Food and Agriculture Organization of the United Nations

Progress on level of water stress

GLOBAL STATUS AND ACCELERATION NEEDS FOR SDG INDICATOR 6.4.2

2021

United Nations | UN WATER

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2021

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Cover photograph: Afghanistan by John Winnie Jr.

MAPS:

Final boundary between the Sudan and South Sudan has not yet been determined.
Final status of the Abyei area is not yet determined.
Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties.

Presenting the UN-Water Integrated Monitoring Initiative for SDG 6

Through the UN-Water Integrated Monitoring Initiative for SDG 6 (IMI-SDG6), the United Nations seeks to support countries in monitoring water- and sanitation-related issues within the framework of the 2030 Agenda for Sustainable Development, and in compiling country data to report on global progress towards SDG 6.

IMI-SDG6 brings together the United Nations organizations that are formally mandated to compile country data on the SDG 6 global indicators, and builds on ongoing efforts such as the World Health Organization (WHO)/United Nations Children's Fund (UNICEF) Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (JMP), the Global Environment Monitoring System for Freshwater (GEMS/Water), the Food and Agriculture Organization of the United Nations (FAO) Global Information System on Water and Agriculture (AQUASTAT) and the UN-Water Global Analysis and Assessment of Sanitation and Drinking-Water (GLAAS).

This joint effort enables synergies to be created across United Nations organizations and methodologies and requests for data to be harmonized, leading to more efficient outreach and a reduced reporting burden. At the national level, IMI-SDG6 also promotes intersectoral collaboration and consolidation of existing capacities and data across organizations.

The overarching goal of IMI-SDG6 is to accelerate the achievement of SDG 6 by increasing the availability of high-quality data for evidence-based policymaking, regulations, planning and investments at all levels. More specifically, IMI-SDG6 aims to support countries to collect, analyse and report SDG 6 data, and to support policymakers and decision makers at all levels to use these data.

> Learn more about SDG 6 monitoring and reporting and the support available: www.sdg6monitoring.org

> Read the latest SDG 6 progress reports, for the whole goal and by indicator: https://www.unwater.org/publication_categories/sdg6-progress-reports/

> Explore the latest SDG 6 data at the global, regional and national levels: www.sdg6data.org

INDICATORS	CUSTODIANS
6.1.1 Proportion of population using safely managed drinking water services	WHO, UNICEF
6.2.1 Proportion of population using (a) safely managed sanitation services and (b) a hand-washing facility with soap and water	WHO, UNICEF
6.3.1 Proportion of domestic and industrial wastewater flows safely treated	WHO, UN-Habitat, UNSD
6.3.2 Proportion of bodies of water with good ambient water quality	UNEP
6.4.1 Change in water-use efficiency over time	FAO
6.4.2 Level of water stress: freshwater withdrawal as a proportion of available freshwater resources	FAO
6.5.1 Degree of integrated water resources management	UNEP
6.5.2 Proportion of transboundary basin area with an operational arrangement for water cooperation	UNECE, UNESCO
6.6.1 Change in the extent of water-related ecosystems over time	UNEP, Ramsar
6.a.1 Amount of water- and sanitation-related official development assistance that is part of a government-coordinated spending plan	WHO, OECD
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, OECD

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Foreword

One of the key premises of the 2030 Agenda for Sustainable Development is "leaving no one behind". To achieve this, the interlinkages between all the 17 Sustainable Development Goals must be articulated well and appropriate actions undertaken for the benefit of all.

The Food and Agriculture Organization of the United Nations (FAO) is supporting the 2030 Agenda through the transformation to MORE efficient, inclusive, resilient and sustainable agri-food systems for better production, better nutrition, a better environment, and a better life - leaving no one behind. The transformation of agri-food systems is at the heart of FAO's mandate and at the core of FAO's Strategic Framework 2022-2031.

Water is the essence of life and central to agri-food systems. This report addresses the importance of reducing water stress, which is a measure of the pressure that human activities exert on natural freshwater resources, and provides an indication of the environmental sustainability of the use of water resources. The path to reduce water stress passes through sustainable agri-food systems.

An important novelty of this report is the presentation of the disaggregation of the indicator by major basins, providing better insights on the sustainability of agricultural systems that may be at risk due to human pressure on land and water.

Alternative water sources such as wastewater, storm run-off and desalination, as well as measures such as water harvesting, can help relieve water stress. Safe wastewater reuse and recycling is a significantly untapped resource for industry and agriculture, but its use must overcome political and cultural barriers.

FAO joined the Integrated Monitoring Initiative for SDG6 ("Clean Water and Sanitation") in 2015, coordinated by UN-Water, which has gathered experiences and resources aimed at ensuring a coherent monitoring framework for water and sanitation by 2030. Such a framework will help countries achieve progress through well-informed decision-making on water, based on harmonized, comprehensive, timely and accurate information.

FAO, predominantly through its AQUASTAT database, remains committed to improving the quality and quantity of data produced and analysed, in close partnership with the relevant national authorities of our Members.

In coordination and collaboration with other stakeholders, FAO will continue supporting Members to achieve this target by providing scientific and technical assistance.

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Qu Dongyu

FAO Director-General

Foreword

The COVID-19 crisis has caused enormous disruption to sustainable development. However, even before the pandemic, the world was seriously off track to meet Sustainable Development Goal 6 (SDG 6) – to ensure water and sanitation for all by 2030.

No matter how significant the challenges we face, achieving SDG 6 is critical to the overarching aim of the 2030 Agenda, which is to eradicate extreme poverty and create a better and more sustainable world. Making sure that there is water and sanitation for all people, for all purposes, by 2030 will help protect global society against many and varied looming threats.

Our immediate, shared task is to establish safe water and sanitation services in all homes, schools, workplaces and health care facilities. We must increase investment in water use efficiency, wastewater treatment and reuse, while protecting water-related ecosystems. And we must integrate our approaches, with improved governance and coordination across sectors and geographical borders.

In short, we need to do much more, and do it much more quickly. In the SDG 6 Summary Progress Update 2021 that preceded this series of reports, UN-Water showed that the current rate of progress needs to double - and in some cases quadruple - to reach many of the targets under SDG 6.

At the March 2021 high-level meeting on the "Implementation of the Water-related Goals and Targets of the 2030 Agenda", UN Member States noted that to achieve SDG 6 by 2030 will require mobilizing an additional USD 1.7 trillion, three times more than the current level of investment in water-related infrastructure. To make this happen, Member States are calling for new partnerships between governments and a diverse group of stakeholders, including the private sector and philanthropic organizations, as well as the wide dissemination of innovative technology and methods.

We know where we need to go, and data will help light the way. As we ramp up our efforts and target them at areas of greatest need, information and evidence will be of critical importance.

Published by the UN-Water Integrated Monitoring Initiative for SDG 6 (IMI-SDG6), this series of indicator reports is based on the latest available country data, compiled and verified by the custodian United Nations agencies, and sometimes complemented by data from other sources.

The data were collected in 2020, a year in which the pandemic forced country focal points and UN agencies to collaborate in new ways. Together we learned valuable lessons on how to build monitoring capacity and how to involve more people, in more countries, in these activities.

The output of IMI-SDG6 makes an important contribution to improving data and information, one of the five accelerators in the SDG 6 Global Acceleration Framework launched last year.

With these reports, our intention is to provide decision-makers with reliable and up-to-date evidence on where acceleration is most needed, so as to ensure the greatest possible gains. This evidence is also vital to ensure accountability and build public, political and private sector support for investment.

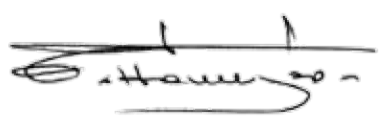
Thank you for reading this document and for joining this critical effort. Everyone has a role to play. When governments, civil society, business, academia and development aid agencies pull together dramatic gains are possible in water and sanitation. To deliver them, it will be essential to scale up this cooperation across countries and regions.

The COVID-19 pandemic reminds us of our shared vulnerability and common destiny. Let us "build back better" by ensuring water and sanitation for all by 2030.

©UN-Water

Gilbert F. Houngbo

UN-Water Chair and President of the International Fund for Agricultural Development



Acknowledgements

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This report was produced as part of a series of reports on SDG indicators 6.3.1, 6.3.2, 6.4.1, 6.4.2, 6.5.1, 6.5.2 and 6.6.1, coordinated by UN-Water through the Integrated Monitoring Initiative for SDG 6.

List of acronyms and abbreviations

ANA	Agência Nacional de Águas e Saneamento Básico (National Water and Basic Sanitation Agency of Brazil)
EFR	Environmental flow requirements
ERWR	External renewable water resources
EVI	Economic Vulnerability Index
FAO	Food and Agriculture Organization of the United Nations
GEFIS	Global Environmental Flow Information System
GHSL	Global Human Settlement Layer
GNI	Gross national income
GVA	Gross value added
GW	Groundwater
HAI	Human Assets Index
IMI	Integrated Monitoring Initiative
IRWR	Internal renewable water resources
IUCN	International Union for Conservation of Nature

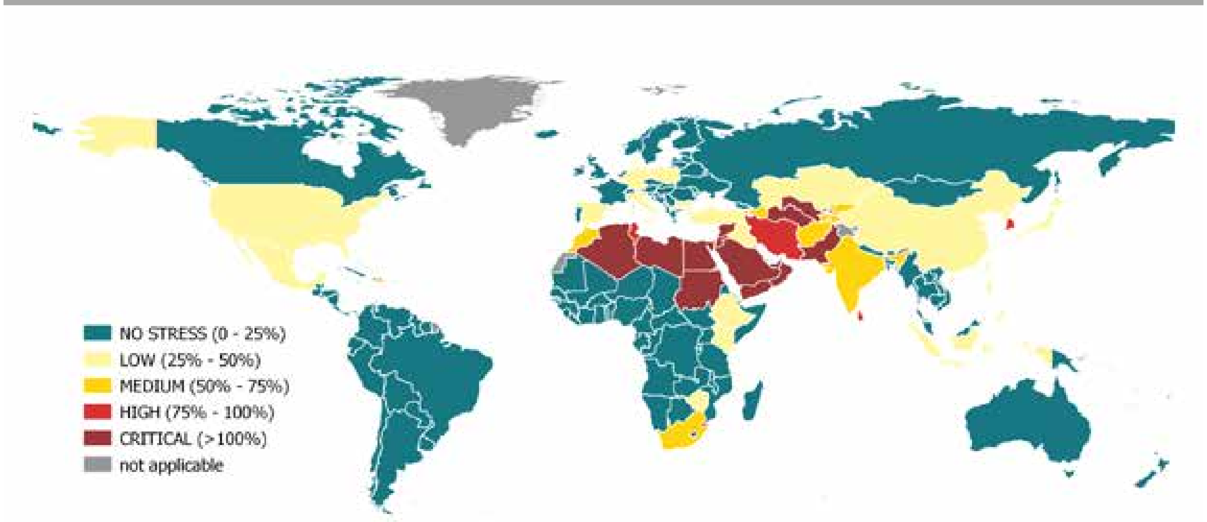
IWMI	International Water Management Institute
IWRM	Integrated water resources management
JMP	Joint Monitoring Programme
LDC	Least Developed Countries
LEAP	Livestock Environmental Assessment and Performance
LLDC	Landlocked Least Developed Countries
MDG	Millennium Development Goal
MIMEC	Mining and quarrying, manufacturing, constructions and energy
NBS	Nature Based Solutions
SDG	Sustainable Development Goal
SIDS	Small Island Developing States
SWOT	Strengths, weaknesses, opportunities and threats
TFWW	Total freshwater withdrawal
TRWR	Total renewable freshwater resources
UNECE	United Nations Economic Commission for Europe
V_A	Volume of freshwater withdrawal by the agricultural sector
V_M	Volume of freshwater withdrawal by the industrial sector
V_S	Volume of freshwater withdrawal by the service sector

Executive summary

This report presents an update of the latest consolidated data in the monitoring process of indicator 6.4.2, which provides an estimate of the pressure exerted by all economic sectors on a country's renewable freshwater resources. It also considers environmental flow requirements since these are essential to maintaining ecosystem health and resilience.

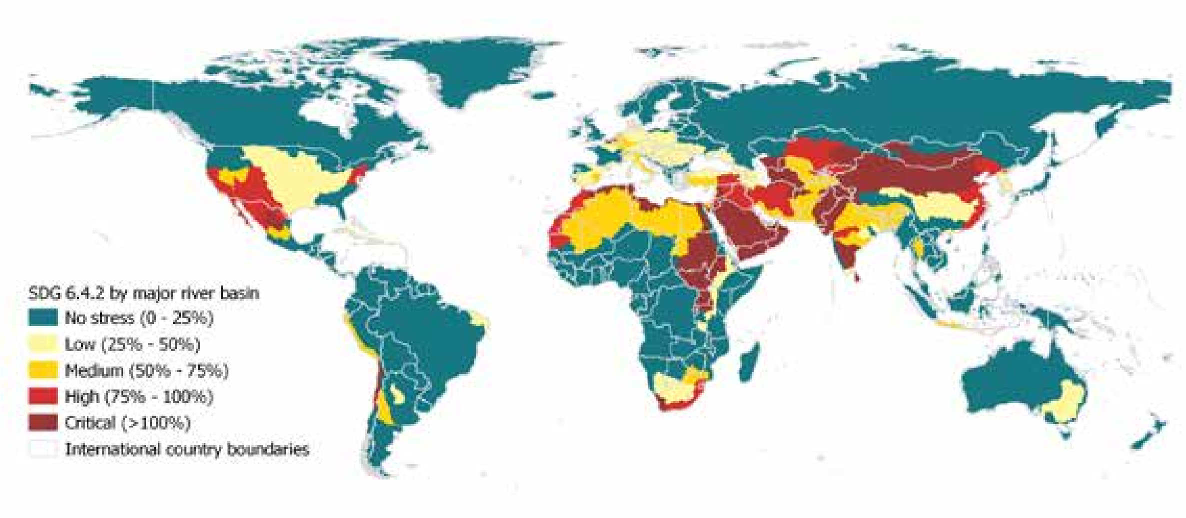
At the **global level**, 18.4 percent of the total renewable freshwater resources available were being withdrawn in 2018. Although this figure may seem safe, it hides **large regional, national and subnational variations**, as can be observed in Figure 0.1. In 2018, three out of seven Sustainable Development Goal (SDG) regions had water stress values above 25 percent, including two subregions with high water stress (Central and Southern Asia) and one with critical water stress (Northern Africa). Western Asia has medium water stress and Eastern Asia low water stress. The rest of the regions and subregions, representing approximately 31 percent of the global population, remained at the "no stress" level, but when analysed at country- or major-basin level, important differences arise in water stress levels.

Figure 0.1. Global map of the level of water stress by country (2018)



Source: FAO IMI-SDG6 adapted from FAO (2021a); UNmap. 2018.

Figure 0.2. Global map of the level of water stress by major basin, with country boundaries (2018)



Source: FAO IMI-SDG6 adapted from FAO (2021a); UNmap. 2018.

This report showcases the efforts made by FAO to disaggregate the indicator into different levels and dimensions such as major basins. The result of the **major basin disaggregation** (Figure 0.2) is very much in-line with that of the map of water stress at country level (Figure 0.1). However, the disaggregation by river basin shows that the basins affected by severe water stress are located not only in Northern Africa and the Near East, but also in Northern America, in Central and Southern Asia, and on the west coast of Latin America, which is not so evident from the map of the indicator at country level. Indeed, countries that may appear safe can include much more stressed basins, in whole or in part, such as Chile and Peru, but also China, Mexico and the United States of America. As many of these basins are shared between two or more countries, this also shows the need for transboundary cooperation on water resources management, as assessed by SDG indicator 6.5.2.

This indicator shows the extent to which water resources are already used and demonstrates the importance of effective supply- and demand-management policies. It indicates the likelihood of increasing competition and conflict between different water uses and users in a situation of increasing water scarcity. On average, **10 percent of the global population lives in countries with high or critical water stress**, which has a significant impact on water access and availability for personal needs. Water is crucial to combat diseases such as the recently discovered COVID-19, and when it is under stress, it significantly affects economic activities, agricultural production, and subsequently, food security. Farmers may experience increasing inequalities in their access to water resources in a water stress situation. Therefore not only sustainable but also inclusive and integrated management and governance of the different water sources needs to be promoted.

Key messages and recommendations

- The two indicators included in the monitoring process of target 6.4 are complementary. Indicator 6.4.1 is an economic indicator, assessing the extent to which a country's economic growth is dependent on the use of water resources while indicator 6.4.2 is an environmental indicator, tracking the physical availability of freshwater resources and the impact of water use.

- At the global level, 18.4 percent of total renewable freshwater resources available are being withdrawn by different economic activities. However, this safe value at the global level hides the higher values and the variability that exist at the regional, national and subnational levels.

- Aggregated values of water stress at global, regional and country level can mask wide differences within the area considered. Disaggregating the indicator is of paramount importance to provide a finer view of both the causes and effects of water stress, supporting the policy choices of the relevant authorities.

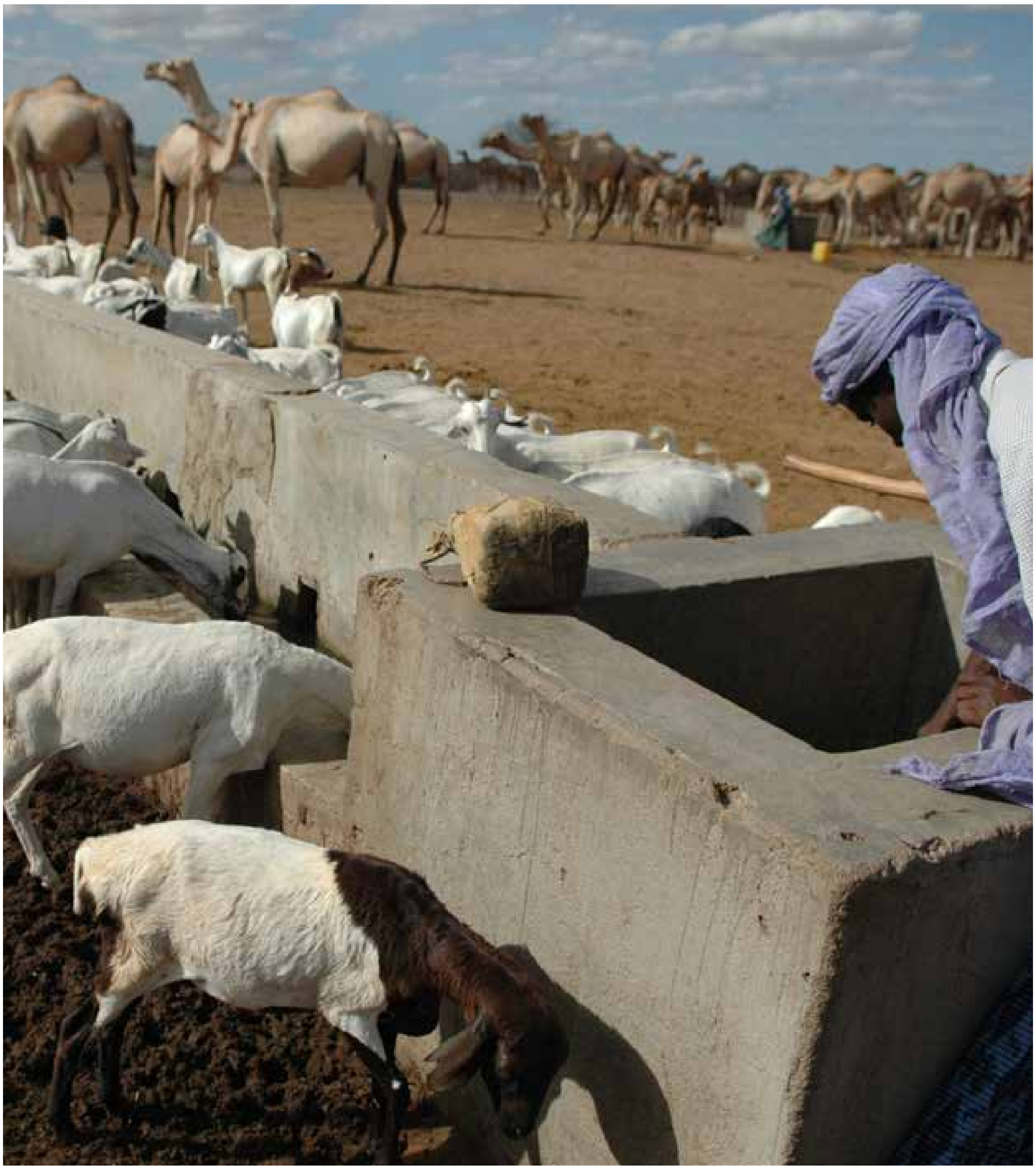
- River basins should be considered the main units for the spatial disaggregation of the indicator. Disaggregating the indicator at river basin level provides a clearer view of the relation between water withdrawal and the availability of water resources. Disaggregating by water source (surface/groundwater) is also crucial to determine where the stress is located and consequently to implement different mitigation strategies.

- Water stress has multiple causes, ranging from climate to demography to land use. Integrated water resources management (IWRM), assessed by SDG 6.5.1, can support controlling and reducing water stress. This can include measures such as reduced losses from water distribution systems, wastewater reuse (SDG target 6.3), desalination and appropriate water allocation.

- Agriculture continues to be the most demanding sector in terms of freshwater withdrawals in most of the basins. It is the dominant withdrawing sector in most of the highly and critically water-stressed major basins, with some exceptions in basins with big or densely populated cities.

- In addition to efficient water distribution systems and sustainable agriculture, reuse of wastewater is a key strategy in reducing water stress, together with water-saving technologies, green and hybrid technologies, and awareness campaigns to reduce the use of water in households and encourage sustainable diets and consumption.

- Poor reporting is hindering the global value of the indicator. More efforts and resources should be dedicated to increasing the countries' capacity to collect, manage and report water data. The opportunities presented by including water supply, demand and allocation in Earth system models, as well as the use of remote sensing techniques that can improve knowledge on precipitation patterns, soil moisture and groundwater changes, should be explored further and promoted for and by countries to improve monitoring capacity.



Livestock drinking from a waterpoint in the Garissa area, Kenya by Thomas Hug ©FAO

On the other hand, extremely low water stress values may indicate the inability of a country to properly use its water resources for the benefit of the population. In such cases, a moderate and controlled increase in the value of the indicator can be a sign of positive development.

Data collection for this indicator is carried out through AQUASTAT, FAO's global information system on water resources and agricultural water management, after countries have filled in and submitted a questionnaire with national data on water use (annex II. questionnaire template). Ideally, countries should submit data on an annual basis, but FAO will accept them updating the water-use information every three years. The **process of data collection and analysis remains a major challenge** since not all countries report on all the variables necessary to calculate the indicator, and some countries are not reporting with the required frequency for an insightful or accurate monitoring.

Nevertheless, for this reporting process, data from 180 countries were available for a period from 2006/2008 until 2018. Data previous to 2015 were easily obtained from the AQUASTAT database since similar variables were already used for the Millennium Development Goal (MDG) monitoring process. The environmental flow requirements (EFR) values have been obtained based on the Global Environmental Flows Information System (GEFIS), elaborated by the International Water Management Institute (IWMI).


South East Asia farmers' field school by K. Pratt ©FAO

1. Reporting water stress under the 2030 Agenda

In September 2015, Heads of State from all around the world adopted the 2030 Agenda for Sustainable Development, consisting of 17 Sustainable Develop¬ment Goals (SDGs) with 169 targets. All SDGs are interlinked, since transitioning towards more sustainable and resilient societies requires an integrated approach. The 2030 Agen¬da includes a goal on water and sanitation (SDG 6) that sets out to **"ensure availability and sustainable management of water and sanitation for all"** (United Nations General Assembly [UNGA], 2015). As a goal concerning the lifeblood of society and the planet, progress towards the eight SDG 6 targets (Box 1) has catalytic effects across the entire 2030 Agenda. Indicator 6.4.2, together with indicator 6.4.1, measures the achievement of target 6.4.

Safe drinking water and sanitation are human rights. Access to these services, including water and soap for handwashing, is fundamental to human health and well-being. SDG 6, however, goes far beyond water and sanitation services to cover the entire water cycle. Apart from domestic purposes, water is needed across all sectors of society, to produce food, energy, goods and services, and to maintain healthy ecosystems that in turn protect life on Earth, and as such it is framed in the goal targets (Box 1).

Within the SDG monitoring framework, data collection and reporting are based on country data and national representatives are included in this process to ensure progress is made and accountability is strengthened.

Lower Kagera River Basin, Burundi by Giulio Napolitano ©FAO

Box 1. SDG 6 – Ensure availability and sustainable management of water and sanitation for all

Targets

6.1: By 2030, achieve universal and equitable access to safe and affordable drinking water for all.

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.

6.3: 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.

6.4: By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of fresh water to address water scarcity and substantially reduce the number of people suffering from water scarcity.

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

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

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.b: Support and strengthen the participation of local communities in improving water and sanitation management.

As the total amount of water on Earth is fixed and cannot be changed, all the water-related SDG targets are interlinked. Nonetheless, it is clear that there are closer and more direct connections between some of these targets than there are among others. Targets 6.3–6.6 are particularly strongly linked, since they all deal with the quantity and quality of the water that we use for all human activity, water management, and water's status in nature.

It is important to note that when discussing the interlinkages among these targets, these linkages are said to exhibit a "circular pattern", in which all efforts to achieve one target may have either a positive or negative impact on any of the other targets. A similar perspective can be taken in the consideration of the indicators of those targets. To this end, these indicators could be divided into two groups:

- Informative indicators: 6.4.1; 6.4.2; 6.6.1
- Operational indicators: 6.3.2; 6.5.1; 6.5.2.

1.1. What is water stress and why is it important?

The objective of this report is to document the latest results available in the monitoring process for indicator 6.4.2, and to provide recommendations to accelerate the achievement of sustainable withdrawals and supply of fresh water so fewer people suffer water scarcity and ecosystems remain healthy. This indicator measures the level of water stress by providing an estimate of the pressure exerted by all economic sectors on the country's renewable freshwater resources. It also considers environmental flow requirements (EFR) since these are essential to maintaining ecosystem health and resilience.

The Millennium Development Goals (MDGs) framework already had a water stress indicator related to target 7.A, defined as "proportion of total water resources used". Although the MDGs were only defined in 1999, these variables were monitored by the Food and Agriculture Organization of the United Nations (FAO) through its global information system on water resources, AQUASTAT, since 1994. The definition of SDG indicator 6.4.2 is relatively similar to that of the MDG indicator with the exception that it explicitly takes EFR into consideration.

The indicator shows the extent to which natural freshwater resources are already used and demonstrates the importance of effective supply- and demand-management policies. It indicates the likelihood of increasing competition and conflict between different water uses and users in a situation of increasing water scarcity. High water stress, determined by a high value of the indicator, has potentially negative effects on the sustainability of the natural resources and of economic development. On the other hand, low values of the indicator indicate that water does not represent a particular challenge for economic development and sustainability. However, extremely low values may indicate the inability of a country to properly use its water resources for the benefit of the population. In such cases, a moderate and controlled increase in the value of the indicator can be a sign of positive development.

1.2. Setting the scene – lessons learned for the new reporting period and capacity-building initiatives

In 2018, FAO released the first report on the 6.4.2 monitoring progress (FAO, 2018). This report focused on the methodology testing process for indicator 6.4.2, including EFR for the first time, in five pilot countries (Jordan, The Netherlands, Peru, Senegal and Uganda) and presented the global baseline (2015–2018) for this indicator. The pilot exercise was an opportunity to further improve data collection and estimations in each of the countries and to improve the way water resources are managed.

Some of the main lessons learned from that report were as follows:

- Monitoring a given indicator at the country level calls for the involvement of various stakeholders and institutions. Countries should appoint a lead institution to coordinate these stakeholders.
- There is a need for a framework for data collection on global indicators to provide guidance to Member States and custodian agencies alike.
- There are several issues during the data-collection process that should be resolved: data inconsistency among various sources; lack of EFR data; poor-quality monitoring by country institutions; outdated data or reference years not specified; weak reporting to the AQUASTAT database; double counting of data.
- Interpretation of indicator 6.4.2 could be further enhanced by conducting a deeper analysis at the basin and regional levels.

Taking note of these concerns, and after analysing a few case studies on the data-collection process for some indicators, the Inter-Agency and Expert Group on Sustainable Development Goal Indicators (IAEG-SDGs) elaborated on its Best Practices and Recommendations in Global Data Reporting.[1]

These principles, criteria and guidelines were prepared in collaboration with the custodian agencies and were intended to provide guidance to all parties on their roles and responsibilities to ensure that data reporting for the 2030 Agenda is as seamless as possible, acknowledging that data requirements of the SDGs present unprecedented challenges for both National Statistical Systems and custodian agencies.

After the 2015–2018 phase, two main steps were undertaken in the data-collection process:

1) All Member States received a precompiled data-collection sheet, which had to be revised or updated with new data and returned.

2) A network of national correspondents was established to ensure that countries produce and submit regular and consistent data to AQUASTAT.

1 See https://unstats.un.org/sdgs/iaeg-sdgs/data-flows/.

Box 2. Capacity-building resources available for country representatives to get acquainted with the indicator 6.4.2 monitoring and reporting process

- SDG 6.4.2 web page: A public website that contains all the background information, training materials and updates on the monitoring and reporting process.
- SDG 6.4.2 metadata: A document providing definitions and methodological and data-collection considerations.
- Step-by-step monitoring methodology for SDG 6.4.2: A document containing a detailed description of all the information and steps needed to collect the data and compute the indicator.
- SDG 6.4.2 e-learning course: An online course providing tools, methods and processes to support countries in monitoring and reporting on the indicator. It also explores interlinkages with other SDG targets. Available in English, French, Spanish and Russian.
- **Regional on-site and online training courses on sustainable water use – SDG 6.4 indicators:** During 2020 and 2021, FAO organized four virtual trainings for Asia, Latin America and the Caribbean, and Africa on SDG 6.4, and before COVID-19 emerged, between 2017 and 2019, another six regional workshops were organized.

Note: For the e-learning course, see https://elearning.fao.org/course/view.php?id=365 (English);

https://elearning.fao.org/course/view.php?id=519 (French);

https://elearning.fao.org/course/view.php?id=588 (Russian) and

https://elearning.fao.org/course/view.php?id=518 (Spanish).

The Integrated Monitoring Initiative for SDG 6,[2] coordinated by UN-Water and including FAO along with other United Nations agencies, has the current objective of supporting countries to increase their technical and institutional capacity for the monitoring of the indicators related to SDG 6 targets, together with data collection and reporting. In its endeavour to build national ownership, FAO has developed differentresources and facilitated several workshops on the data-collection methodologies for indicators 6.4.1 and 6.4.2 (Box 2).

2 UN-Water Integrated Monitoring Initiative for SDG 6 (IMI-SDG6) brings together the United Nations organizations that are formally mandated to compile country data on the SDG 6 global indicators, and builds on ongoing efforts such as the World Health Organization/United Nations Children's Fund (WHO/UNICEF) Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (JMP), the Global Environment Monitoring System for Freshwater (GEMS/Water), FAO's global information system on water and agriculture (AQUASTAT) and the UN-Water Global Analysis and Assessment of Sanitation and Drinking-Water (GLAAS). See https://www.sdg6monitoring.org/.

Tigray, Ethiopia by Petterik Wiggers ©FAOIFADWFP

2. How to monitor water stress

2.1. Globally available data – from country-led collection to the AQUASTAT database

Data for this indicator are usually collected by national ministries and institutions that have water-related issues as part of their mandate, such as national statistical offices and ministries of water resources, agriculture or environment. The data collected is then shared with AQUASTAT, FAO's global information system on water and agriculture. AQUASTAT's data-collection method has evolved since 2018 to align with the principles of data-gathering promoted through the SDGs, to follow country-led (and the countries' own) processes.

In this regard, AQUASTAT has established a network of national correspondents to improve country participation and the ownership of data. Every year, AQUASTAT sends a questionnaire (see annex II. questionnaire template) to a network of national correspondents which includes the variables needed for the calculation of SDG 6.4.2. National correspondents have the key role of ensuring data quality and the coordination of data collection at country level. Having national coordination in place will assure the timely and consistent collection of the data on a regular basis. Once countries submit the data, there is a validation process by AQUASTAT to ensure the quality and consistency of these data. This process includes a constant dialogue with national correspondents (Box 3).

Sanaa, Yemen by Soliman Ahmed ©FAO

Box 3. Steps in the AQUASTAT data-validation process

1. The AQUASTAT questionnaire embeds automatic validation rules to allow national correspondents to identify any data consistency errors while compiling the data.

2. FAO thoroughly reviews the information reported in the questionnaire responses using the following tools:

    c. a manual cross-variable check, which includes cross-comparison with similar countries, as well as historic data for the countries

    d. time-series coherence by running an R-script to compare reported data with those corresponding to previous years

    e. verification of the metadata, particularly the source of the proposed data – the critical analysis of the compiled data gives preference to national sources and expert knowledge.

6. Exchanges between the national corre spondents and FAO take place to corect and confirm the collected data.

7. An automated validation routine is carried out, included in the Statistical Working System, which uses almost 200 validation rules.

Source: FAO (2021b).

As previously mentioned, the total freshwater withdrawals (TFWW) and total renewable freshwater resources (TRWR) variables have been monitored by AQUASTAT since 1994. Data from years earlier than 2015 were therefore easily obtained from the AQUASTAT database since similar variables were already used for the MDG monitoring process. To compute EFR values, FAO makes use of the guidelines based on the Global Environmental Flow Information System (GEFIS),[3] providing a minimum standard method (FAO, 2019). Countries that have more comprehensive and accurate EFR data make use of those data and can also add additional details to their voluntary national report. Countries compile their different variables' values in the questionnaire, which is then sent back to FAO so that it can calculate the regional and global aggregates.

2.1.1. Treatment of missing values at country and regional level

There are three types of imputations that are made at country level to fill in missing years in the time series:

- **Linear imputation:** Between two available data points.
- **Carry forward:** After the last available data points and up to 10 years.
- **Vertical imputation:** Where TFWW is available but without disaggregation by sources. If disaggregated data existed for previous years, the respective ratio by sources is applied to the available total.

3 See http://eflows.iwmi.org.

Thanks to the imputation methods at country level, data are available at regional and global levels for the whole time series (unless the latest official value was obtained more than 10 years ago). Imputed data is displayed with an appropriate qualifier in AQUASTAT.

2.1.2. Regional aggregations

Regional and global estimates are made by adding up the national figures on TFWW and TRWR, considering only the internal renewable water resources of each country to avoid double counting, and the external renewable freshwater resources of the region as a whole, if any. Where there is a case of regional aggregation without physical continuity (such as income groupings or Least Developed Country groups), TRWR are summed up. The EFR at regional level is estimated as the average of the countries' EFRs, in a percentage, and applied to the regional water resources.

2.2. Calculation methodology

Indicator 6.4.2 has been defined as the ratio between total fresh water withdrawn (TFWW) by all major sectors and total renewable freshwater resources (TRWR), after considering the environmental flow requirements (EFR). It is calculated using the following formula:

$$\text{Water stress (\%)} = \frac{\text{TFWW}}{\text{TRWR-EFR}} * 100$$

The indicator is computed as the TFWW divided by the difference between the TRWR and the EFR, multiplied by 100. All variables are expressed in km^3/year (109 m^3/year).

- TRWR are expressed as the sum of (a) internal renewable water resources (IRWR) and (b) external renewable water resources (ERWR). The term "water resources" is understood here as freshwater resources.
    a. "IRWR" refers to the long-term average annual flow of rivers and recharge of groundwater for a given country generated from endogenous precipitation.
    b. "ERWR" refer to the flows of water entering the country, taking into consideration the quantity of flows reserved to upstream and downstream countries through agreements or treaties.
- "TFWW" refers to the volume of fresh water extracted from its source (rivers, lakes, aquifers) for agriculture, industries and services. It is estimated at the country level for the agriculture, services (including domestic water withdrawals) and industries (including cooling of thermoelectric plants) sectors, as these are the main sectors.

"Freshwater withdrawal" includes fossil groundwater. It does not include direct use of non-conventional water, i.e. direct use of treated wastewater, or direct use of agricultural drainage water and use of desalinated water. TFWW is generally the sum of total water withdrawal by sector minus the direct use of wastewater, direct use of agricultural drainage water and use of desalinated water.

- "EFR" refers to the quantity and timing of freshwater flows and levels necessary to sustain aquatic ecosystems which, in turn, support human cultures, economies, sustainable livelihoods and well-being. Water quality and the resulting ecosystem services are excluded from this formulation which is confined to water volumes. This does not imply that water quality and the support to societies which are dependent on environmental flows are not important and should not be taken care of. They are indeed taken into account by other targets and indicators, such as 6.3.2, 6.5.1 and 6.6.1. Methods of computation of EFR are extremely variable and range from global estimates to comprehensive assessments for river reaches. For the purpose of the SDG indicator, water volumes can be expressed in the same units as the TFWW, and then as percentages of the available water resources.

FAO is required to periodically collect global data on SDG 6.4.2 and to report this to the IAEG-SDGs. To do this, FAO makes use of global data sets on renewable water resources, water withdrawals and EFR. This data is summarized per country and for major river basins and sent by FAO to each country. Countries contribute to this global report by endorsing the global data for that country. Each country receives the EFR data from FAO and has the opportunity to comment on its accuracy using a template provided by FAO. Where a country proposes corrections to the data set, these should be based on data that are at a greater level of confidence than those that were used for the global data set. Since the advent of the EFR concept, many methods have been developed for its estimation. For SDG reporting, at the global reporting level, desktop approaches using global data sets are most appropriate, although the option remains for individual countries to undertake assessments at a higher level of confidence and report these. Within this framework, FAO published guidelines that provide a minimum standard method, principally based on the GEFIS.[4] This is the approach used to generate the country environmental flow data for this 6.4.2 report.[5]

2.3. Threshold levels

Identifying a common threshold level of water stress, generally valid across the world, is a difficult and potentially futile exercise. In fact, both logic and experience show that arid countries tend to have higher levels of water stress. At the same time, countries with low levels of water stress but with low levels of water distribution may need to increase the use of their freshwater resources in a sustainable manner that would imply an increase in their water stress value. These considerations brought to light the apparent need to identify a convergent path to a water stress threshold in a way in which countries with high water stress would be encouraged to decrease their level, while low-stress countries would increase it. The ideal convergence level was set at about 20–25 percent. However, ultimately, the convergence approach was discarded, as it was cumbersome, difficult to read and unsuitable for many countries.

Following the experience of the initial five years of application of the indicator, a more conventional approach was taken to categorize the water stress levels, consistent with the solution adopted during the MDG programme. A threshold of 25 percent has been identified as the upper limit for the full and unconditional safety of water stress as assessed by indicator 6.4.2. This means that on the one hand, values below 25 percent can be considered safe in any instance (no stress), whereas on the other, values above 25 percent should be regarded as potentially and increasingly problematic and should be qualified and/or reduced. Water-stress values above 25 percent are categorized into four different levels of stress severity:

4 See http://eflows.iwmi.org.
5 To consult the guidelines, see http://www.fao.org/3/CA3097EN/ca3097en.pdf.

NO STRESS <25%
LOW 25–50%
MEDIUM 50–75%
HIGH 75–100%
CRITICAL >100%

This solution avoids the substantial risk of penalizing water-scarce countries that are working to improve water access for their citizens, reducing the conflict between achieving this indicator and those indicators aimed at monitoring water accessibility and availability, such as SDG 6.1.1 and 6.2.1. At the same time, the identification of a scale of severity of the higher values helps to recognize the efforts made by arid and semi-arid countries to reduce their water stress. On the other hand, for arid countries with lower amounts of available water resources, it will be easier to shift the level of water stress with small changes in their water withdrawals.

2.4. Disaggregation – sector, country and basin level

Disaggregating the indicator has required major efforts since the publication of the previous progress report in 2018. In fact, the global indicator, based on country-level water volumes, offers little information to decision makers at the subnational level, as it is necessary to characterize the water stress level at a lower geographical unit or within a specific economic sector.

From this viewpoint, sectoral data are needed to show the respective contribution of different sectors to the country's water stress, and therefore the relative importance of actions needed to contain water demand in the different sectors (agriculture, services and industry).

Moreover, the computation of the indicator at national level implies the aggregation of the water resource variables at the country level with no consideration of the actual hydrography. This is done in spite of the fact that at the national level, water resources and withdrawals are usually estimated or measured at the level of appropriate hydrological units (river basins or aquifers), and it should therefore be possible to obtain a geographical distribution of water stress by hydrological unit, thus allowing for a more targeted response in terms of water demand management.

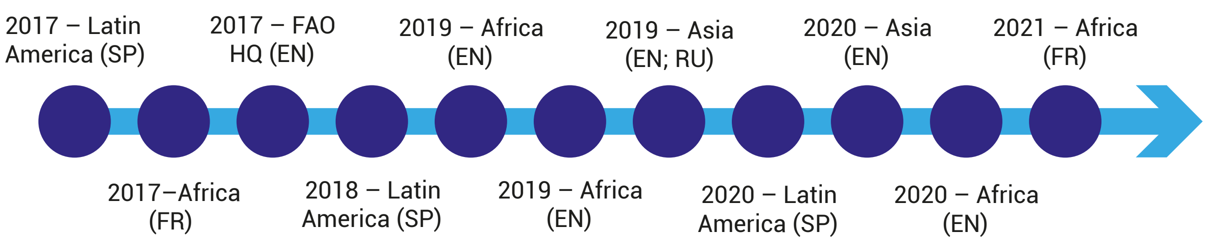
As a first step, in order to obtain the water stress values at the basin level, a pixel-based disaggregation has been applied on country-level data on water withdrawals, water resources and environmental flows, ready to be re-aggregated following the hydrography of the major river basins of the world. This has been carried out starting from the official data from the year 2018 available in AQUASTAT for the withdrawals of the three main economic sectors, estimating the TRWR using the GlobWat model (Hoogeveen et al., 2015), while the EFR have been estimated according to the International Water Management Institute's GEFIS database. The calculation of SDG indicator 6.4.2 by basin was then carried out using the FAO global map of hydrological basins, derived from HydroSHEDS and freely accessible in GeoNetwork, FAO's geospatial catalogue.[6] A more detailed description of the methodology used to disaggregate the results of indicator 6.4.2 by basin is shown in annex III. used to disaggregate the SDG 6.4.2 by major river basin, and a publication about this work will soon become available (Biancalani and Marinelli, forthcoming).

6 See http://www.fao.org/geonetwork.

2.5. Case study – how are countries handling complex data collection?

The monitoring methodology of the SDG indicators, especially for target 6.4 indicators, can be challenging to use. Therefore, FAO has organized several on-site and virtual regional workshops, in different languages, to improve the capacities of the national data-collection frameworks.

The targeted audience of the workshops people involved in water-use monitoring and management and environmental statistics in the countries that participated in each of the regional workshops.



One of the main outcomes from the workshops was to jointly identify the constraints, needs and opportunities of the data-collection process. This was achieved by the participants carrying out a Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis, guided by FAO facilitators, the main outcomes of which main are listed below:

MAIN STRENGTHS	MAIN WEAKNESSES
• Existing suitable institutional framework and professional capacity available • Agenda 2030 has been incorporated into national frameworks/existing legal frameworks • Availability of data (some aspects of water data) • Financial resources	• Missing coordination among institutions and/or missing national data-collection policy for the indicators; decentralized water management with different stages of implementation • Some variables are not being collected (systematically and countrywide) • Missing or partial digitalized information collection and sharing mechanism and practices

MAIN OPPORTUNITIES	MAIN THREATS
• SDG monitoring support from outside/ exchanges with other countries • Technological progress (water-use efficiency and measuring stations to generate data)	• Lack of general awareness (within society, industry and the agricultural sector regarding the use of water) and political will or prioritization of this thematic area • Limited resources in the short or long term

The purpose of this analysis is to help to define the data-collection process in a way that weaknesses and threats do not become constraints to the strengths and opportunities within the countries.

After all the discussions regarding the national data-collection process that took place with country representatives, it can be concluded that there are three main internal aspects that will need further attention and support:

- lack of knowledge on collecting the parameters
- data are distributed in different institutions and therefore assembling the data at the right scale can be challenging
- data for the same variables may have already been collected, but may be unsuitable for the questionnaire.

Terraced paddy fields, China ©Pixabay

3. Results and analysis

3.1. Challenges – dealing with data gaps

Globally, over the past 10 years, 67 countries have not been reporting water stress data. Most of these are Small Island Developing States (SIDS). Generally, the missing information on water stress depends on the lack of data on water withdrawals in one or more economic sectors. However, it must be noted that other aspects, such as conflicts or institutional instability, may affect the reporting capacity of a given country.

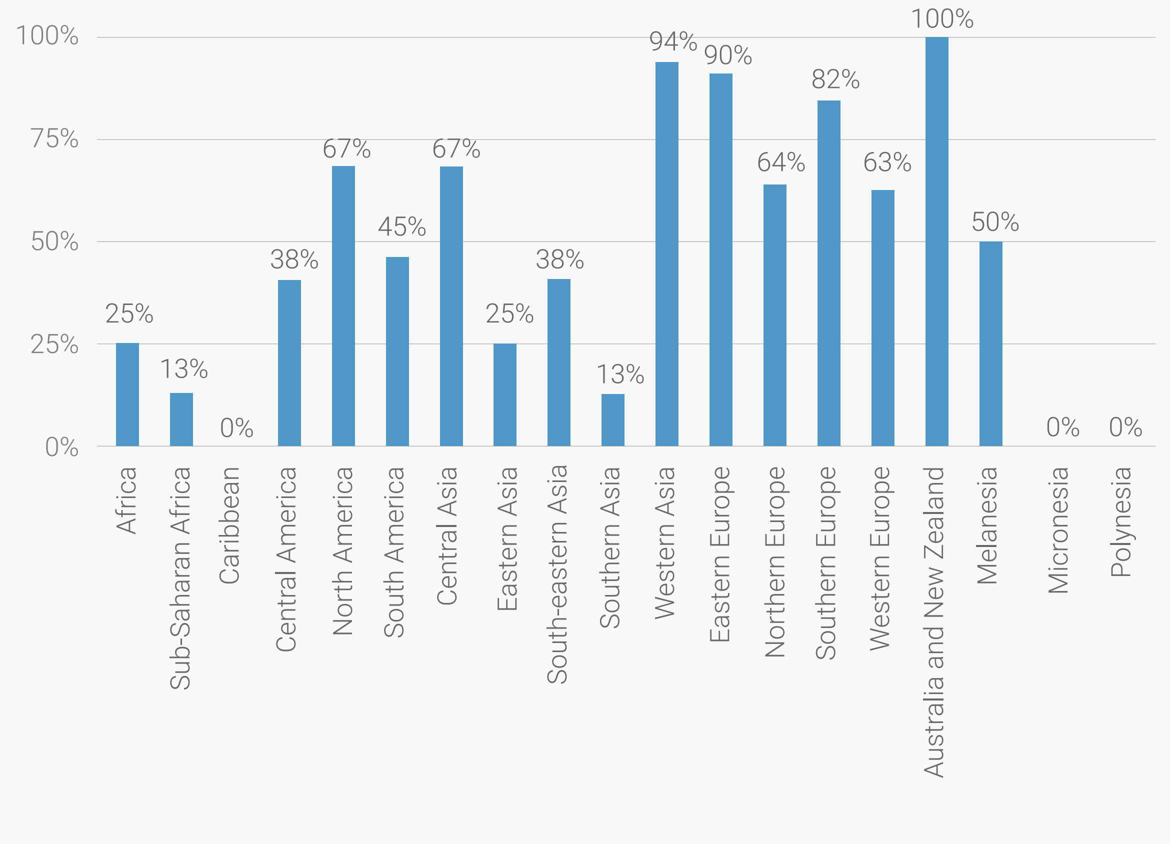
Where SIDS are concerned, in many cases the EFR values are also missing. This is due to the limitations of the GEFIS system used to estimate the environmental flow, which does not allow the assessment of the variable in very small areas.

Another issue to be considered is the fact that the data on water resources are estimated in AQUASTAT as long-term averages, over a period of 30 years from 1961 to 1990. Calculating water stress on the basis of the long-term average of water resources avoids distortions due to casual variations in the amount of water produced by annual climatic variability, including exceptionally dry or wet years. However, keeping the calculation based on a fixed period does not allow broader changes in water availability to be considered, including those due to climate change. A revision of the reference period for water resources assessment – for example, by introducing a mechanism of moving averages on a five-yearly basis – would significantly improve the reliability of the indicator's calculation.

One of the main challenges affecting the indicator 6.4.2 monitoring process is the availability of accurate, complete and up-to-date data. Recognizing that countries have different starting points when it comes to water stress, the monitoring process allows countries to begin monitoring efforts at a level in accordance with their national capacity and available resources, and to advance progressively from that point. Some countries generate their own estimation of EFR while others do not, and some countries have the capacity to disaggregate the variables of the indicator while most of them do not exploit this opportunity or lack the capacity to do so. Therefore, **without a specific effort by the countries, no update, and consequently no monitoring, could be provided.**

In 2020, AQUASTAT distributed the questionnaires (see annex II. questionnaire template) to national correspondents in 156 countries. Seventy-one questionnaires were returned, indicating a response rate of 46 percent, similar to the response rate of previous years. The indicator values for the rest of the countries are calculated based on vertical imputations using the carry-forward method. Questionnaires are filled in retrospectively, meaning that countries have a period of three years to report on the previous years (for example, in the 2020 data drive, the questionnaire contained information for the years 2016, 2017 and 2018). If we consider the response rate by region, the region most active in providing data is Europe. Africa and Southern Asia are the regions that will need further capacity-building and support in the near future (Figure 1).

Figure 1. Percentage of questionnaires received by countries in each of the subregions (2020)



Source: FAO (n.d.).

For this specific report, data from 180 countries were available for a period from 2006/2008 until 2018. Since data were available before 2015, it has been decided to base the analysis on a larger period, to achieve a long-term perspective of how countries and regions have been performing in terms of indicator 6.4.2.

The **process of data collection and analysis remains a major challenge** since not all countries report on all the variables necessary to calculate the indicator, and some countries are not reporting with the required frequency to enable accurate monitoring. This issue is partly resolved by applying the imputation methods of treating missing values described in the previous section, following AQUASTAT guidelines.[7] However, ideally, it would be better not to have to resort to these methods at all and to have real values instead.

7 To consult the guidelines, see http://www.fao.org/aquastat/en/databases/maindatabase/metadata.

3.2. Level of water stress – a global problem regionally differentiated

As previously explained, by using the available water data in the AQUASTAT database and the EFR values provided by each country or by the IWMI and FAO by default calculation per country, and also by using the disaggregation by major basin methodology, the results for water stress percentages can be obtained for each country, and as Figure 2 shows for each river basin.

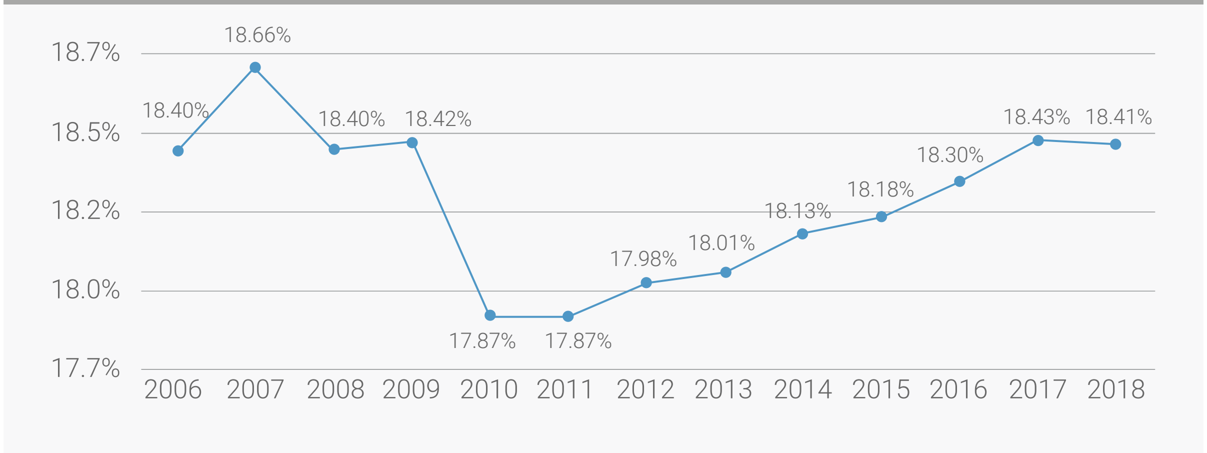
At the global level, 18.4 percent of available TRWR are being withdrawn. At first glance, this figure may seem safe, but it hides large regional, national and subnational variations that need to be addressed to provide more focused information and support, and to facilitate policy identification and implementation. Figure 2 shows the evolution of the global water stress levels. It is worth noting that in the previous baseline report (FAO, 2018), water stress values for 2015 were different, at almost 13 percent, whereas in this report, the global water stress value for 2015 increases to 18.1 percent. This difference is mainly the result of improvements made to the EFR assessment methodology since 2015, resulting in higher values for most countries.

In 2018, three out of seven SDG regions have water stress values above 25 percent (Figure 3), including two subregions with high water stress (Central and Southern Asia) and one with extreme water stress (Northern Africa). Western Asia has medium water stress and Eastern Asia low water stress. The rest of the regions and subregions, and the areas where most of the global population live, have maintained low or no stress levels, but analysis of water stress at country or major basin level reveals significant variations, as described in the next section.

As previously explained, data prior to 2015 were available for the variables that comprise indicator 6.4.2, and therefore they have been included in its computation. Looking at how the water stress value has evolved from 2008 to 2018 at the regional and subregional levels (figure 4), a moderate to large percentage increase can be observed in South-Eastern Asia, Latin America and the Caribbean, sub-Saharan Africa, Oceania and Northern Africa and slower growth in Eastern, Western and Central Asia. Between 2008 and 2018, three subregions (Southern Asia, Europe and Northern America) reduced their water stress level.

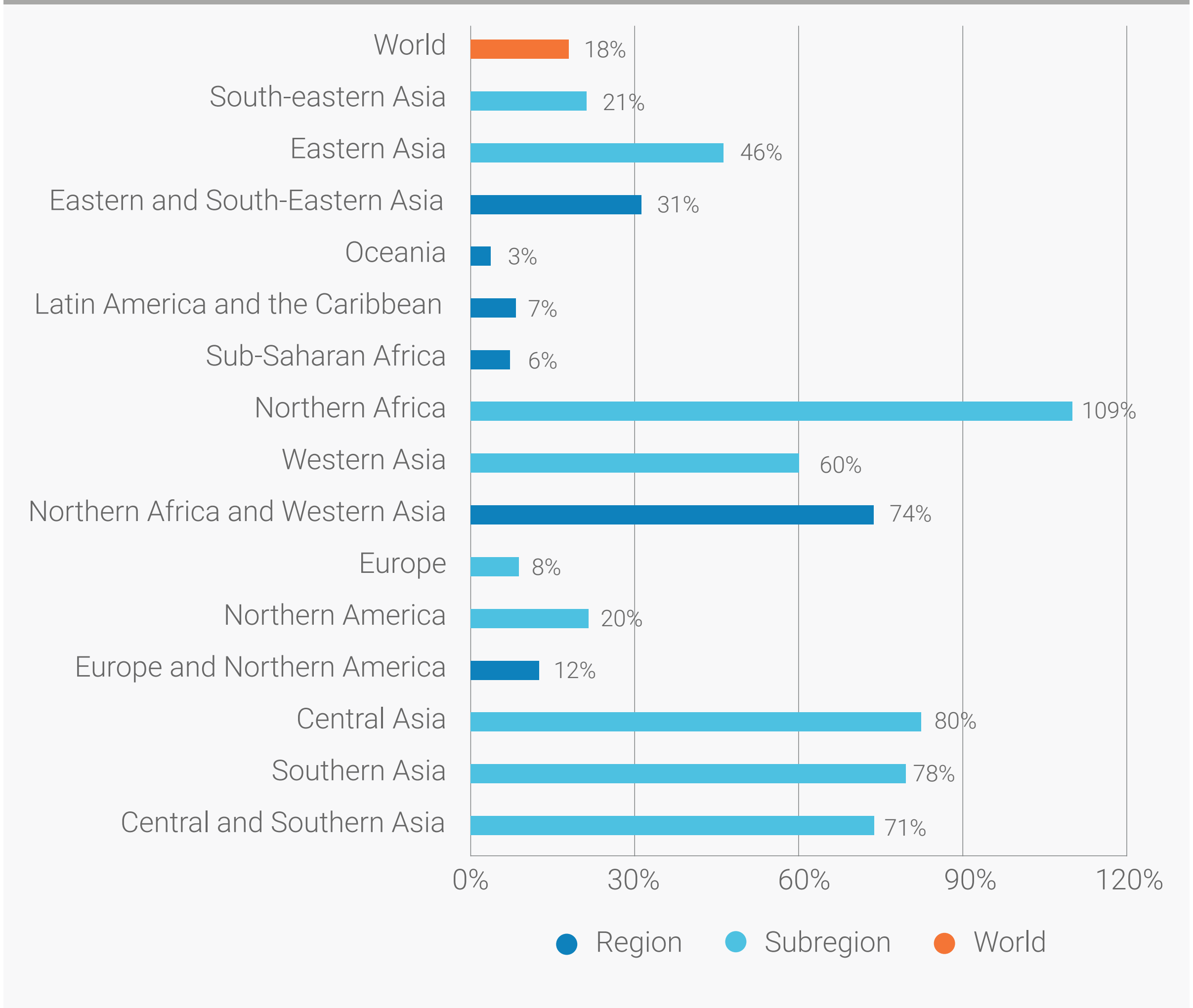
The drivers of this trend in these regions, besides the potential impact of aridity (see Figure 5), need to be carefully examined at a disaggregated level to reverse the effects that a positive increase in the water stress level can have on food security and nutrition and to take action towards increasing and protecting the resilience of livelihoods and ecosystems while fostering sustainable and inclusive agricultural and industrial production and adaptation to climate change.

Figure 2. Change of the global water stress levels (2006–2018)



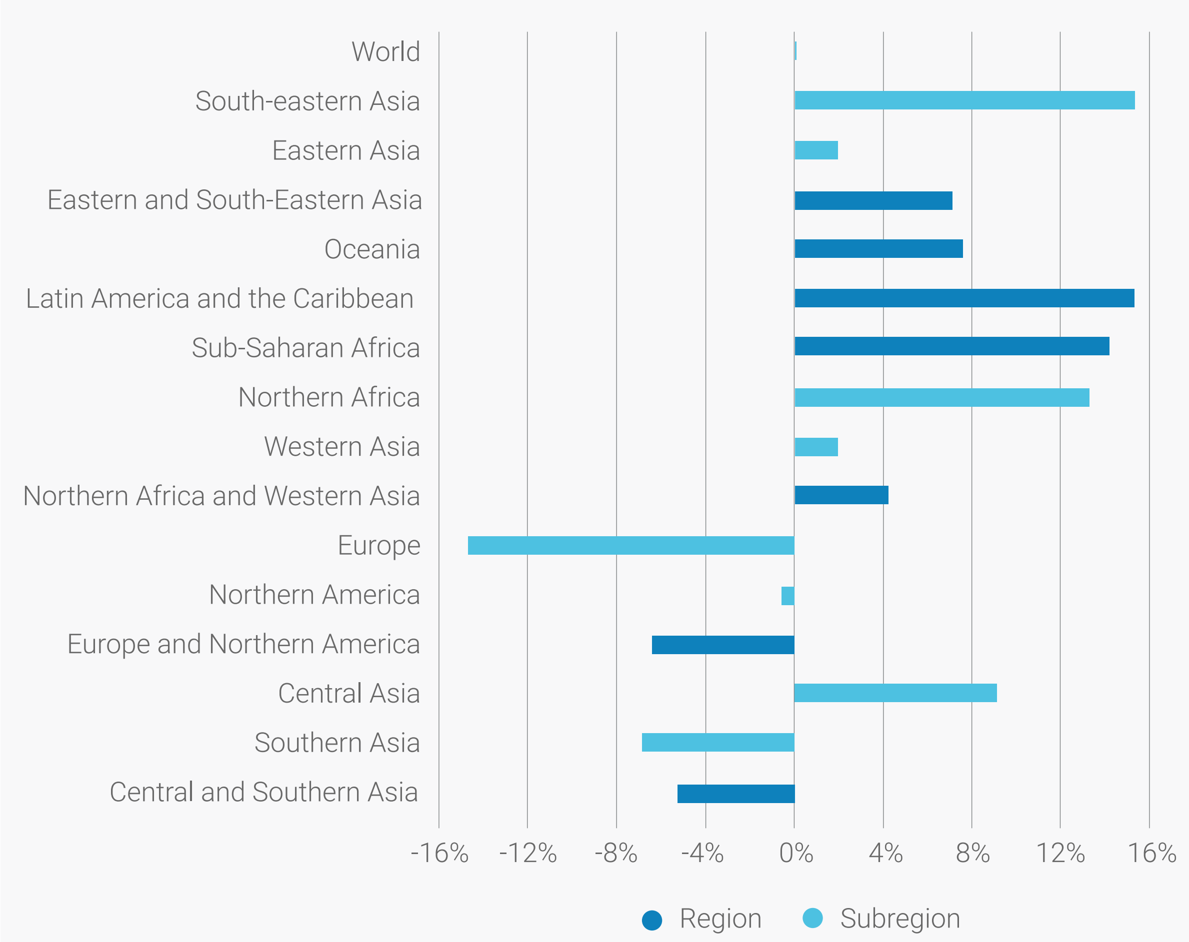
Source: FAO IMI-SDG6 elaboration based on FAO. 2021a

Figure 3. Level of water stress by region and subregion (2018)



Source: FAO IMI-SDG6 adapted from FAO (2021a).

Figure 4. Change in the level of water stress by region and at the global level (2008–2018)

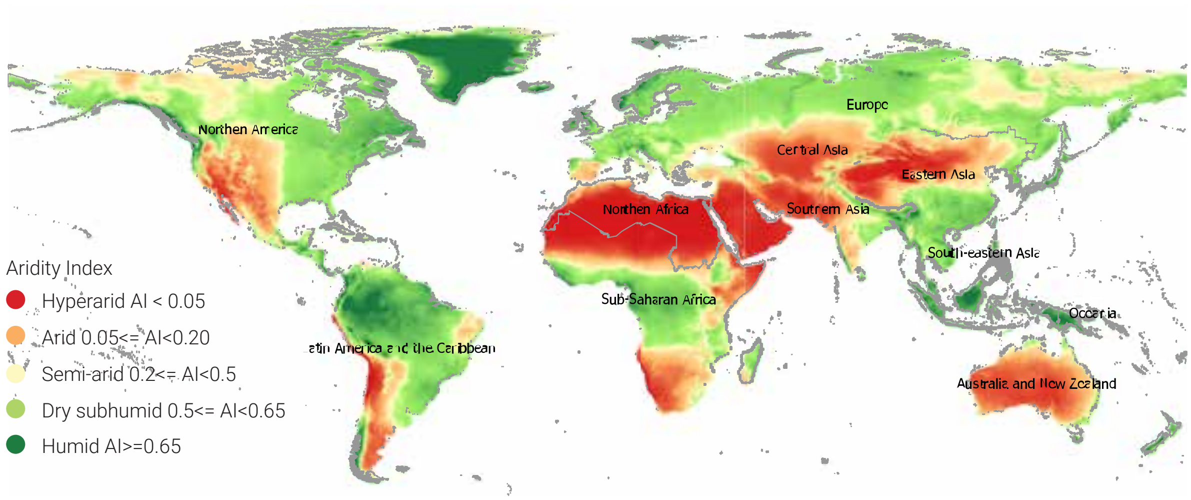


Source: FAO IMI-SDG6 adapted from FAO (2021a).

Note: To reach target 6.4. the level of water stress should decrease (i.e. show a negative percentage change over time).

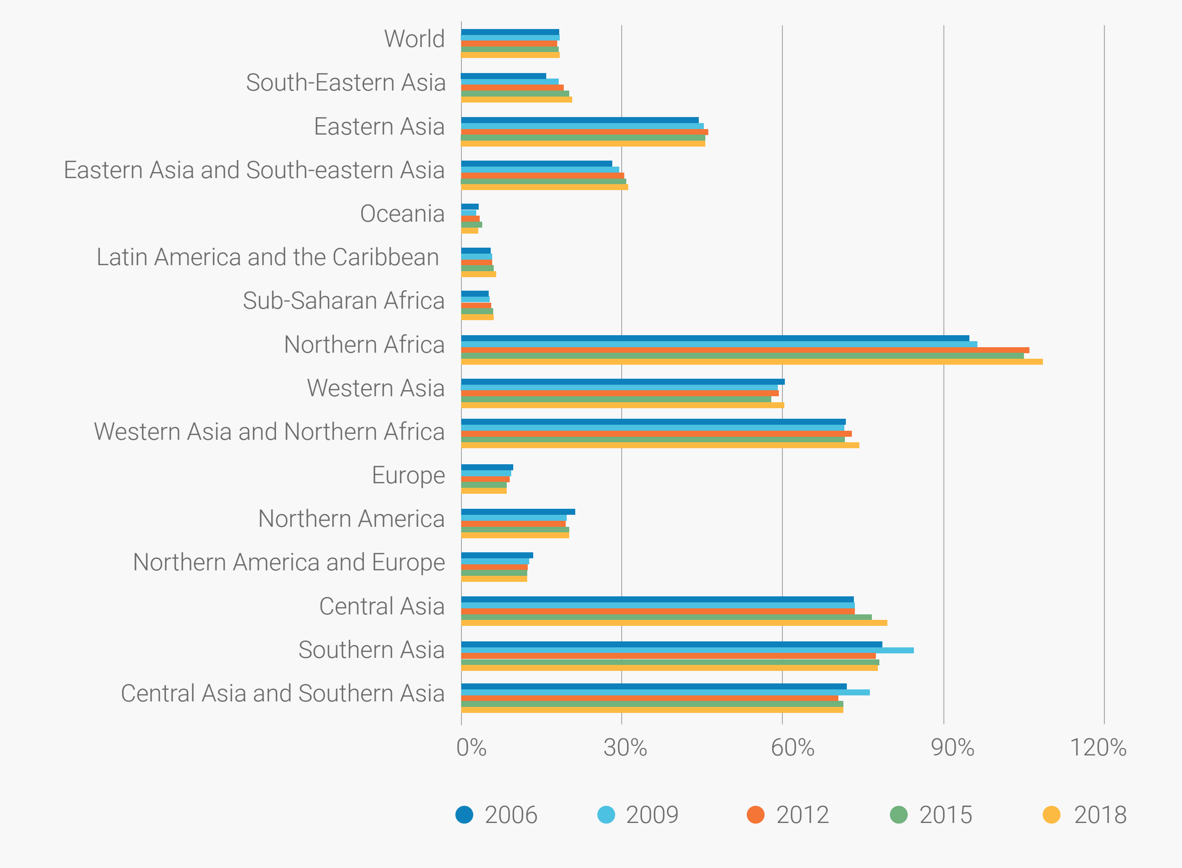
Tigray, Ethiopia - IFAD irrigation site by Petterik Wiggers ©FAO/IFAD/WFP

Figure 5. Global Map of aridity index



Source: Trabucco and Zomer (2018).

Figure 6. Level of water stress, by region and subregion (2006–2018)



Source: FAO IMI-SDG6 adapted from FAO (2021a).

Note: There were no 2006 country values available for Bangladesh in the Southern Asia subregion or for Thailand in the South-Eastern Asia subregion.

Looking at absolute values (Figure 6), most of the regions experiencing an increased percentage change in water stress values are still within low or no stress ranges. However, if the rapid increase continues, it could pose a future threat in countries of South-Eastern Asia, Latin America and the Caribbean. The Northern Africa and Central Asia subregions continue to be of concern given their high water stress values and their upward variation.

3.3. Analysis of water stress by countries

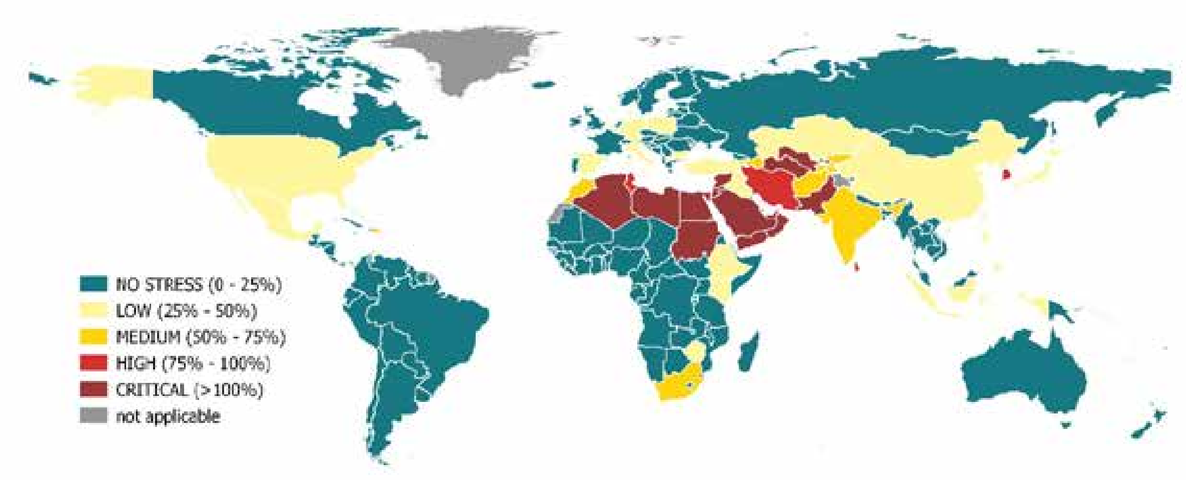
To develop suitable policies and recommendations, a closer look at regions and subregions must be taken so that water stress levels can be compared within the countries that report on them.

3.3.1. Highly water-stressed countries

As is clear from the map in Figure 7, within the Northern Africa and Western Asia and Central and Southern Asia subregions, many countries withdraw all their renewable water resources (100 percent) every year, or even more.

There are 16 countries that are at critical risk of water stress. This means that some of their water sources will eventually run dry, such as groundwater extracted from confined aquifers, and many of them rely on non-renewable resources to meet part of their water needs, as is the case of Kuwait and other Western Asian countries that are highly dependent on desalinated water and wastewater reuse. There are nine countries with a high water stress value. In these countries, greater efforts need to be made and more resources should be directed towards improvement of water governance.

Figure 7. Global map of the level of water stress by country (2018)



Source: FAO IMI-SDG6 adapted from FAO (2021a). UNmap. 2018.

Note: Water stress values for the United States of America correspond to 2017.

3.3.2. Water stress in Least Developed Countries, Landlocked Developing Countries and Small Island Developing States

Water stress in Least Developed Countries

> **FACT BOX**
>
> The category of Least Developed Countries (LDCs) was officially established in 1971 by the United Nations General Assembly, with the aim of attracting special international support for the most vulnerable and disadvantaged members of the United Nations community. There are currently 46 countries in the LDC category: 33 in Africa, 12 in Asia and the Pacific and 1 in Latin America. The identification of LDCs is based on three criteria: gross national income (GNI), the per-capita Human Assets Index and the Economic Vulnerability Index.
>
> *Source:* United Nations Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States (n.d,.a).

Small Island Developing States (n.d,.a). The 2018 water stress values of Least Developed Countries (LDCs) are shown in Figure 8. The 2018 water stress values of Least Developed Countries (LDCs) are shown in Figure 8. The graph shows three distinct types of countries according to the extent of their freshwater withdrawal in relation to their available resources:

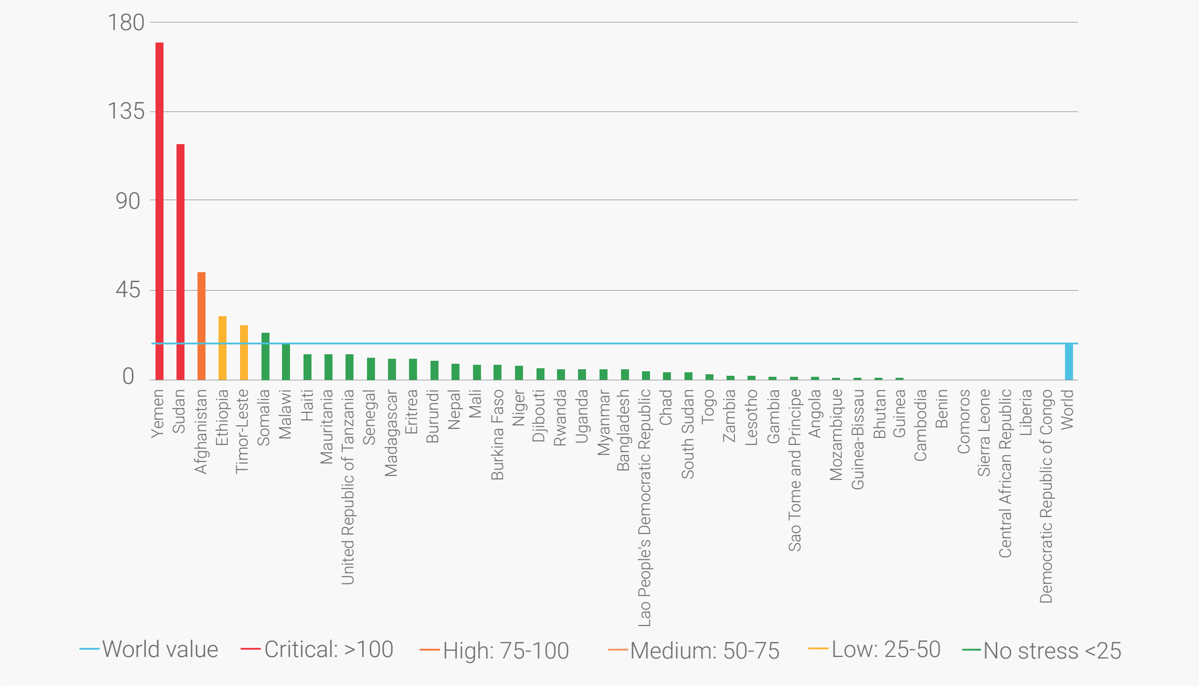
1) countries beyond the critical threshold, such as Sudan and Yemen

2) countries with low water stress

3) countries with very limited water stress, indicating underdevelopment in the agricultural, industrial and service-coverage sectors.

In most of the LDCs, the service levels of drinking water are very low, as shown in Figure 9. Only a few countries are partially covering a safely managed service level. This means that most of these countries have water resources available to increase the drinking water coverage, but may lack the investment level, technical capacity and institutional settings, among other conditions, that would enable them to achieve a safely managed supply.

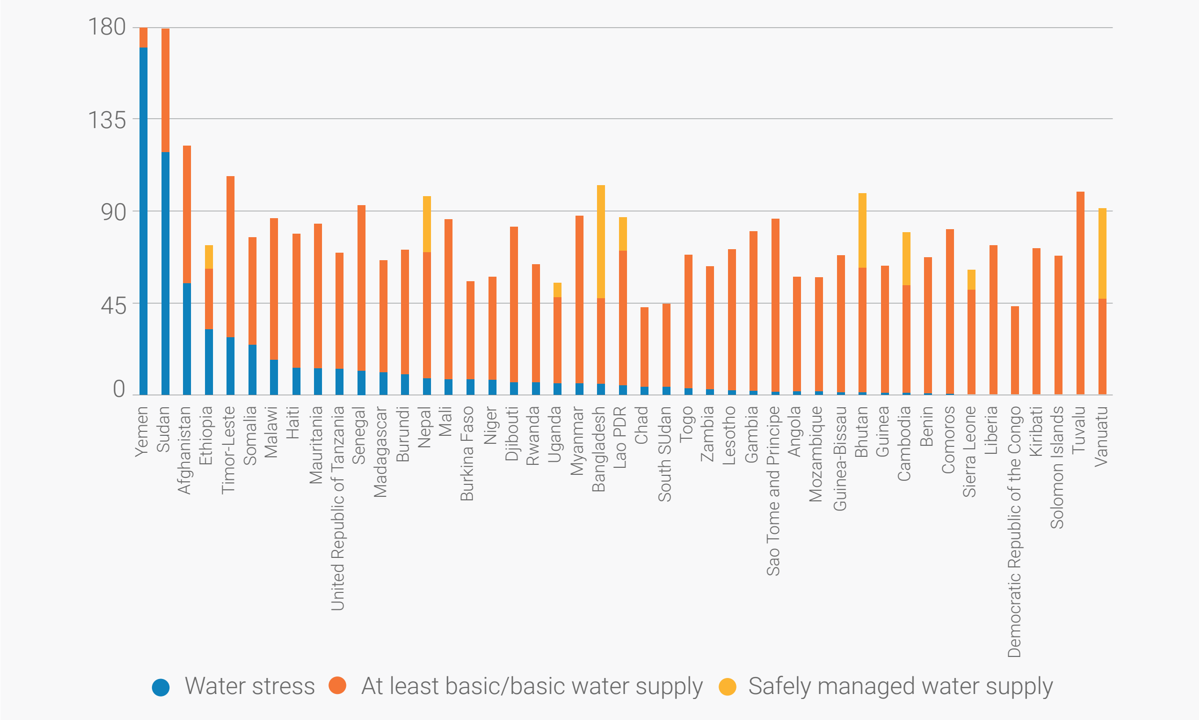
Figure 8. Water stress values in Least Developed Countries (2018)



Source: FAO IMI-SDG6 adapted from FAO (2021a).

Note: No data were available for Kiribati, the Solomon Islands or Tuvalu.

Figure 9. Water stress and drinking water coverage level in Least Developed Countries (2017)



Source: Adapted from UNICEF and WHO (2021).[8]

8 These data are available at https://washdata.org/.

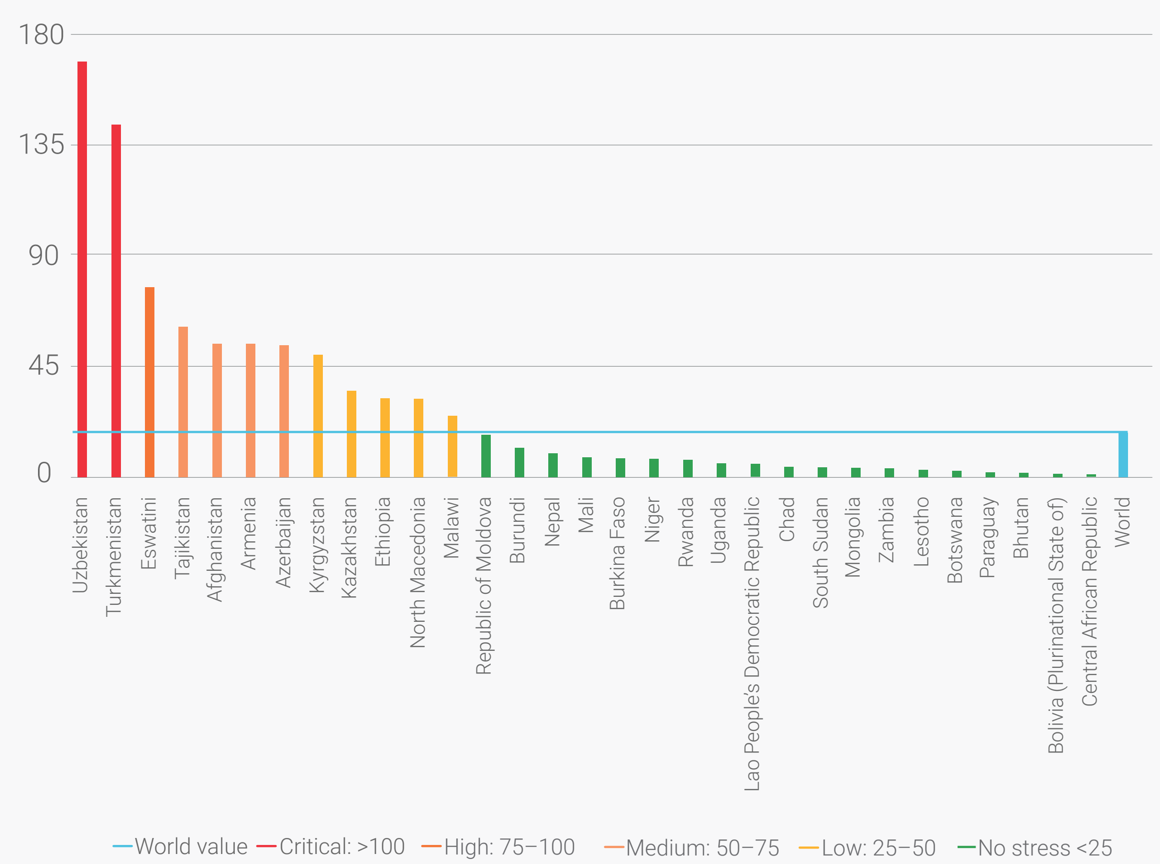
3.3.3. Water stress in Landlocked Developing Countries

FACT BOX

There are currently 32 countries in the Landlocked Developing Countries (LLDC) category: 10 in Asia, 16 in Africa, 4 in Europe and 2 in Latin America. Of the 32 LLDCs, 17 are classified as least developed. LLDCs are characterized by lack of territorial access to the sea, isolation from world markets and high transit costs which impose serious constraints on their overall socioeconomic development. Furthermore, an estimated 54 percent of LLDCs' land is classified as drylands, making them disproportionately affected by issues such as desertification, land degradation and drought. However, our data show that there is no correlation between being landlocked and water-stressed.

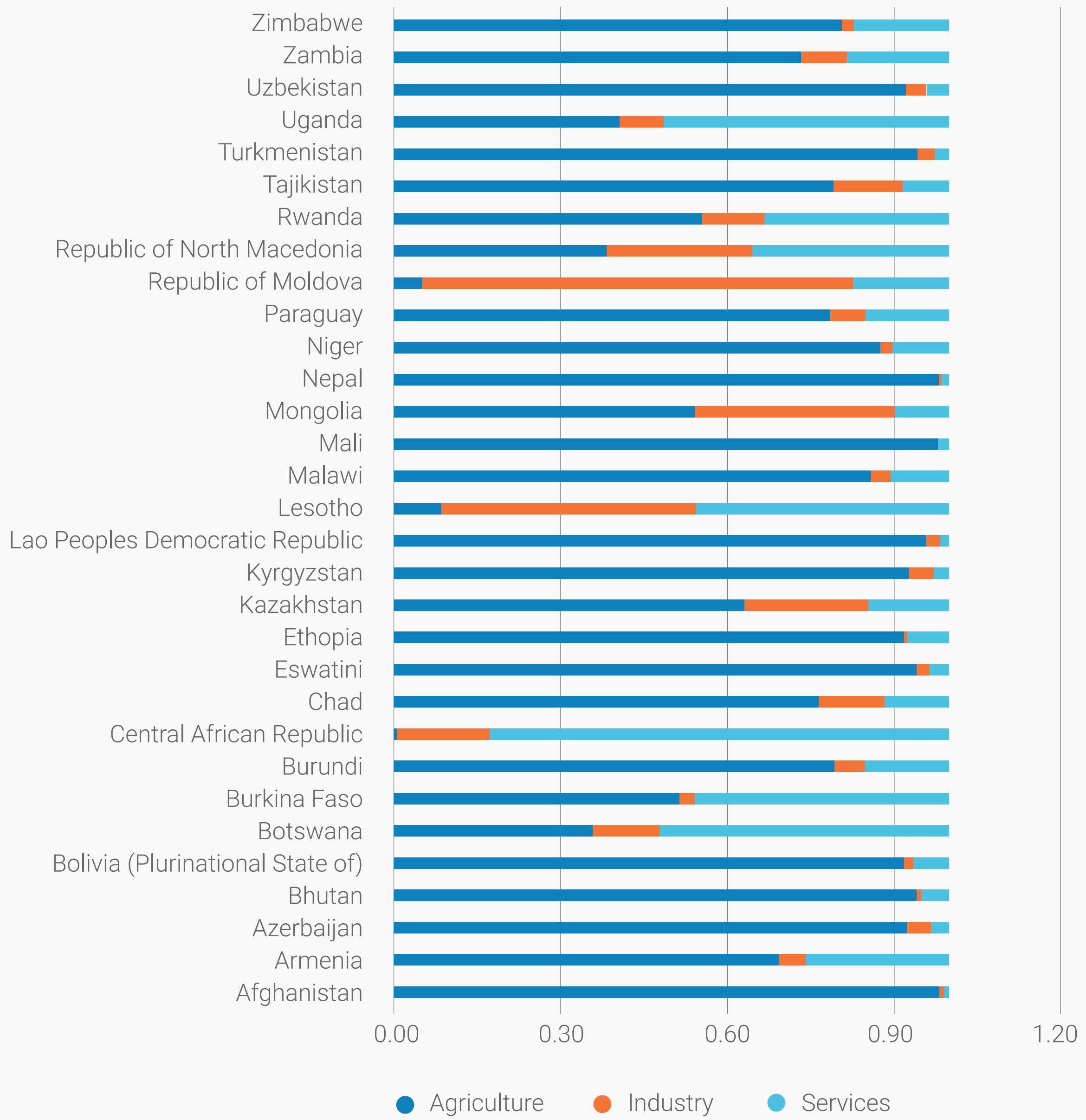
Source: **United Nations Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States (2021).**

Figure 10. Water stress levels (%) in Landlocked Developing Countries (2018)



Source: FAO IMI-SDG6 adapted from FAO (2021a).

Figure 11. Water withdrawals by major sectors in Landlocked Developing Countries (2018)



Source: FAO IMI-SDG6 adapted from FAO (2021a). UN Cartographic Section (2018).

As shown in Figure 10 and Figure 11, LLDC economies are vulnerable to high water stress, but also to very low water stress which may imply the need to implement integrated water management approaches in order to tackle each countries´ challenges in coordinating land, water and other resource management without negatively impacting the environment or generating inequalities.

3.3.4. Water stress in Small Island Developing States

FACT BOX

According to the United Nations Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States, Small Island Developing States (SIDS) tend to face similar constraints in their sustainable development efforts, such as a narrow resource base depriving them of the benefits of economies of scale; small domestic markets and heavy dependence on few external and remote markets; high costs for energy, infrastructure, transportation, communication and services; long distances from export markets and import resources; low and irregular international traffic volumes; little resilience to natural disasters; growing populations; high volatility of economic growth; limited opportunities for the private sector and a proportionately large reliance of their economies on their public sector; and fragile natural environments. These factors make SIDS particularly vulnerable to biodiversity loss and climate change because they lack economic alternatives.

Source: **United Nations Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States (2021).**

For this report, information to compute indicator 6.4.2 was only available in less than 50 percent of SIDS (Figure 12). This is the result of the fact that – as previously mentioned – in many cases, EFR values are not available in SIDS. This, in turn, is due to the limitations of the GEFIS system used to estimate environmental flows, which does not allow the assessment of the parameter in very small areas.

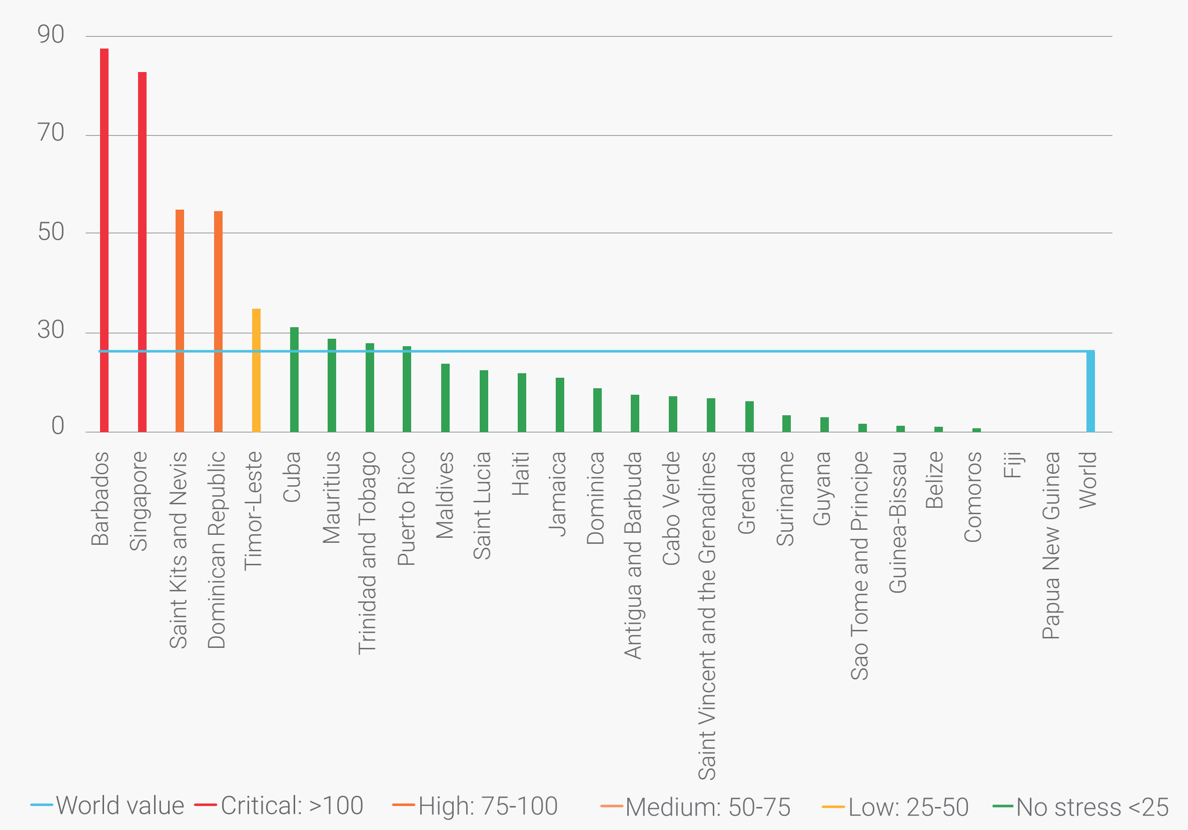
Water stress in SIDS is generally very low, with exceptions such as Barbados and the Dominican Republic whose main water use is related to agriculture, and Singapore, whose main water use is urban supply.

In large archipelagos such as Fiji, variables such as climate, water availability and population density are very heterogeneous. Further disaggregation of the indicator will be necessary to capture a more accurate value of water stress in those situations.

3.4. Level of water stress at major river basin level

Following the thresholds established for this indicator (see section 2.2), major river basins with an indicator level lower than 25 percent have no water stress. Those basins with a water stress level greater than 75 percent have high or critical water stress. High values of water stress mean more water users are competing for limited water supplies. As shown in Figure 13, water stress is evident in all the basins characterized by intensely irrigated agriculture, as well as in those including densely populated cities (for example, Cape Town) which compete with the agriculture sector for the use of water, and where there is less volume of available freshwater resources due to climatic conditions. Overall, the results shown in Figure 13 are aligned with what is shown in the map of water stress at country level (Figure 7).

Figure 12. Water stress in Small Island Developing States with available data (2018)

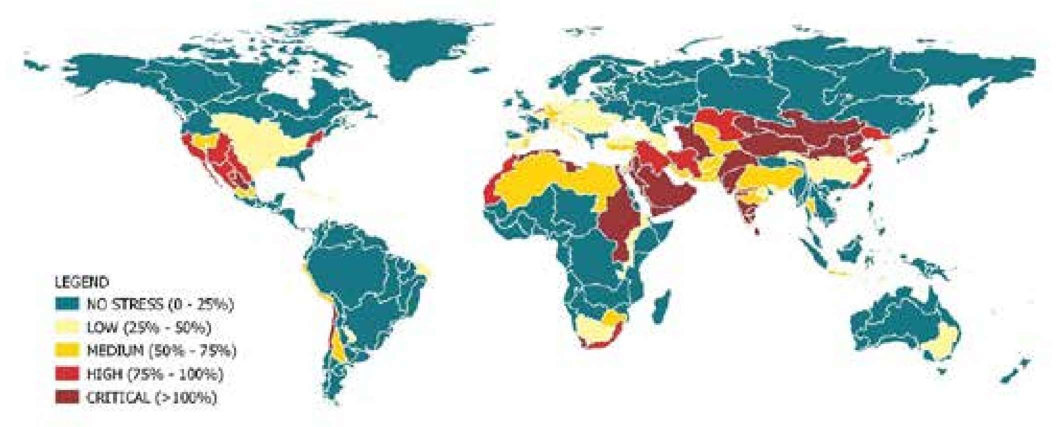


Source: FAO IMI-SDG6 adapted from FAO (2021a). UN Cartographic Section (2018).

However, the disaggregation by river basin shows that the basins affected by severe water stress are located not only in Northern Africa and the Near East, but also in Northern America, in Central and Southern Asia and on the west coast of Latin America, which is not so evident from the country-level map. Indeed, countries that may appear safe can include much more stressed basins, in whole or in part, such as Chile and Peru, but also China, Mexico and the United States of America. This can be the result of a country being divided between different basins with different levels of water stress or, on the contrary, of a single basin crossing several countries. Figure 14 shows how some countries may include different basins internally with varying water stress levels or share stressed basins with neighbouring countries.

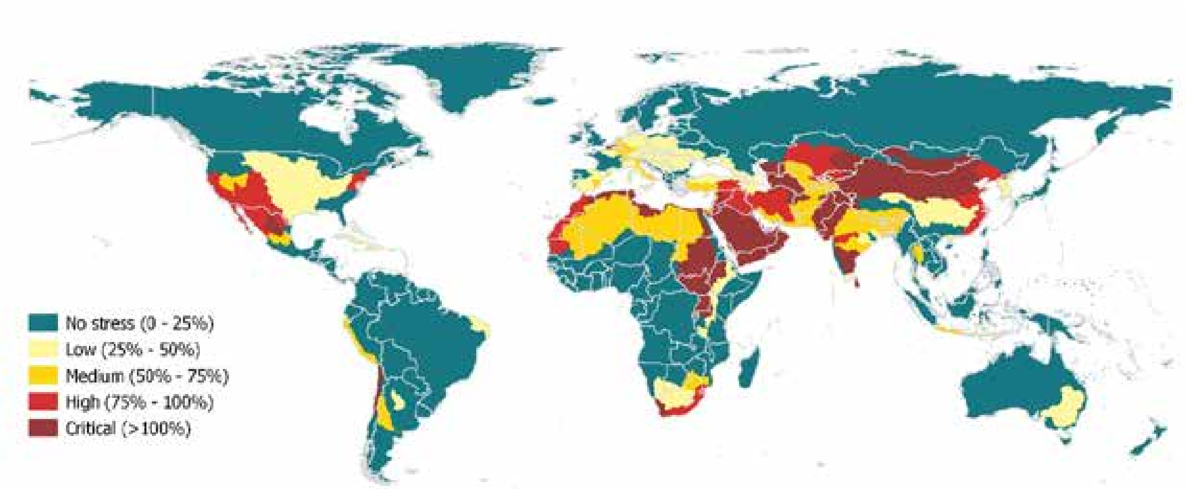
In this latter case, when the calculation is carried out at country level, water resources could be counted more than once in the different sections of the basin. This issue is resolved by calculating the water resources based on the major river basin as a whole. For this reason, Burundi, Rwanda, South Sudan, Tanzania and Uganda are classified as "No stress" countries in Figure 7, despite sharing the Nile basin that suffers from critical water stress.

Figure 13. Global map of the level of water stress by major river basin (2018)



Source: Biancalani and Marinelli (forthcoming).

Figure 14. Global map of the level of water stress by major river basin with country boundaries (2018)



Source: Biancalani and Marinelli (forthcoming); UNmap. 2018.

With 153 countries being part of one or more of the world's 286 transboundary river basins (United Nations Economic Commission for Europe [UNECE] and United Nations Educational, Scientific and Cultural Organization [UNESCO], 2021), transboundary cooperation over water resources is essential for ensuring sustainable and efficient water resources management in most countries.

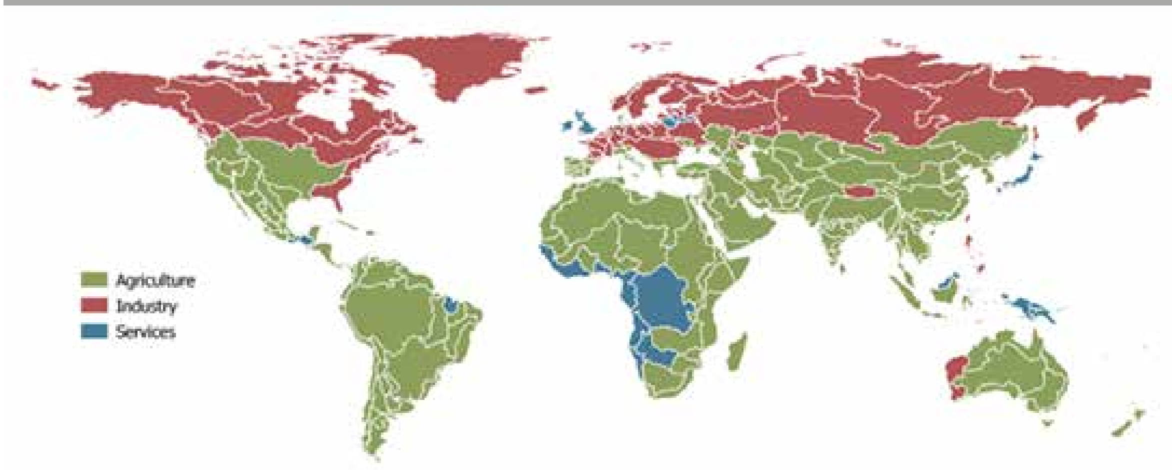
3.4.1. Sectoral disaggregation at the major basins

One of the major efforts of this disaggregated analysis shown in Figure 13 was to ensureconsistency between the AQUASTAT national statistical data available for each economic sector and the global geospatial data sets used for their spatialization, despite the latter often not being available (for example, for industries) or updated to the year 2018.

For this reason, both the assumptions made – despite them being based on published studies and models – and the global input data sets used could have been sources of uncertainty in the output. In this section, the sectoral data evolution and potential input to water stress in the basins are further analysed.

Agriculture continues to be the most demanding sector in terms of freshwater withdrawals in most of the basins, as can be observed in Figure 15 and Figure 16. When these figures are compared with the map of the level of water stress by major basin (Figure 13), it is clear that the dominant sector in most of the highly and critically water-stressed major basins is agriculture, with some exceptions in basins with big cities or dense populations.

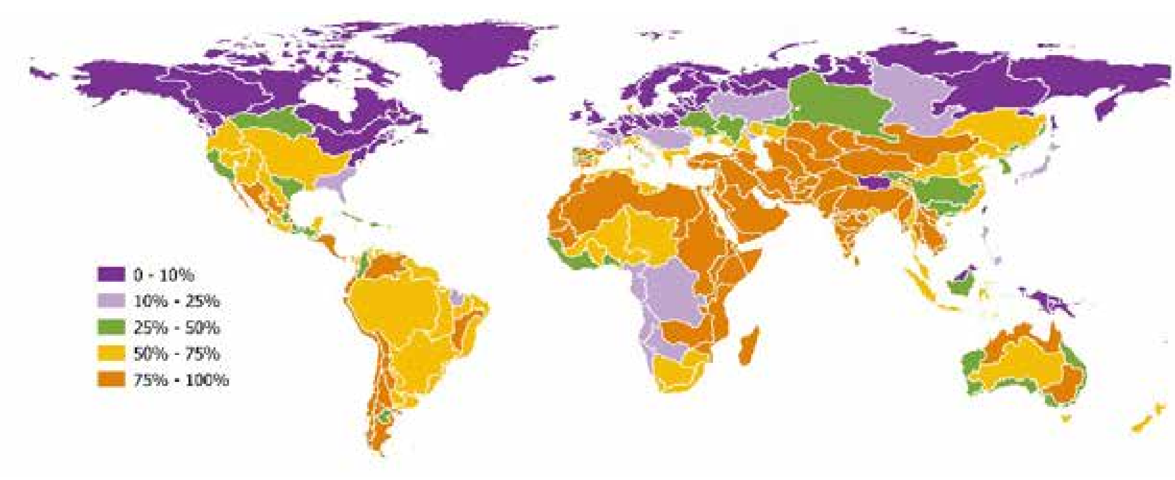
Figure 15. Global map of the dominant economic sectors for freshwater withdrawals by major river basins (2018)



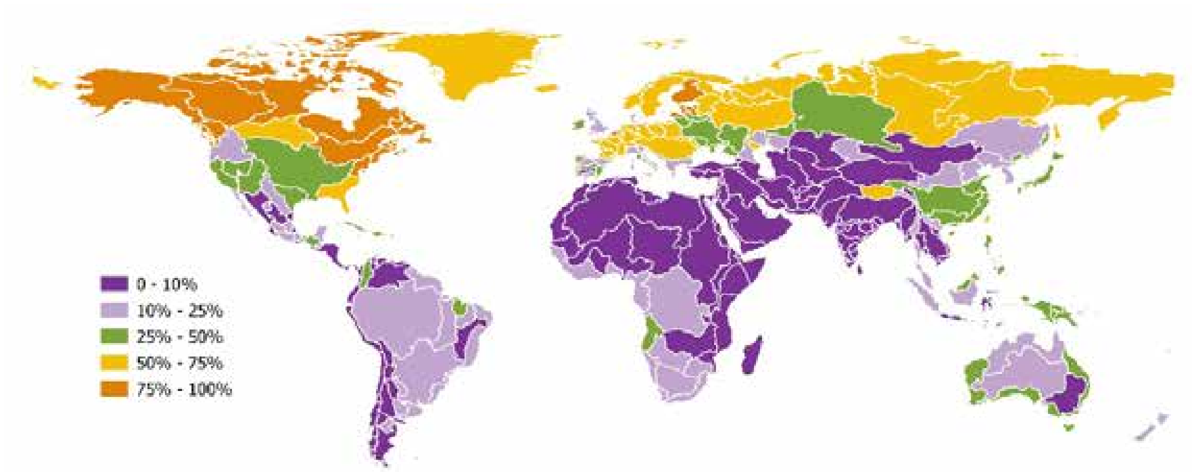
Source: Biancalani and Marinelli (forthcoming).

Figure 16. Global maps of the proportion of freshwater withdrawal of each economic sector over the total freshwater withdrawal (2018)

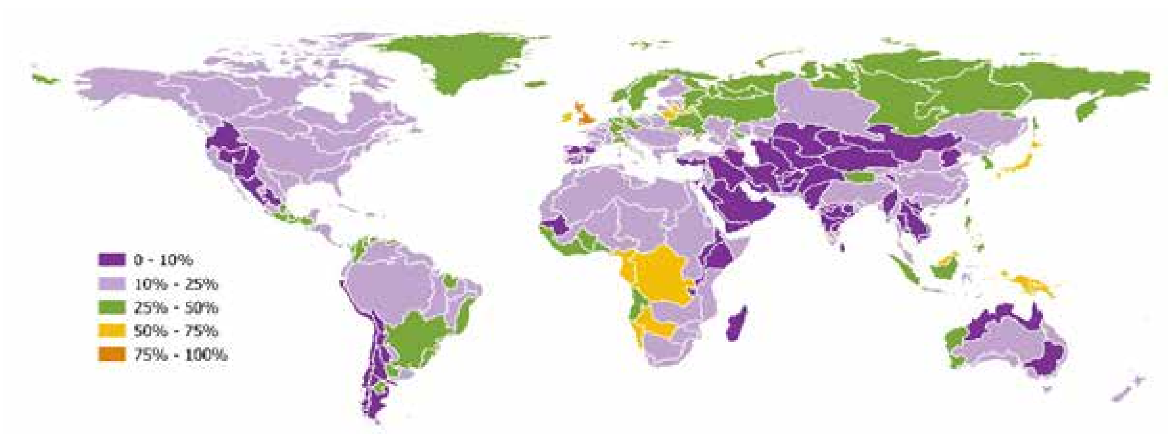
a) Proportion of agriculture freshwater withdrawal over the total freshwater withdrawal



b) Proportion of industry freshwater withdrawal over the total freshwater withdrawal



c) Proportion of service freshwater withdrawal over the total freshwater withdrawal



Source: Biancalani and Marinelli (forthcoming).

Irrigated agriculture is the most frequent type of farming system in basins with critical and high water stress values, whereas irrigated and non-irrigated paddy rice is the most prominent in medium water-stressed basins (Figure 17). Food production in these basins is vulnerable to water scarcity, and there may be competing interests between the environment and agriculture and between users on the access to water resources.

Creating the conditions to optimize water use by improving irrigation efficiency and optimizing crop water productivity by reducing crop water consumption is essential for these areas. There are other factors that may influence the dynamics of the farming systems' intensified water withdrawal, such as market demand, population growth and access to land or to advanced technologies. However, in the short-term, water is a limiting factor in critically and highly stressed areas.

In light of the challenges that disaggregating the indicator brings, this work will continue. Pilot test cases will be organized in some countries (for example, Brazil, Italy and Tunisia) to establish a common reference protocol to implement the disaggregation of the indicator in all the countries of the world at the sub-basin level.

The disaggregation of the water stress indicator by major basin highlights the importance of the proper consideration of hydrological conditions when assessing the pressure that the use of water for human needs puts on natural water resources. That provides a more comprehensive view of the global distribution of water stress, allowing the identification of those cases where country-level assessments may be hiding issues that are relevant at regional or subregional level. Such analysis also provides the basis for taking the disaggregation exercise to the subnational level in order to provide decision makers with more in-depth information on the availability of water resources within a country.

Disaggregating the indicator by sector also offers another perspective, which becomes particularly important in the context of the economic development of a country and the consequent changes in the structure of its economy.

Shifting the use of water from agriculture to other sectors may result in conflicts and create local shortages.

This type of analysis will require further investigation, beyond the scope of this report.

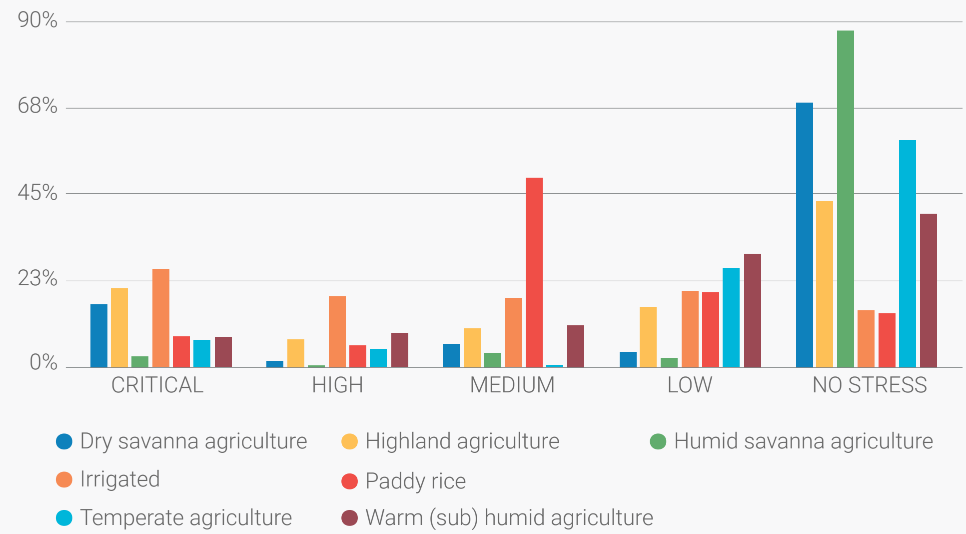
In conclusion, the disaggregation of SDG 6.4.2 by sector and by basin allows the identification of hotspots where actions should be prioritized, highlighting the importance of international cooperation in the management of water resources.

3.5. Socioeconomic drivers and impacts of water stress

Water is one of the pillars of development and therefore societies have tended to settle in areas with water sources. When analysing water stress, it should be understood that the total freshwater availability is only part of the equation, and it will vary according to the climatic conditions of each region and geographical characteristics of the river basins and aquifers, as well as climate change. Nevertheless, the key element of the water stress indicator is the nature of the water withdrawals, which is driven by socioeconomic factors.

Globally, 72 percent of all water withdrawals are used by agriculture, 16 percent by municipalities for households and services, and 12 percent by industries (Figure 18). These percentages vary from region to region, but irrigated agriculture is still the most water-demanding sector at the global level, as can be observed in Figure 15. In many developing countries, the proportion of water used by agriculture is often much higher, as water policies in such countries focus on the expansion of irrigated land as well as intensification of agricultural production. This typically occurs in the foreground of increased competition for water and other resources.
It is important to look at how water is used within each of the sectors, and for this, the results of indicator 6.4.1 on water-use efficiency will be crucial, to monitor the evolution of the demand and dynamics in each of the three main sectors and therefore the relative importance of actions needed to contain water demand in those sectors (agriculture, industry and services).

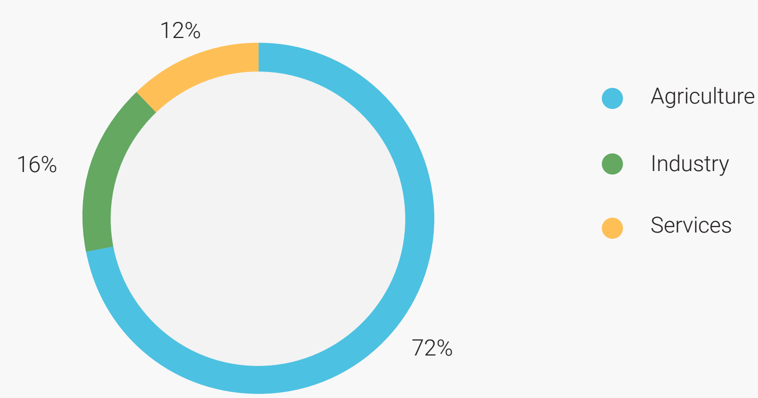
Figure 17. Major farming system occurrence according to the level of water stress in major river basins



Source: **FAO IMI-SDG6 adapted from FAO (2011); FAO (2021).**

Figure 18. Global water withdrawals by main sector (2018)

	km³/ year	%
Agriculture	2860.8	72
Industry	646.3	16
Services	482.8	12



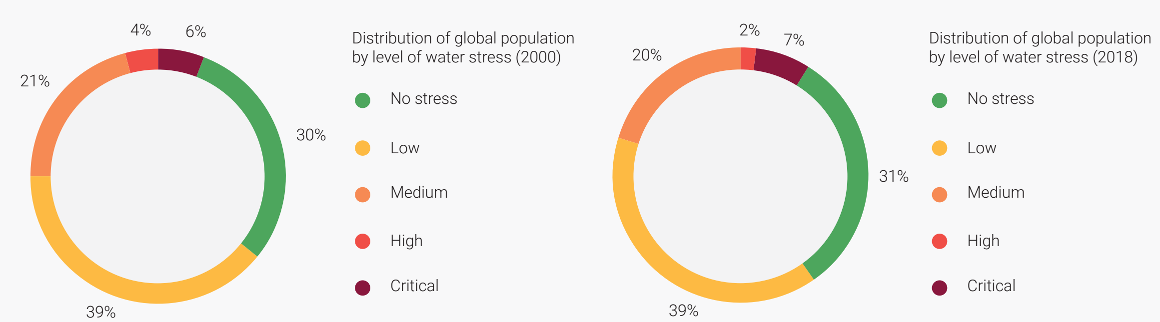
Population growth, regional and rural-urban migrations are a driver for increasing water demands that can challenge the current water stress levels. Although it remains a matter of debate, water stress could also be a driver of temporary or permanent rural-urban migration, as well as high temperatures that lead to a decrease in the production yield and therefore make livelihoods unsustainable wherever there are no water sources available.

However, research shows that in migratory regions, there are usually other factors than environment that drive migration (Wrathall et al., 2018).

In January 2018, Cape Town became the first major city to nearly reach day zero in terms of water availability, almost having no supply service. The dam levels that fed the city fell to 13.5 percent, and this required all taps in the city of Cape Town to be shut off and citizens to fetch 25 litres per person per day from public points of distribution (Organisation for Economic Co-operation and Development [OECD], 2021). The immediate response was to divert water allocated for the agricultural sector to the city supply, which resulted in a reduction in the agricultural production. This exposed the vulnerability of the urbanized world, but also highlighted the interdependency between urban, agricultural and industrial water uses. Questions remain regarding the causes of that crisis such as rapid population growth, climate-related issues – a decrease and a change in the spatial and temporal pattern of rainfall –, the increase in irrigation demand and insufficient land and water management that could anticipate this issue. Similar causes and combinations may put other large cities worldwide in a similar position. Large agglomerations such as Beijing, London, Mumbai or Tokyo are likely to face water crises by 2050, which pose threats to health, well-being and progress towards the achievement of the SDGs (UNESCO, 2019). These challenges point to the need for coordinated approaches to achieving SDG 6.

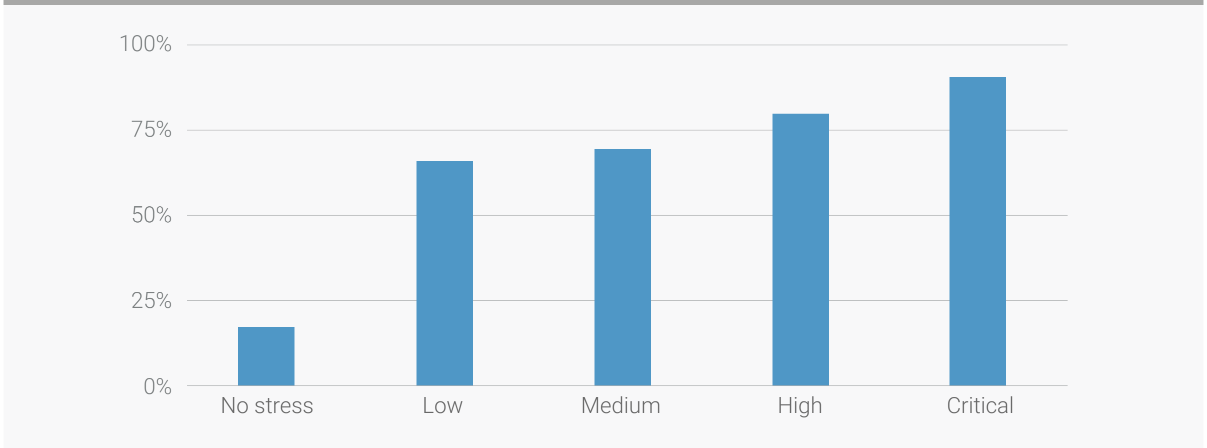
More than 733 million people live in countries with high and critical water stress, which is approximately 9–10 percent of the global population (Figure 19). Population density is larger in critical and high water-stressed basins than in the other categories (Figure 20), again showing the vulnerability of the livelihoods, water supply and industry potential in those areas.

Figure 19. Distribution of global population by water stress at country level in 2000 (left) and 2018 (right)



Source: FAO IMI-SDG6 adapted from FAO (2021a).

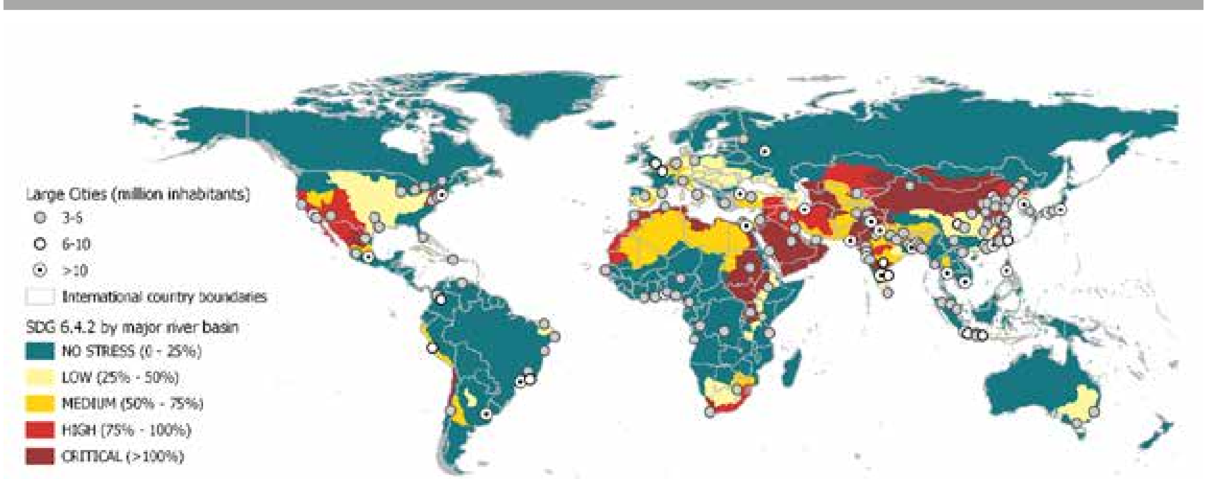
Figure 20. Distribution of population density (people/km2) by water stress class at major basin level (2018)



Source: FAO IMI-SDG6 adapted from FAO (2021a).

Following the global pattern of urban growth, the urban population living in countries with high and critical water stress regions has increased (Figure 21) at the expense of a reduction of the rural population. This could be linked to problems of public water supply access in cities where infrastructure is not ready to cope with the growing population. Furthermore, this demographic move towards a greater urban population is often accompanied by a change in diet and lifestyle with a higher water footprint.

Figure 21. Global map of the level of water stress by major river basin indicating large cities (2018)



Source: Biancalani and Marinelli (forthcoming); UNmap. 2018.

4. Conclusion, challenges and next steps

4.1. Summary of findings

At the global level, 18.4 percent of TRWR available are being withdrawn by different economic activities. The safe water stress percentage at the global level hides the higher values and variability that exist at regional, country and major river basin level. Spatial, sectoral and temporal disaggregation are crucial to get a clearer picture of water stress issues in order to establish better corrective and management measures. In particular, the disaggregation of the indicator at basin level uncovers hidden differences, showing that countries that may appear safe can include much more stressed basins.

High levels of water stress indicate that human activity exerts strong pressure on the water resources in a country. The presence of environmental flows among the variables used to compute the indicator implies that high water stress values have an impact on the health status of the ecosystem that may already be vulnerable to climate change. In turn, the worsening of ecosystem health, assessed by the SDG target 6.6 indicator, translates into the worsening of the ecosystem services they may provide. Water stress helps us to focus on the human implications that withdrawing more water than is available may have on the sustainability of the livelihoods of both the rural and urban population. Disaggregation of water stress by basin allows for a better territorial analysis than that which a country approach can show, and further efforts will be made to improve data collection at basin level.

On average, 10 percent of the global population live in countries with high water stress, which has a significant impact on water access and availability for personal needs. Water is crucial to combat diseases such as the recently discovered COVID-19, and when it is under stress, it significantly affects economic activities, agricultural production, and subsequently, food security. Farmers may experience increasing inequalities in their access to water resources in a water stress situation.

As mentioned in this report, rapid urban population growth can threaten water availability in water-stressed countries, not only to meet the basic needs for drinking and sanitation, but also to cover the demands of other sectors such as agriculture whose allocated share of water resources could be affected by it. This could translate to increased food insecurity and loss of jobs.

4.2. Recommendations to accelerate the achievement of a reduction in water stress

The United Nations has launched an initiative that involves all sectors of society to speed up the progress and support countries on the achievement of SDG 6 (UN-Water, 2020). The framework includes five accelerators:

1. Optimized financing – fully-funded plans leading to services where they are needed most.

2. Improved data and information to inform decision-making and increase accountability.

3. Capacity development of people and institutions to improve and expand services.

4. Innovation – new practices and technologies are to be scaled up.

5. Governance is to be improved across sectors and national boundaries to make SDG 6 everyone's business.

The recommendations listed below aim to support the process of acceleration and to set paths of action for the different actors that can mobilize resources, knowledge and cooperation on the achievement of target 6.4.

4.2.1. Policy recommendations

Irrigated agriculture cannot continue to grow at the current withdrawal rate, especially in highly and critically water-stressed countries.

Efficient water distribution systems, reuse of treated wastewater, and circular economy approaches in water and direct use of agricultural drainage water are all key elements of reducing water stress, together with awareness campaigns to reduce the use of water in households. It is even more crucial to achieve more sustainable agriculture, by optimizing rain-fed agriculture, reducing the irrigation water demand and adapting farming practices to the climatic, economic and hydrologic conditions of the regions. Investments in research and innovation, as well as technology development and transfer, can provide further improvements to water efficiency and crop productivity.

In this way, exploring and innovating with grey, hybrid and green technologies such as Nature Based Solutions (NBS) can improve the overall water availability in ecosystems and support sustainable agriculture. As defined by the International Union for Conservation of Nature (IUCN), NBS are actions to protect, sustainably manage and restore natural or modified ecosystems that effectively and adaptively address societal challenges, simultaneously providing human well-being and biodiversity benefits. Green infrastructure is becoming increasingly recognized as an important tool to address the complex challenges of water management. It can provide landscape-scale benefits if implemented over large areas (WWAP and UN-Water, 2018).

In terms of ecosystems services provided by water, NBS can help improve water regulation, water quality and water-related risk reduction. Agriculture will need to meet projected food demand increases through improved resource use efficiency while simultaneously reducing its external footprint, and water is central to this process (Alfarra and Turton, 2018). Soil and water conservation techniques including conservation agriculture, composting, applying vegetative cover, agroforestry and structural approaches such as water harvesting and terraces, are examples of effective green infrastructure that improve water availability, infiltration and groundwater recharge.

Furthermore, increased biological diversity in agricultural systems has been proven to improve resistance to and recovery from various forms of stress, including droughts and floods.

It is necessary to explore and exploit the synergies with other SDG targets related to water stress reduction, at all levels. There has been considerable discussion over the past 30 years on how to define “sustainable agriculture”, the core of target 2.4. SDG indicator 2.4.1, of which FAO is also custodian, is defined as the “proportion of agricultural area under productive and sustainable agriculture” and will be measured at farm level. It brings together themes on productivity, profitability, resilience, land and water, decent work and well-being to capture the multidimensional nature of sustainability. One of its 11 subindicators relates to water availability, associating unsustainable use of water with the progressive reduction in the level of groundwater and drying out of springs and rivers, which is also linked to increased conflicts among water users.

Efforts to achieve target 6.4 will also have co-benefits on achievement of target 15.3, which strives to achieve a land degradation-neutral world, combating desertification and restoring land affected by desertification, drought and floods, and vice versa.

Other important targets that co-benefit from reduction in water stress are those included under SDG 12 on responsible consumption and production patterns. Initiatives related to capacity-building, awareness and education could accelerate overall success under target 6.4. and may include:

- Promotion of life cycle and water footprint analysis, to find out where efficiencies can be made in all the sectors and the products that exert more pressure over water resources.
- Awareness of the reduction of food losses. Estimates of food losses indicate that globally around 14 percent of the economic value of food produced is lost from post-harvest, up to, but not including, the retail level (FAO, 2019b).
- Promotion of and incentives for sustainable diets could also reduce the use of water for food production by about 20 percent compared with current diets. Sustainable diets are defined as those that are healthy, have a low environmental impact, are affordable and are culturally acceptable (Burlingame et al., 2012).
- Raising the general public’s awareness of the importance of sustainable consumption through education, public information and promotional campaigns and food labelling.
- Introduction of sound policy development and enforcement in the territories. It is necessary to use water balances at basin and aquifer level as a tool to control and allocate water withdrawals in a sustainable and equitable way and avoid over-abstraction or tackle it wherever it may be taking place. Technology advances, crop management and choices of crop varieties, soil conservation and modernization, and irrigation efficiency measures are important but will not solve the problem of water stress alone. In certain cases, it

will be necessary to anticipate a social and economic transition to minimize the impact of the reduction in water withdrawal.

Integrated water resources management (IWRM) and participatory approaches are recommended to empower communities and facilitate decision-making processes and agreements. The SDG 6 IWRM Support Programme assists governments in designing and implementing IWRM Action Plans as an entry point to accelerate progress towards the achievement of water-related SDGs and other development goals, in-line with national priorities. The IWRM Acceleration Package is available to all countries to facilitate government-led multi-stakeholder processes to develop Action Plans.

The inclusion of institutions with responsibility for sustainable and efficient water-use management in this process will directly support action on SDG target 6.4.

4.3. Recommendations for the reporting process

Improving the capacity of disaggregating the indicator is crucial for a sound policy response. At the moment, only a few countries have fully exploited the opportunities that disaggregating the indicator can bring in terms of monitoring and policy development (see case study of Brazil in box 4). It is expected to be further developed in the next years.

Groundwater systems, Guthi, India by Noah Seelam ©FAO

Box 4. Water stress indicator in Brazil by hydrographic region

The National Water Agency of Brazil (ANA) has made a substantial effort to adopt the different SDG 6 targets at the national and subnational levels.

Figure 22. Extract from the National Water Agency of Brazil application where the results of indicator 6.4.2 at the national and hydrographic-region level are publicly available[9]

9 The application can be accessed at http://app.powerbi.com/view?r=eyJrjoiNmRkN2jMzctMzU2Mi00ODBmLT3NDgtODFmMWQ4OWViOGUwliwidCl6lmUwYml0MDEyLTgxMGltNDY5YS04YjRkLTY2N2ZjZDFiYWY4OCJ9.

In this application, indicator 6.4.2 has been disaggregated by hydrographic region, providing results for the indicator in the 12 different regions within the country. This makes it possible to identify the areas in which water demand and availability management actions are most urgently required. These results (from 2006 onwards) are available in a visual application within the ANA website (Figure 22). It is important to note that the values of the indicator at country level are lower than those in annex I, mainly due to a difference in the estimation of the environmental flows.

Source: ANA (2019; 2021).

Country representatives are highly encouraged to provide the information requested by AQUASTAT. In this way, bias and uncertainties in the results will be minimized, and a more effective and useful monitoring process will be performed, so that international funding and cooperation resources are better addressed.

More efforts and resources should be dedicated to increasing countries' capacities to collect, manage and report water data. The opportunities presented by including water supply, demand and allocation in Earth system models, as well as the use of remote sensing techniques that can improve knowledge on precipitation patterns, soil moisture and groundwater changes, should be explored further and promoted for and by countries to improve monitoring capacity.

To facilitate coordination across SDG 6 targets and indicators, it is crucial that a multidisciplinary team is established at country level in which the focal points of all SDG 6 indicators have the opportunity to communicate with stakeholders from across the water-use community (subsectors) on the importance of sustainable and efficient use management for achieving multiple development objectives. This would also allow responsible institutions to put the case forward for coordinated planning to balance social, economic and environmental demands.


General view of ponds of the acquafarming system, Dominica by Dwayne Benjamin ©FAO

4.3.1. Next steps in the monitoring process

- **Improve disaggregated values:** A common framework for disaggregating the indicator in a way that best captures the conditions of the freshwater withdrawals over the available water resources will be developed through case studies at country, major basin or sub-basin level. In this way, additional variables such as surface/ groundwater, gender and socioeconomic dynamics will be more accessible, and the complexities that water stress and water allocation entail will be better understood.

- **Spatially disaggregate the indicator by aquifer:** This would provide useful information for those areas that mainly rely on groundwater. However, significant methodological limits and knowledge gaps impede any global assessment of this aspect since there are varying degrees of uncertainty in water storage and aquifer groundwater withdrawals in most of the known aquifers.

- **Establish a target status methodology:** Both target 6.4 indicators are not fully operational at the local level. As a next step, a specific methodology could be established to assess the target status in terms of the impact of water scarcity and water-use efficiency change on the well-being of people – since the target includes decreasing the number of people suffering from water scarcity – and to capture variables that are not accessible at the global, regional or national level.

- **Follow-up on interlinkages with other SDGs:** Work will continue on the analysis of the synergies and trade-offs between the achievement of this and other indicators.

- **Review data gaps and data quality issues:** Further improvement of the database and data-collection process is continuously carried out and will continue throughout the next few years.

- **Resolve the issue of unavailable data from SIDS:** This issue, known to be due to the scale resolutions of the GEFIS system, is currently under consideration. A refinement of the tool will be sought to enable estimation of EFR in small geographic areas.

- **Examine the impact of climate change on water resources:** Climate change is likely to already be having an impact on the availability of water resources, due to the change in rainfall patterns and temperature. A revision of the assessment of renewable water resources will be essential to take these effects into consideration.

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Annexes

Annex I. Country data for the water stress indicator (2018)

Country	Water stress (2018)	Environmental flow requirement	Total freshwater withdrawal (2018)	Total renewable freshwater resources	Δ WS 2015–2018
	%	10^9 m^3/year	10^9 m^3/year	10^9 m^3/year	%
Afghanistan	54.76	28.29	20.282	65.33	0.00
Albania	5.76	13.56	0.958	30.2	0.23
Algeria	137.92	4.56	9.802	11.667	11.93
Angola	1.87	110.7	0.7057	148.4	0.00
Antigua and Barbuda	8.46		0.0044	0.052	0.00
Argentina	10.46	515.8	37.69	876.24	0.00
Armenia	54.75	2.812	2.714	7.769	-11.26
Australia	4.66	243.3	11.58411	492	-2.08
Austria	9.64	41.51	3.49	77.7	0.00
Azerbaijan	53.73	12.03	12.167	34.675	-0.52
Bahrain	133.71		0.1551	0.116	-3.45
Bangladesh	5.72	600.3	35.87	1227.032	0.00
Barbados	87.50		0.07	0.08	0.00
Belarus	4.58	27.56	1.39	57.9	-0.19
Belgium	49.07	10.16	3.994	18.3	0.00
Belize	1.26	13.72	0.101	21.734	0.00
Benin	0.98	13.06	0.13	26.39	0.00
Bermuda	4.24		0.0053	0.125	0.00

Country	Water stress (2018)	Environmental flow requirement	Total freshwater withdrawal (2018)	Total renewable freshwater resources	Δ WS 2015–2018
	%	10^9 m^3/year	10^9 m^3/year	10^9 m^3/year	%
Bhutan	1.41	54.1	0.3379	78	0.00
Bolivia (Plurinational State of)	1.18	396.6	2.088	574	0.00
Bosnia and Herzegovina	2.66	22.44	0.4009	37.5	-0.12
Botswana	2.02	2.677	0.193	12.24	0.06
Brazil	3.05	6532	64.61	8647	0.03
Brunei Darussalam	3.47	5.846	0.092	8.5	0.00
Bulgaria	40.10	7.771	5.425	21.3	-1.51
Burkina Faso	7.81	3.04	0.8167	13.5	0.00
Burundi	10.19	9.788	0.2801	12.536	0.00
Cabo Verde	8.43		0.0253	0.3	0.00
Cambodia	1.04	265.4	2.184	476.1	0.00
Cameroon	1.56	213.4	1.0884	283.15	0.00
Canada	3.67	1931	35.6	2902	-0.01
Central African Republic	0.34	119.4	0.0725	141	0.00
Chad	4.29	25.22	0.8796	45.7	0.00
Chile	21.62	529.3	85.128	923.06	1.26
China	43.22	1471	591.8	2840.22	0.00
Colombia	2.04	1692	13.6019057	2360	0.04
Comoros	0.83		0.01	1.2	0.00
Congo	0.03	664.4	0.046	832	0.00
Costa Rica	4.11	54.4	2.41	113	-1.34
Côte d'Ivoire	5.09	61.3	1.162	84.14	0.00
Croatia	1.50	60.52	0.673	105.5	-0.02
Cuba	23.94	9.055	6.958	38.12	0.00
Cyprus	28.29	0.0484	0.207	0.78	-3.42
Czechia	24.19	6.574	1.591	13.15	-0.14
Democratic People's Republic of Korea	27.74	45.94	8.6578	77.15	0.00
Democratic Republic of the Congo	0.23	981.7	0.6836	1283	0.00

Country	Water stress (2018)	Environmental flow requirement	Total freshwater withdrawal (2018)	Total renewable freshwater resources	Δ WS 2015–2018
	%	10^9 m^3/year	10^9 m^3/year	10^9 m^3/year	%
Denmark	28.93	2.302	1.07	6	6.98
Djibouti	6.33		0.019	0.3	0.00
Dominica	10.00		0.02	0.2	0.00
Dominican Republic	50.31	5.456	9.0779	23.5	0.00
Ecuador	6.78	296.2	9.9158	442.4	0.00
Egypt	116.94	2.6	64.2	57.5	6.38
El Salvador	13.21	10.24	2.118	26.27	0.00
Equatorial Guinea	0.18	15.21	0.0198	26	0.00
Eritrea	11.18	2.107	0.582	7.315	0.00
Estonia	17.41	3.566	1.60855	12.806	0.31
Eswatini	77.56	3.133	1.068	4.51	0.00
Ethiopia	32.26	89.3	10.5481	122	0.75
Fiji	0.30		0.0849	28.55	0.00
Finland	15.56	67.83	6.562	110	0.00
France	23.64	96.77	27.007	211	-0.98
Gabon	0.50	138.3	0.1391	166	0.00
Gambia	2.21	3.402	0.1016	8	0.00
Georgia	4.21	32.63	1.29112	63.33	-0.52
Germany	33.50	81.04	24.443	154	-0.41
Ghana	6.31	33.26	1.4486	56.2	0.04
Greece	20.48	18.97	10.122	68.4	0.44
Grenada	7.05		0.0141	0.2	0.00
Guatemala	5.74	70.02	3.3241	127.91	0.00
Guinea	1.37	161	0.89	226	0.11
Guinea-Bissau	1.50	19.7	0.175	31.4	0.00
Guyana	3.30	227.2	1.4447	271	0.00
Haiti	13.38	3.188	1.45	14.022	0.00
Honduras	4.62	57.39	1.607	92.164	0.00
Hungary	7.65	46.1	4.43	104	0.69
Iceland	0.39	96.41	0.29	170	0.01

Country	Water stress (2018)	Environmental flow requirement	Total freshwater withdrawal (2018)	Total renewable freshwater resources	Δ WS 2015–2018
	%	10^9 m^3/year	10^9 m^3/year	10^9 m^3/year	%
India	66.49	937.1	647.5	1910.9	0.00
Indonesia	29.70	1269	222.635	2018.7	0.92
Iran (Islamic Republic of)	81.29	22.7	92.95	137.045	0.00
Iraq	47.13	18.66	33.559	89.86	-1.89
Ireland	6.87	31.22	1.427	52	1.08
Israel	95.94	0.6209	1.112	1.78	-2.93
Italy	30.00	77.81	34.0457	191.3	0.00
Jamaica	12.47		1.35	10.823	4.80
Japan	36.46	212.5	79.3	430	-0.22
Jordan	100.08	0.0341	0.9036	0.937	3.92
Kazakhstan	32.65	36.31	23.542	108.41	2.61
Kenya	33.24	18.57	4.032	30.7	6.69
Kuwait	3850.50		0.7701	0.02	451.50
Kyrgyzstan	50.04	8.216	7.707	23.618	0.00
Lao People's Democratic Republic	4.77	180.1	7.32	333.5	-0.35
Latvia	1.08	17.97	0.18335	34.94	0.04
Lebanon	58.79	1.421	1.812	4.503	0.00
Lesotho	2.57	1.315	0.0438	3.022	0.00
Liberia	0.26	176.8	0.1459	232	0.00
Libya	817.14		5.72	0.7	0.00
Lithuania	1.83	10.63	0.25439	24.5	-0.92
Luxembourg	4.33	2.294	0.0522	3.5	0.61
Madagascar	11.34	217.5	13.5569	337	0.00
Malawi	17.50	9.529	1.3568	17.28	0.00
Malaysia	3.44	385	6.707	580	0.25
Maldives	15.67		0.0047	0.03	0.00
Mali	8.00	55.2	5.186	120	0.00
Malta	81.74		0.04128	0.0505	-1.03
Mauritania	13.25	1.222	1.3482	11.4	0.00

Country	Water stress (2018)	Environmental flow requirement	Total freshwater withdrawal (2018)	Total renewable freshwater resources	Δ WS 2015–2018
	%	10^9 m^3/year	10^9 m^3/year	10^9 m^3/year	%
Mauritius	21.48		0.591	2.751	-0.77
Mexico	33.32	195.3	88.84	461.888	1.19
Mongolia	3.40	21.18	0.4624	34.8	0.25
Morocco	50.75	8.167	10.573	29	0.00
Mozambique	1.75	133	1.473	217.1	0.00
Myanmar	5.80	595	33.231	1167.8	0.00
Namibia	0.86	7.19	0.2819	39.91	0.00
Nepal	8.31	95.94	9.4971	210.2	0.00
Netherlands	15.38	38.33	8.0987	91	-0.59
New Zealand	8.05	204.3	9.875	327	0.00
Nicaragua	2.69	107.2	1.5433	164.52	0.00
Niger	7.45	10.61	1.7472	34.05	0.11
Nigeria	9.67	157.2	12.472	286.2	0.00
North Macedonia	25.27	2.268	1.044	6.4	4.44
Norway	2.05	261.5	2.6911	393	-0.01
Oman	116.71		1.634	1.4	0.00
Pakistan	118.24	83.79	192.74	246.8	-2.55
Palestine	62.76	0.1359	0.44	0.837	11.47
Panama	0.90	4.864	1.2114	139.304	-0.03
Papua New Guinea	0.13	504.5	0.3921	801	0.00
Paraguay	1.84	256.3	2.413	387.77	0.00
Peru	6.54	1343	35.133	1879.8	3.60
Philippines	28.66	151.9	93.73514	479	2.25
Poland	33.22	31.61	9.598	60.5	-2.94
Portugal	12.32	27.63	6.12953	77.4	-4.98
Puerto Rico	19.54	2.621	0.875	7.1	0.00
Qatar	431.03		0.25	0.058	0.00
Republic of Korea	85.22	35.44	29.197	69.7	0.00
Republic of Moldova	12.43	5.536	0.837	12.27	-0.04
Réunion	15.33		0.7667	5	0.00

Country	Water stress (2018)	Environmental flow requirement	Total freshwater withdrawal (2018)	Total renewable freshwater resources	Δ WS 2015–2018
	%	10^9 m^3/year	10^9 m^3/year	10^9 m^3/year	%
Romania	6.01	105.2	6.416	212.01	-0.04
Russian Federation	4.04	2953	63.58	4525.445	0.07
Rwanda	6.09	10.28	0.1839	13.3	0.00
Saint Kitts and Nevis	50.83		0.0122	0.024	0.00
Saint Lucia	14.30		0.0429	0.3	0.00
Saint Vincent and the Grenadines	7.90		0.0079	0.1	0.00
São Tomé and Príncipe	1.88		0.0409	2.18	0.07
Saudi Arabia	992.83		23.828	2.4	43.96
Senegal	11.81	20.16	2.22095	38.97	0.00
Serbia	6.26	73.47	5.5575	162.2	0.98
Sierra Leone	0.50	117.2	0.2122	160	0.00
Singapore	82.02		0.4921	0.6	-2.56
Slovakia	2.39	26.86	0.5565	50.1	-0.08
Slovenia	6.50	17.08	0.961	31.87	0.43
Somalia	24.53	1.254	3.298	14.7	0.00
South Africa	63.56	20.12	19.85	51.35	3.81
South Sudan	4.23	33.93	0.658	49.5	0.00
Spain	42.56	38.15	31.221	111.5	-0.40
Sri Lanka	90.79	38.54	12.946	52.8	0.00
Sudan	118.66	15.1	26.935	37.8	0.00
Suriname	3.95	83.41	0.6159	99	0.00
Sweden	3.43	104.7	2.375	174	0.00
Switzerland	6.50	27.28	1.704	53.5	0.00
Syrian Arab Republic	124.36	5.573	13.9644	16.802	0.00
Tajikistan	61.51	6.752	9.324	21.91	-7.23
Thailand	23.01	189.6	57.307	438.61	0.00
Timor-Leste	28.27	4.069	1.172	8.215	0.00
Togo	3.39	8.125	0.223	14.7	0.00
Trinidad and Tobago	20.33	2.186	0.3362	3.84	0.00

Country	Water stress (2018)	Environmental flow requirement	Total freshwater withdrawal (2018)	Total renewable freshwater resources	Δ WS 2015–2018
	%	10^9 m^3/year	10^9 m^3/year	10^9 m^3/year	%
Tunisia	96.00	0.6767	3.78072	4.615	-11.94
Turkey	45.38	76.97	61.09358	211.6	5.49
Turkmenistan	143.56	5.355	27.865	24.765	0.00
Uganda	5.83	49.17	0.637	60.1	0.00
Ukraine	13.87	98.1	10.705	175.28	2.07
United Arab Emirates	1667.33		2.501	0.15	-101.76
United Kingdom	14.35	88.35	8.419	147	0.44
United Republic of Tanzania	12.96	56.28	5.184	96.27	0.00
United States of America	28.16	1491	444.396112	3069	0.00
Uruguay	9.79	134.8	3.66	172.2	0.00
Uzbekistan	168.92	14	58.904	48.87	10.79
Venezuela (Bolivarian Republic of)	7.54	1025	22.6211	1325	0.00
Viet Nam	18.13	432.6	81.862	884.12	0.00
Yemen	169.76		3.565	2.1	0.00
Zambia	2.84	49.36	1.572	104.8	0.00
Zimbabwe	35.41	9.348	3.77138	20	3.54


Praia, Cabo Verde, West Africa, 19-22 March 2019 ©FAO

Annex II. AQUASTAT questionnaire template

NATIONAL DATA

0	Water resources				
0.1.		**Unit**	**2016**	**2017**	**2018**
011	Total renewable water resources (long-term average)	10^9 m^3/year			

I	Water resources				
I.1.	**Water withdrawals by sector**	**Unit**	**2016**	**2017**	**2018**
111	Total water withdrawal (1111 + 1112 + 1113)	10^9 m^3/year			
1111	Agricultural water withdrawal: total (11111 + 11112 + 11113)				
11111	Water withdrawal for irrigation				
11112	Water withdrawal for livestock (watering and cleaning)				
11113	Water withdrawal for aquaculture				
1112	Municipal water withdrawal				
1113	Industrial water withdrawal (incl. water for cooling of thermoelectric plants)				
11131	Water withdrawal for cooling of thermoelectric plants				
112	Environmental flow requirements (stable over time)				
I.2.	**Water withdrawals by source**	**Unit**	**2016**	**2017**	**2018**
121	Total surface water and groundwater withdrawal (freshwater) (1211 + 1212)	10^9 m^3/year			
1211	Surface water withdrawal				
1212	Groundwater withdrawal				
122	Desalinated water produced				
123	Direct use of treated municipal wastewater				
124	Direct use of agricultural drainage water				

II	Municipal wastewater	Unit	2016	2017	2018
21	Produced municipal wastewater	10_9 m_3/year			
22	Collected municipal wastewater				
23	Treated municipal wastewater				

III	Irrigation and drainage	Unit	2016	2017	2018
III.1.	**Area under agricultural water management**				
311	Total agricultural water managed area (3111 + 3112 + 3113)	1,000 ha			
3111	Area equipped for irrigation: total (31112 + 31113 + 31114)				
31111	Area equipped for irrigation: part actually irrigated				
31112	Area equipped for full control irrigation: total (311122 + 3111232 + 311124)				
311121	Area equipped for full control irrigation: part actually irrigated				
311122	Area equipped for full control irrigation: surface irrigation				
311123	Area equipped for full control irrigation: sprinkler irrigation				
311124	Area equipped for full control irrigation: localized irrigation				
31113	Area equipped for irrigation: equipped lowland areas				
31114	Area equipped for irrigation: spate irrigation				
3112	Cultivated wetlands and inland valley bottoms non-equipped				
3113	Flood recession cropping area non-equipped				
III.2.	**Irrigated production**				
321	Total harvested irrigated crop area (full control irrigation only)	1,000 ha			
III.3.	**Drainage**				
331	Area equipped for irrigation drained	1,000 ha			
IV	**Environment**	**Unit**	**2016**	**2017**	**2018**
41	Area salinized by irrigation	1,000 ha			

SDG INDICATOR 6.4.1 ON WATER-USE EFFICIENCY – COMPUTATION (IN USD/M³)

This worksheet is a tool to automatically calculate the SDG indicator 6.4.1 on water-use efficiency. Please do not touch: no compilation is required. It is automatically filled in based on the data you provided in the "National Data" worksheet and some additional data (see table below). If the indicator is not calculated, too many variables are missing – please check if you can fill in more variables in the "National data" worksheet. Bright blue cells are calculated based on the data automatically filled in grey blue cells.

IRRIGATED AGRICULTURE WATER-USE EFFICIENCY (Awe)		UNIT		CALCULATION RULES
Ratio between rain-fed and irrigated yields	[1]	0.000	decimals	AQUASTAT data (below) used if no data are entered
Proportion of irrigated land on the total arable land (Ai)	[2]	#N/D	decimals	=[3]/[4]
Irrigated land	[3]	#N/D	1000 ha	
Cultivated land	[4]	#N/D	1000 ha	
Proportion of agricultural gross value added (GVA) produced by rain-fed agriculture (Cr)	[5]	#N/D	decimals	=(1/(1+([2]/((1-[2])*[1]))))
Gross value added by agriculture (excluding river and marine fisheries and forestry)	[7]	#N/D	USD (2015 price)	
Volume of water used by the agricultural sector (including irrigation, livestock and aquaculture)	[6]	#N/D	10^9 m^3	
Irrigated agriculture water-use efficiency	[8]	#N/D	USD/m^3	=([7]*(1-[5]))/([6]*1000000000)

MIMEC WATER-USE EFFICIENCY (Mwe)				
Gross value added by MIMEC sector (including energy)	[9]	#N/D	USD (2015 price)	
Volume of water used by the MIMEC sector (including energy)	[10]	#N/D	10^9 m³	
MIMEC sector water-use efficiency	[11]	#N/D	USD/m³	=([7]*(1-[5]))/([6]*1000000000)
SERVICES WATER-USE EFFICIENCY (Swe)				
Gross value added by services	[12]	#N/D	USD (2015 price)	
Volume of water used by the services	[13]	#N/D	10^9 m³	
Services water-use efficiency	[14]	#N/D	USD/m³	**=[12]/([13]*1000000000)**
WATER-USE EFFICIENCY (WUE)				
Proportion of water used by the agricultural sector over the total water use	[15]	#N/D	decimals	=[6]/([6]+[10]+[13])
Proportion of water used by the MIMEC sector over the total water use	[16]	#N/D	decimals	=[10]/([6]+[10]+[13])
Proportion of water used by the service sector over the total water use	[17]	#N/D	decimals	=[13]/([6]+[10]+[13])
Water-use efficiency	[18]	#N/D	USD/m³	=([15]*[8])+([16]*[11])+([17]*[14])

Additional data used in the computation of the SDG 6.4.1:

Source	Variable	Unit	2016	2017	2018
UNSD	Agriculture, value added to GDP	USD (current)	0	0	0
	Industry, value added to GDP (MIMEC)	USD (current)	0	0	0
	Services, value added to GDP	USD (current)	0	0	0
FAOSTAT	GDP Deflator (2015)	-	0	0	0
	Cultivated land (arable land + permanent crop)	1,000 ha	0	0	0
AQUASTAT	Ratio between rain-fed and irrigated yields	%			0.000

SDG INDICATOR 6.4.2 ON WATER STRESS – COMPUTATION (IN %)

WATER STRESS			UNIT	CALCULATION RULES
Total freshwater withdrawal (surface + groundwater)	[1]	#N/D	10^9 m³	=[2]-[3]-[4]-[5] if missing from "National data"
Total water withdrawal	[2]	#N/D	10^9 m³	**#N/D**
Desalinated water produced	[3]	#N/D	10^9 m³	
Direct use of treated municipal wastewater	[4]	#N/D	10^9 m³	
Direct use of agricultural drainage water	[5]	#N/D	10^9 m³	
Total renewable freshwater resources	[6]	#N/D	10^9 m³	AQUASTAT data (below) used if no data are entered
Environmental flow requirements (volume)	[7]	#N/D	10^9 m³	FAO-IMWI data (below) used if no data are entered
Water stress	[8]	#N/D	%	=[1]/([6]-([7]/100))

Additional data used in the computation of the SDG 6.4.2:

Source	Variable	Unit	2016	2017
AQUASTAT	Total renewable freshwater resources	10^9 m³		0
FAO & IWMI	Environmental flow requirements	10^9 m³		0

Annex III. Approach used to disaggregate the SDG 6.4.2 by major river basin

Sustainable management of water resources cannot disregard the economic needs and choices linked to their use and the environmental and demographic conditions of each area. In fact, the indicator can be calculated as the sum of the withdrawals by different economic sectors divided by the total renewable freshwater resources (TRWR), while considering the environmental flow requirements (EFR). The economic sectors used for such purpose are those identified in the metadata of the indicator SDG 6.4.1 ("change in water-use efficiency over time") (UNSTATS, 2020) to maintain consistency among the two indicators. The disaggregated formula of SDG 6.4.2 becomes:

$$Water\ stress\ (\%) = \frac{V_A + V_S + V_M}{TRWR - EFR} * 100$$

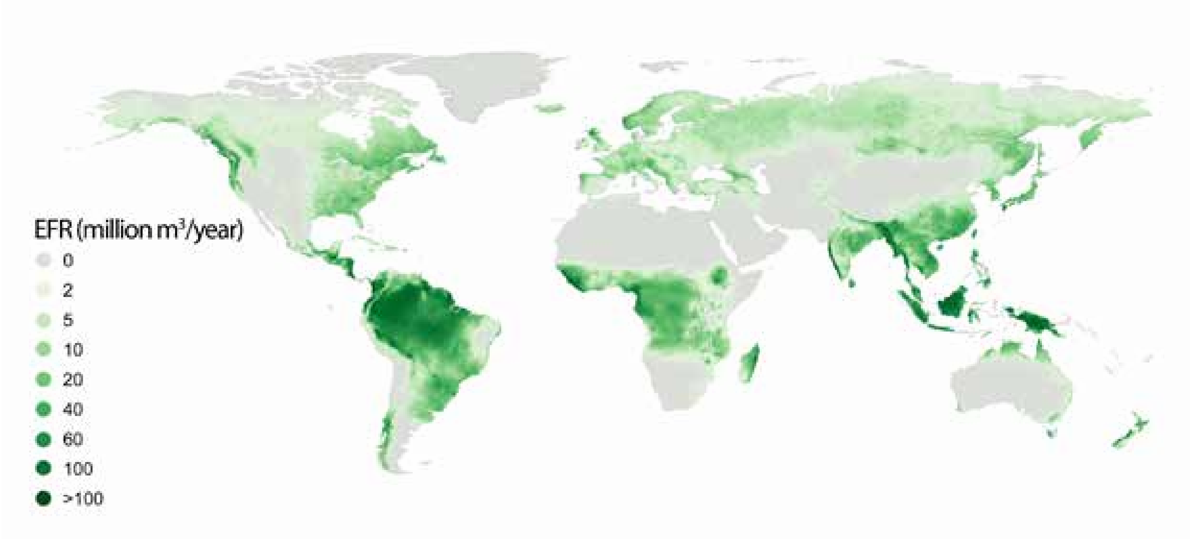
In this calculation, "V_A" is the volume of freshwater withdrawal by the agriculture sector, including irrigation (including nurseries), livestock (watering and cleaning) and freshwater aquaculture. "V_S" is the volume of freshwater withdrawal by the service sector. "V_M" is the volume of freshwater withdrawal by the industrial sector. "TRWR" is the total renewable freshwater resources. "EFR" is the environmental flow requirements. All the variables are expressed as volumes in million m^3.

TRWR refers to the fresh water available for use in a territory and includes surface waters (lakes, rivers and streams) and groundwater. In this global disaggregation analysis of SDG 6.4.2, the TRWR at basin level have been estimated using GlobWat (Hoogeveen et al., 2015), a global water balance model used by FAO to assess water use in irrigated agriculture. GlobWat, which can be downloaded online, is based on spatially distributed high-resolution data sets that are consistent at global level and calibrated against long-term averages for internal renewable water resources (IRWR), as published in the AQUASTAT database. To assess the TRWR of each major river basin annually, we have considered the sum of the annual drainage and of the annual groundwater recharge estimated by the model per basin.

$$TRWR = P - ET_{act} = Drainage + GW$$

In this calculation, "P" is the precipitation, "ET_{act}" is the actual evapotranspiration (water consumption), "Drainage" is the surface run-off (million m^3), and "GW" is the groundwater recharge (million m^3).

Figure III.1. Global distribution of environmental flows (2018)



Source: Biancalani and Marinelli (forthcoming).

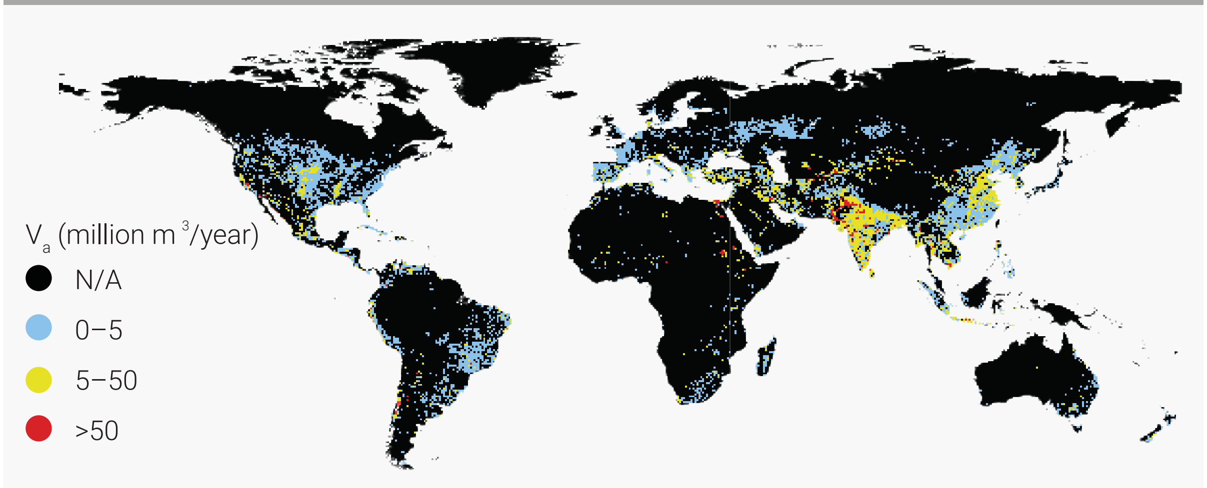
Note: The resolution is 5 arc minutes (approximately 10 km at the equator).

The **EFR** were assessed using the data published online by the International Water Management Institute (IWMI) in the Global Environmental Flows Information System (GEFIS).[10] In particular, GEFIS provides the environmental flow value as a percentage of the total actual flow. This percentage value has subsequently been applied to the amount of TRWR as estimated by GlobWat, in order to achieve a volume of EFR that is consistent with the estimation of water resources available in AQUASTAT.

Only a few countries had **agriculture freshwater withdrawal** (V_A) data disaggregated for irrigation, livestock and aquaculture available. However, those that were available showed irrigation water withdrawal ranges between 70 percent and 90 percent of the overall agriculture water withdrawal (Food and Agriculture Organization of the United Nations [FAO], 2021). Therefore, irrigation water withdrawal was used as a proxy to estimate V_A. To assess the volume of water withdrawn for agriculture, we used GlobWat to assess the annual incremental evapotranspiration due to irrigation (ETinc-irr). This is an estimation of the irrigation water consumed in irrigated areas, meaning the share of the water withdrawn actually used by the crop or evaporated from the ground. From ETinc-irr, the spatialization was derived through the consumptive ratio, defined as the ratio between (i) ETinc-irr estimated with GlobWat and (ii) the national V_A for 2018 available in AQUASTAT.

10 See http://gef.iwmi.org/.

Figure III.2. Global distribution of the agriculture water withdrawal (2018)



Source: FAO IMI-SDG6 elaboration based on FAO. 2021a and GEFIS (http://gef.iwmi.org/)

Note: The resolution is 5 arc minutes (approximately 10 km at the equator).

The **volume of water withdrawn by the service** or municipal sector largely depends on the number of people living in a certain area. Therefore, for this sector, we started by analysing the population density (using the Global Human Settlement Layer [GHSL] – Schiavina, Freire and MacManus, 2019) and then considered the access to water through "basic services" both in rural and urban areas. This category includes all the people who can access water through an infrastructure or within a walking distance of less than 30 minutes. Then, using the data available in AQUASTAT (for 2018), the service water withdrawal per capita was calculated for each country, followed by the spatialized global map of the service water withdrawal. To determine the number of people accessing water through "basic services", we used the data set produced by the Joint Monitoring Programme (JMP) on water supply, sanitation and hygiene. For those countries for which JMP data were not available, the analysis was based only on the GHSL population data (for example, Timor-Leste).

For the **industrial water withdrawal**, considering that global data on the distribution of industrial settlements are not available, it was assumed that the population density layer (in the GHSL – JRC, 2019), based on the Nighttime Lights satellite data, would provide a good proxy of where electricity is requested and consumed and therefore where industries are located over the world, in order to estimate how much water each inhabitant uses in this sector.

Figure III.3. Service water withdrawal for the year 2018 (Vs 2018) spatialized using the Global Human Settlement Layer population density layer and the Joint Monitoring Programme database (access to water through "basic services")

Source: Biancalani and Marinelli (forthcoming).

Note: This figure shows the New York area in the United States of America. The spatial resolution is 30 arc seconds (approximately 1 km at the equator).

Starting with the population density, we considered the percentage of people with access to electricity and living in rural and urban areas. This information is publicly available for several years on the World Bank website (Sustainable Energy for All [SE4ALL], 2010). Then, using AQUASTAT data, we calculated the industrial freshwater withdrawal per inhabitant per year and finally the global map industrial freshwater withdrawal for year 2018 expressed in volumes.

Once all the variables of the indicator formula had been spatialized, we calculated the Sustainable Development Goal (SDG) indicator 6.4.2 value by major river basin.

Both the assumptions made and the global input data sets used to feed the GlobWat model could be sources of uncertainty in the output.

In light of these challenges, we will continue our research on disaggregation to improve the quality of the final results once more accurate and recent global data sets become available for this topic.

Annex IV. Indicators-related basic documents and information resources

FAO. **SDG 6.4.1 page**: http://www.fao.org/sustainable-development-goals/indicators/641/en/ (available in Arabic, Chinese, English, French, Russian, Spanish).

FAO. **SDG 6.4.2 page**: http://www.fao.org/sustainable-development-goals/indicators/642/en/ (available in Arabic, Chinese, English, French, Russian, Spanish).

FAO. **SDG 6.4.1** metadata: https://unstats.un.org/sdgs/metadata/files/Metadata-06-04-01.pdf (available in English).

FAO. **SDG 6.4.2 metadata**: https://unstats.un.org/sdgs/metadata/files/Metadata-06-04-02.pdf (available in Arabic, English).

FAO. **Step-by-step monitoring methodology for SDG 6.4.1**: http://www.fao.org/3/ca8484en/ca8484en.pdf (available in Arabic, English, French, Russian and Spanish).

FAO. **Step-by-step monitoring methodology for SDG 6.4.2**: http://www.fao.org/3/ca8483en/ca8483en.pdf (available in Arabic, English, French, Russian and Spanish).

FAO. **SDG 6.4.1 e-learning course**: https://elearning.fao.org/course/view.php?id=475 (available in English and Russian; Arabic, French and Spanish forthcoming).

FAO. **SDG 6.4.2 e-learning course**: https://elearning.fao.org/course/view.php?id=365 (available in English, French, Russian and Spanish; Arabic forthcoming).

FAO. SDG 6.4 monitoring sustainable use of water resources papers. **Change in water-use efficiency over time (SDG indicator 6.4.1). Analysis and interpretation of preliminary results in key regions and countries**: http://www.fao.org/3/ca5400en/ca5400en.pdf (available in English).

FAO. SDG 6.4 monitoring sustainable use of water resources papers. **The Agronomic Parameters in the SDG Indicator 6.4.1: Yield Ratio and Proportion of Rainfed Production – Guidelines for Calculation at Country Level for Global Reporting** (forthcoming).

FAO. SDG 6.4 monitoring sustainable use of water resources papers. **Incorporating environmental flows into "water stress" indicator 6.4.2 - Guidelines for a minimum standard method for global reporting**: http://www.fao.org/3/CA3097EN/ca3097en.pdf (available in English and French).

FAO. **AQUASTAT database**: http://www.fao.org/aquastat/en/.

FAO and UN Water. **Progress on Water-Use Efficiency – Global baseline for SDG indicator 6.4.1 – 2018**. http://www.unwater.org/publications/progress-on-water-use-efficiency-641/(availablein Arabic, Chinese, English, French, Russian and Spanish).

FAO and UN Water. **Progress on Level of Water Stress – Global baseline for SDG indicator 6.4.2 - 2018**: http://www.unwater.org/publications/progress-on-level-of-water-stress-642/(availablein Arabic, Chinese, English, French, Russian and Spanish).

IWMI. **Global Environmental Flow Information System**: http://eflows.iwmi.org/ (available in English).

UN DESA. **ISIC - International Standard Industrial Classification of All Economic Activities (ISIC), Rev. 4:** https://unstats.un.org/unsd/publication/SeriesM/seriesm_4rev4e.pdf (available in Arabic, Chinese, English, French, Japanese, Russian and Spanish).

UN DESA. **System of Environmental-Economic Accounts for Water (SEEA-Water):** https://seea.un.org/content/seea-water (available in Chinese, English, French, Russian and Spanish).

Learn more about progress towards SDG 6

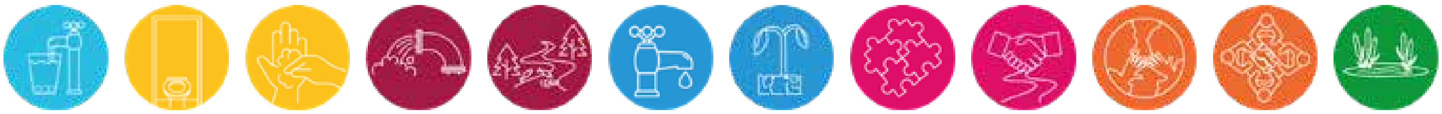
How is the world doing on **Sustainable Development Goal 6**? View, analyse and download global, regional and national water and sanitation data: https://www.sdg6data.org/

Sustainable Development Goal (SDG) 6 expands the Millennium Development Goal (MDG) focus on drinking water and basic sanitation to include the more holistic management of water, wastewater and ecosystem resources, acknowledging the importance of an enabling environment. Bringing these aspects together is an initial step towards addressing sector fragmentation and enabling coherent and sustainable management. It is also a major step towards a sustainable water future.

Monitoring progress towards SDG 6 is key to achieving this SDG. High-quality data help policymakers and decision makers at all levels of government to identify challenges and opportunities, to set priorities for more effective and efficient implementation, to communicate progress and ensure accountability, and to generate political, public and private sector support for further investment.

The 2030 Agenda for Sustainable Development specifies that global follow-up and review shall primarily be based on national official data sources. The data are compiled and validated by the United Nations custodian agencies, who contact country focal points every two to three years with requests for new data, while also providing capacity-building support. The last global "data drive" took place in 2020, resulting in status updates on nine of the global indicators for SDG 6 (please see below). These reports provide a detailed analysis of current status, historical progress and acceleration needs regarding the SDG 6 targets.

To enable a comprehensive assessment and analysis of overall progress towards SDG 6, it is essential to bring together data on all the SDG 6 global indicators and other key social, economic and environmental parameters. This is exactly what the SDG 6 Data Portal does, enabling global, regional and national actors in various sectors to see the bigger picture, thus helping them make decisions that contribute to all SDGs. UN-Water also publishes synthesized reporting on overall progress towards SDG 6 on a regular basis.



Summary Progress Update 2021: SDG 6 – Water and Sanitation for All	Based on latest available data on all SDG 6 global indicators. Published by UN-Water through the UN-Water Integrated Monitoring Initiative for SDG 6. https://www.unwater.org/publications/summary-progress-update-2021-sdg-6-water-and-sanitation-for-all/
Progress on Household Drinking Water, Sanitation and Hygiene – 2021 Update	Based on latest available data on SDG indicators 6.1.1 and 6.2.1. Published by World Health Organization (WHO) and United Nations Children's Fund (UNICEF). https://www.unwater.org/publications/who-unicef-joint-monitoring-program-for-water-supply-sanitation-and-hygiene-jmp-progress-on-household-drinking-water-sanitation-and-hygiene-2000-2020/
Progress on Wastewater Treatment – 2021 Update	Based on latest available data on SDG indicator 6.3.1. Published by WHO and United Nations Human Settlements Programme (UN-Habitat) on behalf of UN-Water. https://www.unwater.org/publications/progress-on-wastewater-treatment-631-2021-update/
Progress on Ambient Water Quality – 2021 Update	Based on latest available data on SDG indicator 6.3.2. Published by United Nations Environment Programme (UNEP) on behalf of UN-Water. https://www.unwater.org/publications/progress-on-ambient-water-quality-632-2021-update/
Progress on Water-Use Efficiency – 2021 Update	Based on latest available data on SDG indicator 6.4.1. Published by Food and Agriculture Organization of the United Nations (FAO) on behalf of UN-Water. https://www.unwater.org/publications/progress-on-water-use-efficiency-641-2021-update/
Progress on Level of Water Stress – 2021 Update	Based on latest available data on SDG indicator 6.4.2. Published by FAO on behalf of UN-Water. https://www.unwater.org/publications/progress-on-level-of-water-stress-642-2021-update/
Progress on Integrated Water Resources Management – 2021 Update	Based on latest available data on SDG indicator 6.5.1. Published by UNEP on behalf of UN-Water. https://www.unwater.org/publications/progress-on-integrated-water-resources-management-651-2021-update/
Progress on Transboundary Water Cooperation – 2021 Update	Based on latest available data on SDG indicator 6.5.2. Published by United Nations Economic Commission for Europe (UNECE) and United Nations Educational, Scientific and Cultural Organization (UNESCO) on behalf of UN-Water. https://www.unwater.org/publications/progress-on-transboundary-water-cooperation-652-2021-update/
Progress on Water-related Ecosystems – 2021 Update	Based on latest available data on SDG indicator 6.6.1. Published by UNEP on behalf of UN-Water. https://www.unwater.org/publications/progress-on-water-related-ecosystems-661-2021-update/
National Systems to Support Drinking-Water, Sanitation and Hygiene – Global Status Report 2019	Based on latest available data on SDG indicators 6.a.1 and 6.b.1. Published by WHO through the UN-Water Global Analysis and Assessment of Sanitation and Drinking-Water (GLAAS) on behalf of UN-Water. https://www.unwater.org/publication_categories/glaas/

UN-Water reports

UN-Water coordinates the efforts of United Nations entities and international organizations working on water and sanitation issues. By doing so, UN-Water seeks to increase the effectiveness of the support provided to Member States in their efforts towards achieving international agreements on water and sanitation. UN-Water publications draw on the experience and expertise of UN-Water's Members and Partners.

SDG 6 Progress Update 2021 – summary	This summary report provides an executive update on progress towards all of SDG 6 and identifies priority areas for acceleration. The report, produced by the UN-Water Integrated Monitoring Initiative for SDG 6, present new country, region and global data on all the SDG 6 global indicators.
SDG 6 Progress Update 2021 – 8 reports, by SDG 6 global indicator	This series of reports provides an in-depth update and analysis of progress towards the different SDG 6 targets and identifies priority areas for acceleration: Progress on Drinking Water, Sanitation and Hygiene (WHO and UNICEF); Progress on Wastewater Treatment (WHO and UN-Habitat); Progress on Ambient Water Quality (UNEP); Progress on Water-use Efficiency (FAO); Progress on Level of Water Stress (FAO); Progress on Integrated Water Resources Management (UNEP); Progress on Transboundary Water Cooperation (UNECE and UNESCO); Progress on Water-related Ecosystems (UNEP). The reports, produced by the responsible custodian agencies, present new country, region and global data on the SDG 6 global indicators.
UN-Water Global Analysis and Assessment of Sanitation and Drinking-Water (GLAAS)	GLAAS is produced by the World Health Organization (WHO) on behalf of UN-Water. It provides a global update on the policy frameworks, institutional arrangements, human resource base, and international and national finance streams in support of water and sanitation. It is a substantive input into the activities of Sanitation and Water for All (SWA) as well as the progress reporting on SDG 6 (see above).
United Nations World Water Development Report	The United Nations World Water Development Report (WWDR) is UN-Water's flagship report on water and sanitation issues, focusing on a different theme each year. The report is published by UNESCO, on behalf of UN-Water and its production is coordinated by the UNESCO World Water Assessment Programme. The report gives insight on main trends concerning the state, use and management of freshwater and sanitation, based on work done by the Members and Partners of UN-Water. Launched in conjunction with World Water Day, the report provides decision-makers with knowledge and tools to formulate and implement sustainable water policies. It also offers best practices and in-depth analyses to stimulate ideas and actions for better stewardship in the water sector and beyond.

The progress reports of the WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (JMP)	The JMP is affiliated with UN-Water and is responsible for global monitoring of progress towards SDG6 targets for universal access to safe and affordable drinking water and adequate and equitable sanitation and hygiene services. Every two years the JMP releases updated estimates and progress reports for WASH in households, schools and health care facilities
Policy and Analytical Briefs	UN-Water's Policy Briefs provide short and informative policy guidance on the most pressing freshwater-related issues that draw upon the combined expertise of the United Nations system. Analytical Briefs provide an analysis of emerging issues and may serve as basis for further research, discussion and future policy guidance.

UN-Water planned publications

- **UN-Water Policy Brief on Gender and Water**
- **Update of UN-Water Policy Brief on Transboundary Waters Cooperation**
- **UN-Water Analytical Brief on Water Efficiency**

More information: https://www.unwater.org/unwater-publications/

The global indicator on water stress tracks the level of pressure that human activities exert over natural freshwater resources, indicating the environmental sustainability of the use of water resources. A high level of water stress has negative effects on social and economic development, increasing competition and potential conflict among users. This calls for effective supply and demand management policies. Securing environmental flow requirements is essential to maintaining ecosystem health, resilient and available for future generations.

This indicator addresses the environmental component of target 6.4. In this report, you can learn more about the progress on the level water stress globally, by country and by major basin.

All maps are in geographic projection.

More information and the methodological guidance can be found at:
www.fao.org/sustainable-development-goals/ indicators/642/

This report is part of a series that track progress towards the various targets set out in SDG 6 using the SDG global indicators. To learn more about water and sanitation in the 2030 Agenda for Sustainable Development, and the Integrated Monitoring Initiative for SDG 6, visit our website:
www.sdg6monitoring.org

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