivate their water stewardship goals. The companies are reliant on good water quality, for inclusion in the final product and for processing, cleaning, pasteurization, cooling, dilution, brining, fermentation and more (Jones and others, 2015).

Water-use analysis and benchmarking in one food and beverage company in Turkey were used to identify opportunities for water conservation in the factory's cooling systems. Water recycling and reuse were implemented. The cooling water demand dropped 92 per cent as a result, saving the company 503,893 m^3 of water yearly and reducing the wastewater discharge by over 57 per cent. The payback period for these changes was seven months (Alkaya and Demirer, 2015).

Coca-Cola has worked for many years to reduce water risk. It has identified one solution outside of its bottling factories: a goal to return water to communities and nature equal to the volume of their beverages. It replenished 221 billion litres or 133 per cent of the water used in its drinks in 2016. The methods included conducting a source water vulnerability assessment for each bottling plant and developing a source water protection plan to address issues by supporting specific community projects (The Coca-Cola Company, 2017).

Source: CEO Water Mandate (2017).

6. Water and the energy sector

WASH services, agriculture and industry consume substantial amounts of energy for pumping water, treating wastewater, irrigating crops and desalination. Providing energy for pumping can increase access to water, producing many benefits in community health, food production and people's livelihoods. It can reduce cooking with biomass with noted health benefits and make available more time for women and children to pursue education and other productive activities.

Energy generation requires water to cool thermal power plants, grow biofuels, extract primary fossil fuels and generate hydropower. About 10 per cent of global water withdrawals was used for producing energy in 2014 (excluding hydropower). Some 12% of water withdrawals for energy generation was used for producing primary fuels. (Figure 46) (IEA, 2016a).

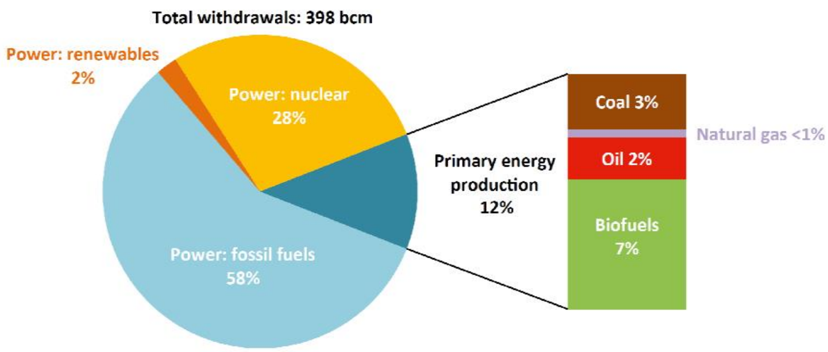


Figure 46 Water withdrawals in the energy sector, 2014

Source: IEA (2016a).

Abbreviation: bcm, billion cubic metres.

Growing economies will consume more energy, which means more water will be needed for generation. Predictions for future energy consumption vary. It is estimated that global energy consumption will increase by 48 per cent above 2012 levels by 2040 (US EIA, 2016). However, the International Energy Agency suggests the increase will be lower (30 per cent), with demand declining in OECD countries and increasing in Southeast Asia, India, China and parts of Africa, Latin America and the Middle East (IEA, 2016b).

Projections to 2040 based on 2005 figures show less than a 2 per cent rise in water withdrawals for energy, yet the water sector is expected to double its energy consumption to 8 per cent (IEA, 2016a; 2016b). Much of the water withdrawn for energy generation returns to the source, but consumption is expected to increase by 60 per cent to 75 billion m^3 due to advanced cooling methods and particularly significant withdrawals for growing biofuel crops (IEA, 2016a).

Two thirds of global water withdrawals are from surface water and one third is from groundwater. Pumping groundwater is about seven times more energy intensive than surface water abstraction. But surface water usually requires much more (energy-intensive) treatment prior to use than groundwater (IEA, 2016a). One growing concern is the increasing use of groundwater for irrigation and the impact this will have on energy demand.

Groundwater already supplies one third of the world's irrigated area. This source is popular among the many millions of impoverished smallholder farmers across sub-Saharan Africa and South Asia because of easy access, reliability and flexibility (Shah, 2012). The demand for groundwater is likely to increase substantially, and so too will the energy need for pumping, with few effective controls in place.

The link between energy requirements and groundwater pumping is direct and strong in India. India's energy policy is used to stimulate or control groundwater abstraction for irrigation, where electric pumps are used (Shah, 2012).

(a) Energy for water services

Although 86 per cent of the world's population has access to electricity, there are still 1.1 billion people living mostly in LDCs that do not (IEA 2017a); some 590 million, more than half the global total live in sub-Saharan Africa. Access to electricity is poor and population growth is overtaking progress in electrification (World Bank and IEA, 2017). Significantly more people lack access to electricity than water (Figure 47), although there are no indications on water reliability, which is a problem in many countries. There are no data on how many people lack both water and electricity. China is an exception to these overall statistics with 100 per cent access to electricity and close to 95 per cent for water (although this still means that over 73 million people do not have access to water) (World Bank and IEA, 2017).

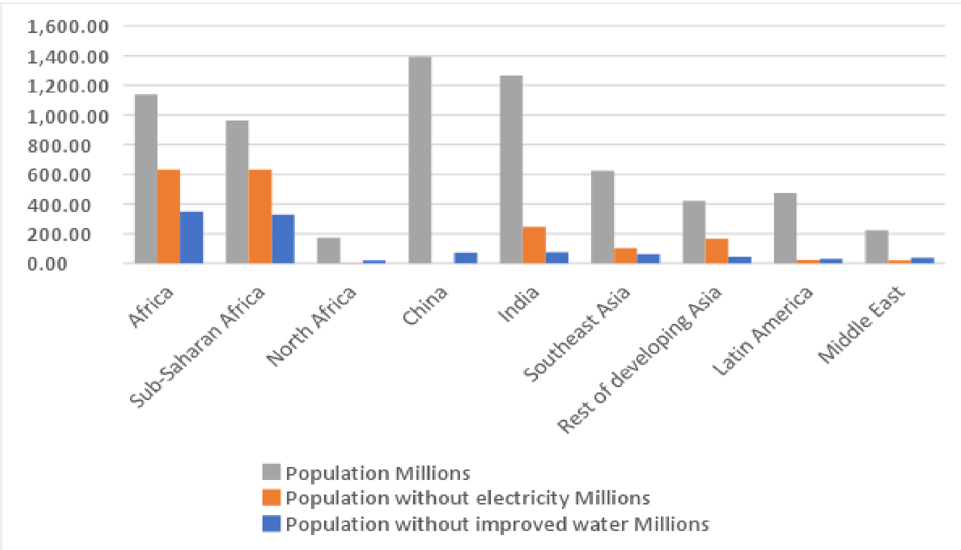


Figure 47 Population (millions) without access to water and electricity, 2014

Sources: IEA (n.d.); WHO and UNICEF (n.d.).

Introducing electricity for pumping and water treatment would increase access to water with the potential to improve health and well-being and increase growth in agricultural and industrial economies. Providing much-needed electricity in water-stressed areas may lead to conflicts among competing water users, with trade-offs needed to resolve them. It will be important for the water and energy sectors to cooperate and coordinate investments if targets for providing water services and wastewater treatment are not to be constrained by a lack of electricity. This also applies in reverse, if increasing access to energy is not to be constrained by the lack of water.

A special case that illustrates the connection between energy and water supply is desalination (Box 41), which is evolving into a viable alternative water source to combat water scarcity and water stress. It only provides around 1 per cent of the world's drinking water, but its use is growing annually.

Box 41 Desalination

There were approximately 18,000 desalination plants around the world in 2015, with a total installed production capacity of 87 million m^3/day. Some 44 per cent of this capacity (37 million m^3/day) was in the Middle East (mainly Saudi Arabia, Kuwait, United Arab Emirates, Qatar and Bahrain) and North Africa (mainly Libya and Algeria). An expected US$10 billion investment in the next five years would add 5.7 million m^3/day. The capacity is expected to double by 2030.

Other countries using large desalination plants include Australia, Israel, Spain and United States of America. While desalination in the Middle East is projected to grow by 7–9 per cent annually, large desalination developments over the next decade are expected across Asia, United States of America, and Latin America (FAO, 2017; IWA, 2016; USGS, 2016).

Desalinated water is produced from brackish water (salt content less than 10,000 mg/l) and seawater with a salinity in the range 30,000–44,000 mg/l. Brackish water is limited in volume, and so most desalination will be from seawater, which is abundant. This offers a logical solution for sustainable, long-term management as water demand grows in arid regions (IWA, 2016).

However, desalination is costly and energy intensive, requiring significant investments in infrastructure. Technology advances can be expected to reduce the cost of desalinated water by 20 per cent in the next five years, and by up to 60 per cent in the next 20 years, making it a viable and cost-effective competitor for potable water production (IWA, 2016; USGS, 2016).

Desalination also has an environmental impact that must be understood and managed. Modern reverse-osmosis desalination plants take in large volumes of seawater and discharge highly concentrated brine back into the sea. This is potentially harmful to fish and other marine organisms such as plankton, fish eggs and larvae. Brine has twice the salinity of seawater and it is much denser, so the two do not mix easily. The brine sinks and spreads along the ocean floor. There are methods for dispersing concentrated brine that involve diluting with wastewater and encouraging mixing, but further research is needed, especially to understand the long-term impact.

The International Energy Agency estimates that 120 million tons of oil equivalent (Mtoe) of energy was consumed to treat, process and move water in 2014. This was just over 1 per cent of the world's total energy consumption and equivalent to the energy demand of Australia (IEA, 2016a). Electricity accounted for 60 per cent of this total (820 TWh), which was equivalent to the annual electricity consumption in the Russian Federation.

The water sector consumed 4 per cent of the world's total electricity production in the same year (Figure 48): 40 per cent for abstraction, 25 per cent for wastewater treatment and 20 per cent for water distribution. Energy consumption in the water sector is projected to increase by about 50 per cent above 2014 levels by 2030 (IEA, 2016b). The largest increases are expected in desalination and water transfers. However, water management can also be part of the solution to meeting the demand. Wastewater treatment plants can be designed to generate energy due to heat content and organic material.

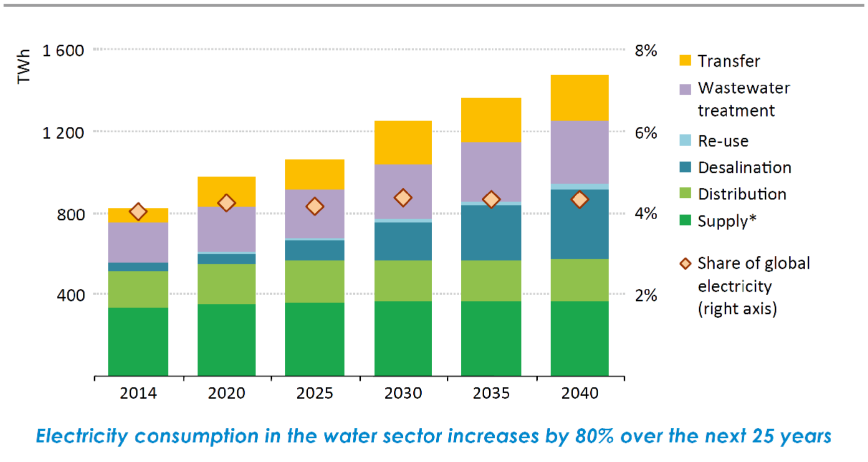


Figure 48 Electricity consumption in the water sector by process

Sources: IEA (2016a) and sources cited therein.

Global energy consumption across the water sector is projected to double by 2040 (IEA, 2016c). The largest increase is expected for desalination, which may increase from 5 per cent in 2015 to 20 per cent of all electricity consumption in the water sector by 2040 (IEA, 2016a) (Figure 48).

(b) Energy for and from wastewater treatment

In developed countries, 42 per cent of electricity consumption in the water sector is already used to treat wastewater. However, 80 per cent of wastewater (including urban and agricultural runoff) is still not treated globally (WWAP, 2017). Between 60 per cent and 95 per cent of municipal wastewater is not collected in LDCs (IEA, 2016a). A significant increase of energy consumption is expected if all this wastewater is to be treated.

Wastewater collection and treatment will require 60 per cent more electricity by 2040 (Figure 48). Halving the 80 per cent of untreated wastewater would require an additional 400 TWh of energy, if conventional techniques are applied. This is almost 50 per cent more than the 820 TWh already being consumed across the water sector. Most of this will be required in low-income countries where only 8 per cent of the industrial and municipal wastewater receives any kind of treatment (Sato and others, 2013).

A potential bonus is that the energy contained in wastewater is about 5–10 times greater than the energy needed to treat it. This energy source could produce 30–100 TWh to treat municipal wastewater by 2040 if the energy is properly harnessed (IEA, 2016a).

(c) Renewable sources of energy

Some 17.5 per cent of global energy consumption came from renewable sources of energy in 2010 (United Nations, Department of Economic and Social Affairs, Population Division, 2017b). This increased to 18.3 per cent in 2014. Hydropower contributes 70 per cent, wind 16 per cent, bioenergy 9 per cent and solar photovoltaics 5 per cent (IEA, 2017). Renewables are expected to contribute nearly 60 per cent of all new electricity generation by 2040 (IEA, 2016b). But only a few countries are making sufficient progress to meet the 2030 renewables target.

Hydropower will account for 33 per cent of new renewable energy generation by 2040. Hydropower in non-OECD countries is expected to increase by 71 per cent from 2012 to 2040. This is almost 40 per cent of the total renewables increase for these countries, particularly in Asia (US EIA, 2016). As hydropower grows, so too will the demand for water. This is mitigated to some extent as most of the water is only used and not consumed. Water is still available for others downstream, though matching downstream demands, often from agriculture, and mitigating ecosystem and other effects does not always fit with the demands for energy in cities and industry.

The water consumed for irrigating biofuels is a concern. It can be as much as 500,000 l/MWh, which contrasts with fossil fuel which requires only up to 1,000 l/MWh (IEA, 2016a).

Box 42 Reducing water used to produce energy

The 10 per cent of annual global water withdrawals for energy represents a large volume of water – 398 billion m^3. A small saving in energy use or an increase in efficiency can make a big difference to water accessible for people. A saving of 1 per cent (4 billion m^3) would provide enough water annually for 219 million people based on 50 litres per day as a basic access service level.

This offers the prospect that solutions to water scarcity are within reach, especially if similar reductions are made in other water-using sectors such as agriculture and industry, although it is tempered by location and many other factors.

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Abbreviations and acronyms used in chapter IV (in addition to those already used in chapters I, II and III)

NBS	nature-based solution
NTD	neglected tropical disease

V. Key messages

This synthesis report for SDG 6 (*Ensure availability and sustainable management of water and sanitation for all*) reviews the opportunities and challenges for progress towards achievement of the goal and highlights the following key messages.

The 2030 Agenda is universal and transformative for all Member States of the United Nations. It aims to end poverty in all its forms and "shift the world on to a sustainable and resilient path" (United Nations, General Assembly, 2015). Its 17 global targets are integrated and indivisible, seek to balance social, economic and environmental welfare, and address the desired outcomes and MoI. The ambitious agenda is intended to be implemented by all countries and all stakeholders, acting in collaborative partnership. SDG 6 on water and sanitation provides a tremendous opportunity to accelerate progress on the 2030 Agenda, given the water sector's central role in human rights, poverty reduction, eliminating inequalities, peace and justice, and the environment.

A. Integrating SDG 6 into the 2030 Agenda

An integrated approach to the 2030 Agenda can make implementing and monitoring SDG-related national development plans more cost-effective, will help maximise synergies and reduce the risks that actions taken to meet one goal will undermine other goals. It will also ensure appropriate timing and sequencing of policy and institutional reforms and public investments so that limited resources are used more efficiently and sustainably.

- **Achieving SDG 6 is essential for progress on all other SDGs and vice versa.** Sustainable management of water and sanitation for all underpins wider efforts to end poverty and advance sustainable development. Making progress on SDG 6 will enable and drive progress on all the other SDGs, from health to hunger and from gender equality to environmental protection and sustainable growth. This means that achieving SDG 6 depends on the overall progress of the entire 2030 Agenda. All SDGs are mutually dependent on one another; action therefore needs to be of an integrated nature, ensuring that all SDGs advance together.
- **The time to act on SDG 6 is now.** The global targets for SDG 6 will not be achieved by 2030 at current rates, taking into account the status of SDG 6 global indicators, and considering trends in financing, capacity and political commitment. The targets present challenges for all countries but continuing with business as usual will not suffice. Achieving sustainable management of water and sanitation for all will require profound evolution of actions among policymakers and decision makers. Actions need to be taken now to move towards a more sustainable and resilient path, leaving no one behind, if we are to achieve the 2030 Agenda targets.
- **Global SDG 6 targets must be localized and adapted to the country context.** The SDG 6 targets are aspirational, like all global SDG targets. Each national government must decide how to incorporate SDG 6 targets into its national planning processes, policies and strategies. It must set its own targets guided by the level of ambition at the global level, while taking into account local circumstances (United Nations Development Group, 2016). The global targets are relevant to all countries, but their relative importance is highly context specific. SDG 6 national targets should build on existing national priorities and international agreements related to water and sanitation, including international human rights standards, for the benefit of all.
- **More and better data are required for national, regional and global monitoring.** Less than half of Member States currently have comparable data available on progress made towards each of the global

SDG 6 targets. Almost 60 per cent of countries do not currently have data available for more than four global SDG 6 indicators, and only 6 per cent reported on more than eight global indicators, representing a major knowledge gap. Data sometimes exist but are often not accessible or shared. The financial, institutional/organizational and human resources to fully monitor SDG 6 are lacking. Further work is required to standardize and harmonize indicators used in national and global monitoring, as well as to increase understanding on how to assess MoI across SDG 6. Increased uptake and use of data to inform decision-making and ensure accountability will be crucial for achieving SDG 6.

B. Understanding the baseline status and trends of the global indicators of SDG6

This review of the latest SDG 6 indicator data has produced a baseline from which to measure future progress and has identified gaps in knowledge, capacity and resource availability.

- **Extending access to safe drinking water presents a huge challenge and requires increased attention on the quality of services provided.** Achieving universal access to safe and affordable drinking water requires extending access to the 844 million people who still lack even a basic water service. It also requires progressively improving the quality of services for the 2.1 billion who lack water that is accessible on premises, available when needed and free from contamination. Universal access also implies providing access in services in schools, health-care facilities and other institutional settings. This will require substantial increases in investment from governments and other sources and strengthening institutional arrangements for managing and regulating drinking water services in many countries. The health and economic benefits of doing so will far outweigh the costs. It also requires the development of increasingly sophisticated information systems to close current gaps, and to monitor coverage and quality of services.
- **Billions of people still need access to basic toilet and handwashing facilities, and treatment and disposal of excreta is an even bigger challenge.** Some 892 million people still practise open defecation, and faster progress is needed for its eradication by 2030. Over 2.3 billion people still lack basic sanitation services and 4.5 billion people lack safely managed sanitation services. Only 27 per cent of the population in LDCs has access to soap and water for handwashing on premises. Achieving universal access to sanitation and hygiene will enable progress on health, nutrition, education and gender issues, but it will require considerable investment, especially in areas of rapid urbanization. Strengthening the capacity of local and national authorities is essential for managing and regulating sanitation systems, especially in low- and middle-income countries. Further work is required to harmonize the methods and standards used to monitor the treatment and disposal of excreta from on-site sanitation systems.
- **Improving water quality can increase water availability.** Pollution of water resources is a barrier to making progress towards the 2030 Agenda targets. Water pollution has worsened since the 1990s in almost all rivers in Latin America, Africa and Asia, with severe pathogen pollution already affecting around one third of all river stretches in these regions. Increasing political will to tackle pollution at its source and treat wastewater will protect public health and the environment, mitigate the costly effects of pollution and provide additional water resources. Wastewater is an undervalued source of water, energy, nutrients and other recoverable by-products. Recycling, reuse and recovering of what is normally seen as waste can alleviate water stress. A coordinated, coherent and pragmatic policy environment is therefore required for the multiple stakeholders involved in the monitoring, collection, treatment, recycling and reuse of wastewater to engage in safe and innovative practices.
- **Agriculture offers opportunities for significant water savings.** More than 2 billion people live in countries experiencing high water stress. The agriculture sector is by far the largest user of fresh water, accounting for nearly 70 per cent of global water withdrawals. Saving just a fraction of this would

significantly alleviate water stress in other sectors, particularly in arid countries where agriculture can consume as much as 90 per cent of available water resources. It would also strengthen economic development instead of constraining growth. Agricultural water savings can come in many forms, such as increasing productivity of food crops ("more crop per drop"), improving water management practices and technologies, implementing sustainable agricultural practices, growing fewer water-intensive crops in water-scarce regions, reducing food loss and waste, and importing food grown from water-rich countries. Savings can also come from municipalities, industry and energy production.

- **Implementing IWRM is the most comprehensive step towards achieving SDG 6.** The global average degree of implementation of IWRM is 48 per cent, corresponding to a medium-low level, but with great variation among countries. Accelerated progress is needed in most regions to achieve the IWRM target. However, it must be recognized that there is no universal approach and that each country must develop its own pathway to implementation based on its own political, social, environmental and economic circumstances. Achieving an advanced level of implementation requires increased financing for water resources development and management and devolving IWRM to the lowest appropriate level. Transboundary cooperation is essential to implement IWRM at all levels, with 153 countries sharing rivers, lakes and aquifers. The average national proportion of transboundary basins covered by an operational arrangement is 59 per cent, meaning that a significant effort is needed to ensure that operational arrangements are in place for all transboundary waters by 2030. Now is the time to take advantage of the global legal frameworks on shared surface water and groundwater to develop countries' capacities to negotiate and implement transboundary cooperative arrangements.

- **Sustaining water-related ecosystems is crucial to societies and economies.** The world has lost 70 per cent of its natural wetland extent in the last century, including significant loss of freshwater species. Water is essential for the health of all ecosystems and provides vital services to economies and societies that are not properly valued when trade-offs are required in decision-making around the precious resource. The baseline data of the indicator do not allow for a proper picture of the general state or trends known about freshwater ecosystems. More detailed data (quantitative, geospatial and qualitative), and its compilation are required to demonstrate an accurate, contextualized understanding of water-related ecosystems, in particular monitoring their change over time, which will provide evidence of the benefits they deliver.

- **Improved international cooperation and more and better use of funding is needed.** Over 80 per cent of participating countries reported insufficient finance to meet national WASH targets. The current indicator based on ODA monitors external aid provided to developing countries but does not reflect all elements of the target. It may be necessary to complement the existing indicator with additional information relating to capacity development, human resources and other elements in target 6.a. Stronger domestic financial engagement and better use of existing resources will be required to achieve the goal of leaving no one behind, although ODA will continue to contribute to development needs for water and sanitation.

- **Public participation is critical to water management.** Local community participation in water and sanitation management has the potential to yield benefits such as empowerment of marginalized groups and more sustainable service delivery. However, the current indicator monitors the existence of policies and procedures for local community participation and not whether this participation is genuine and meaningful. Further research is required to understand the complexities of participation and its impact, to ensure that implemented policies are effective and sustainable.

C. Enabling and accelerating progress towards SDG 6

MoI offers a framework for enabling and accelerating progress on all aspects of SDG 6, including the challenging issues of governance and eliminating inequalities, which will be essential for achieving this goal and leaving no one behind.

- **Good water governance is essential.** Bold political choices will be needed to ensure that resources are equitably allocated and to ensure the provision of water and sanitation for all. Good governance, intersectoral coordination and policy development via engaging stakeholders in an accountable and transparent manner can then be expressed as national legislation, sector regulation and/or institutional arrangements, which identify clear roles and responsibilities for institutions. This requires implementation of IWRM as well as national strategies that focus on the water–food–energy–ecosystem nexus and seek to maximize synergies and address trade-offs between SDG 6 and other goals. An improved enabling environment for investment will create the necessary impetus for private sector investment that will boost progress on SDG 6.
- **Inequalities must be eliminated.** Inequalities exist in every country where marginalized communities and disadvantaged groups such as women, children, poor, indigenous peoples, rural communities and those living in fragile states do not have equal access to water and sanitation and are more susceptible to the impacts of pollution and water-related disasters. The 2030 Agenda will not succeed if governments fail these people. The inequalities that prevent the rights to water and sanitation of marginalized communities and disadvantaged groups from being satisfied must be addressed in accordance with the international human rights framework. Disaggregated data play a vital role in supporting these efforts, to enable policymakers to identify disadvantaged groups and to tailor support to their specific needs and priorities.
- **Water and sanitation require a new financing paradigm.** Increasing the efficiency of existing financial resources and mobilizing additional ones in the form of domestic public finance and domestic and international finance (ODA, loans, grants, etc.) are necessary. Domestic and public finance can be leveraged to increase the role of private financing, through promoting innovative financing streams such as blended finance and microfinance. Targeted public finance and reforms are necessary to improve the performance of existing services, increase cost recovery and financial security, and make the sector more attractive to private investment. This can lead to a virtuous circle of improved service levels, attracting further investment until services are financially sustainable.
- **Capacity must be developed.** A serious lack of capacity is constraining progress towards SDG 6 in many countries. Capacity development is a cross-cutting issue that is essential for improving service levels, operating and maintaining technology, and monitoring performance. Capacity development is required in engineering, scientific and technical disciplines, and also across all areas of the water sector, including in policy, law, governance, finance, information technology and management. Investment in capacity development requires a long-term view, as its benefits may not be felt immediately.
- **Smart technologies can improve management and service delivery.** Applying existing methods and tools will help in achieving the SDG 6 targets. However, smart technologies supported by information technology can effectively improve all aspects of water and sanitation management. Use of the latest Earth observations, citizen science and private sector data is increasing, but these are not yet sufficiently incorporated into data monitoring systems at all levels. Furthermore, local adaptation of technology and sharing of knowledge can be supported through collaborative partnerships for sustainable development.

- **Multi-stakeholder partnerships can unlock potential.** Sharing, accessing and adapting solutions takes cooperation. Multi-stakeholder partnerships, at the national, regional and global levels, can bring actors together from the public and private sectors, civil society and academia to align work, optimize resources and unlock the potential of collaboration through ownership and interdependence. SDG 6 provides the ideal platform for multi-stakeholder partnerships due to its interconnectivity with the other goals of the 2030 Agenda, thus ensuring progress on poverty reduction and sustainable development.

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