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Moving towards Water Security in the Arab Region

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Executive Summary

Arab States are among the most water scarce in the world, with nearly 362 million people living in countries under conditions of scarcity to absolute scarcity. In 2015, there were more than 51 million people in the Arab region lacking access to basic drinking water services, and more than 74 million people without access to basic sanitation services.[1] The freshwater scarcity situation is aggravated by several factors, such as dependency on shared water resources, pollution, climate change impacts and extreme events, non-revenue water losses from ageing systems, intermittency, inefficient use, and high population growth. Occupation and conflict also affect people's ability to access water and sanitation services.

For many States, water scarcity has been perceived as the equivalent of water insecurity, more so in countries sharing water resources with other countries, specifically those downstream. Equating scarcity to security was the prevalent concept up to the 1990s. Water security was used mainly to express the condition of having a sufficient supply to satisfy the demands of a country's population. Recently, there has been a shift from traditional notions of security and conflict towards the individual's water security, facilitated by the recognition of the human rights to water and sanitation and the advancement of sustainable development agendas.

A conceptual framework for achieving water security in the Arab region requires, first, putting people at the centre of water issues, and second, an understanding of the systemic conditions hampering its achievement. Systemic conditions vary in scale and severity, and impact water security at various levels, and thus require a flexible approach but one grounded in principles that transcend analysis.

An approach, guided by the indivisibility and universality of human rights, provides the foundation. Such an approach is cross-sectoral; it considers the implications of water security on human rights, where the achievement of such security and the right to water, for example, do not compromise the right to food or the right to development in other sectors. And such an approach can ensure coherence and consistency at various scales, from global development agendas to regional and national ones.

In the region, water scarcity is a significant challenge for sustainable development. Increasing scarce conditions are affecting water security, which in turn has implications for food and energy security, economic development, livelihoods and human health. Water security is thus tied to national and regional security considerations, which must be considered as States pursue commitments to global goals. In this context, mapping the linkages between water security common definitions and the Sustainable Development Goals (SDGs) elaborates how critical water security is to sustainable development and the need to mainstream water security within national development plans.

This report presents a conceptual framework for achieving water security in the region. It considers the regional systemic conditions of water stress and scarcity, shared water and climate change that hinder the achievement of water security, through the perspective of sustainable development, where water is central to advancing the three dimensions – economic, social and environmental – of sustainable development. This is combined with a human rights-based approach to examining the implications of water security at all levels, including community and household, to ensure water security is grounded in efforts that leave no one behind. It does so in view of an enabling environment based on a set of means of implementation.[2]

The framework, in conjunction with the principle of universality of human rights, realizes the symbiotic relationship between water security and sustainable development. It acknowledges the criticality of water to the three dimensions of sustainable development and ensures that water security reflects this requirement in seeking to achieve global, regional and national sustainable development goals. The framework provides an opportunity to mainstream water-related priorities across national development strategies and plans, maximizing synergies and creating an opportunity to capture the momentum from global to regional to national agendas for achieving water security.

The framework will benefit from the complementarity of sustainable development and human rights-based approaches, prescribing inclusivity that empowers all, including women and the most vulnerable, to participate in demanding their rights and becoming leaders in managing water resources. Additionally, it identifies the means of implementation for moving towards achieving water security based on identified priorities for the region. These focus on six axes of the enabling environment that include improved governance, regional cooperation, research and technology development, finance, reconstruction and resilience and capacity development. The need for an inclusive, participatory approach that empowers the vulnerable and draws attention to the essential role and needs of women in water security is highlighted within each.

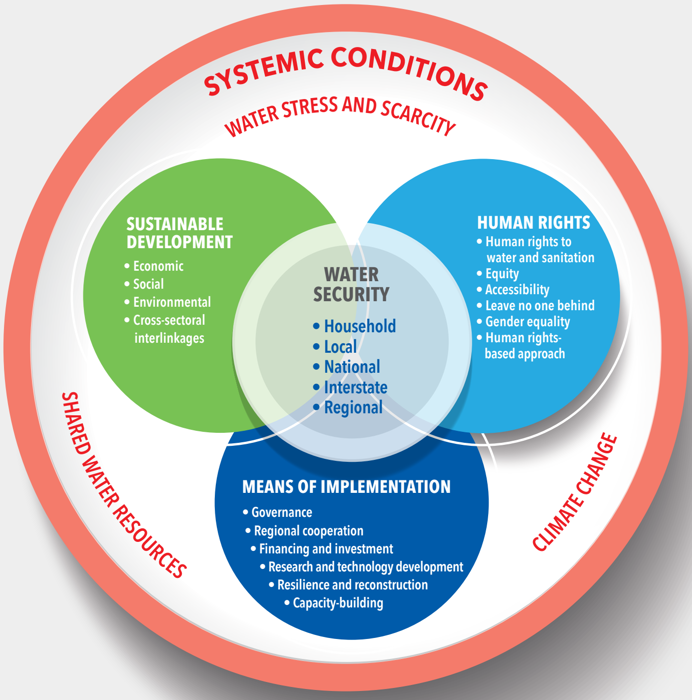
A set of recommendations based on the report's findings across the conceptual framework for achieving water security in the Arab region are presented. These include the following:

- People must be at the centre of all water issues and water security. This is ensured by a human rights-based approach that facilitates broad participation and consensus while providing a wider analysis based on international human rights principles;
- Universal blueprints for water security are non-existent, especially for the water-scarce Arab region. Approaches must match the local context, and the available water resources, specificities, strengths and challenges;
- Central decision-making within the water sector and a silos approach have failed to advance the region towards achieving water security. Consensus must be reached on strategies and sets of goals through a participatory approach that engages and empowers a range of stakeholders, not just water stakeholders;
- Water security as a regional and national priority must be mainstreamed within national development planning, utilizing various means of implementation that address several systemic conditions simultaneously to maximize synergies across sectors and build coherence at all levels;
- Women have a critical role to play in achieving water security at all scales. States should facilitate the empowerment of women and their engagement in the water sector through targeted initiatives, including setting minimum employment quotas in the water sector and financing for women's schemes;
- Policy silos are counterproductive to achieving water security. States must recognize the critical role of policy integration and harmonization, horizontally and vertically, at the national level between various sectors, at the regional level between regional and national strategies, and at the global level between various global water-related agendas and national goals and targets;
- As the majority of water resources in the Arab region are shared, regional cooperation is central to achieving water security. Traditional

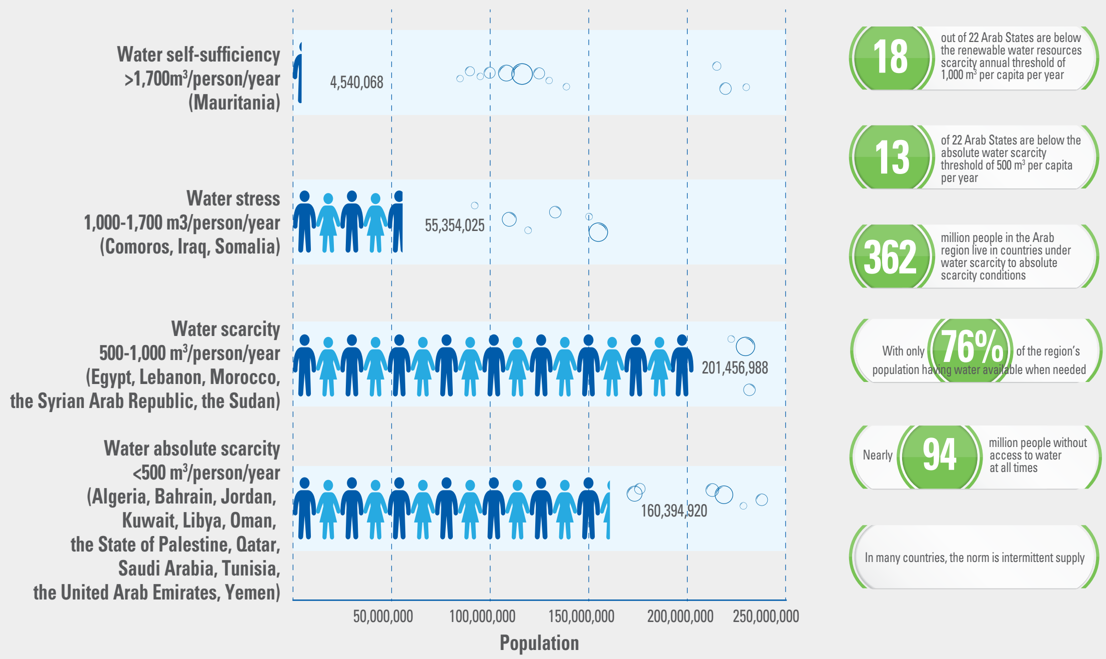
cooperation approaches focused only on water shares have failed to build trust and partnerships. Regional cooperation, based on innovative initiatives that build on iterative success and expand beyond the water sector, is vital to improving cooperation and moving towards water security;

- Water scarcity necessitates innovative solutions, developed and adapted for the region. Arab States need to prioritize and build national and regional research and development capacities combined with technological innovations to meet the increasing water demands;
- After maximizing benefits from available global funding for the region, efforts to finance water security and water-related SDGs must be increased through better national, innovative and private financing while creating the proper enabling environment;
- Transparency and accountability must advance beyond policy rhetoric. They are the key pillars to success in attracting new funding sources, successful private-sector participation and increased efficiencies;
- Climate change is expected to greatly affect the region, with decreased precipitation, increased temperatures and more frequent extreme events. This requires States to apply due diligence to improving resilience and water-related infrastructure and developing more efficient adaptive management as they move towards achieving water security;
- There is wide consensus on the need for capacity development in the region to meet the challenges of achieving water security. Targeted, efficient capacity development at various scales and levels is key to the momentous effort needed to achieve water security.

Conceptual framework for water security in the Arab region



Water scarcity in the Arab region



Major milestones to the recognition of the human rights to water and sanitation

1976 June — Vancouver Declaration on Human Settlements
Clean water is a basic human need

1977 March — Mar del Plata United Nations Water Conference
Water as a right

1979 — CEDAW
Ensure women the right to water and sanitation

1989 — Convention on the Rights of the Child
Child's right to clean drinking water

1992 January — Dublin Conference
Right to access to clean water and sanitation at an affordable price

1992 June — Rio Summit
Water as a right, commonly agreed premise

1994 — United Nations International Conference on Population and Development
Right to water and sanitation

2000 — General Assembly Resolution A/RES/54/175
Right to development, inter alia, right to clean water as a fundamental human right

2002 — General Comment 15 to the Economic and Social Council
Confirms right to water in international law and provides guidelines for interpretation

2005 — Report of Special Rapporteur on realization of the right to drinking water and sanitation
Guide to implementing the right to drinking water and sanitation

2006 — Convention on the Rights of Persons with Disabilities
Rights of persons with disabilities to clean water services

2007 — Report of the High Commissioner for Human Rights
Time to consider drinking water and sanitation as a human right

2010 July — General Assembly Resolution A/RES/64/292
Right to safe and clean drinking water and sanitation is a human right

2010 October — Human Rights Council Resolution A/HRC/RES/15/9
Human right to safe drinking water and sanitation

2014 July — Human Rights Council Resolution A/HRC/RES/26/27
Impact of climate change on right to safe drinking water and sanitation

2016 February — General Assembly Resolution A/RES/70/169
Human right to safe drinking water and sanitation

Mapping linkages between water security and SDGs and their targets

Global Water Partnership (2000)

Water security, at any level from the household to the global, means that every person has access to enough safe water at affordable cost to lead a clean, healthy, and productive life, while ensuring that the natural environment is protected and enhanced

EVERY PERSON HAS ACCESS TO ENOUGH SAFE WATER AT AFFORDABLE COST TO LEAD A CLEAN, HEALTHY AND PRODUCTIVE LIFE

- SDG 1.2, 1.4, 1.5
- SDG 2.1-2.4
- SDG 3.3, 3.9
- SDG 5.1, 5.4, 5.5
- SDG 6.1- 6.4
- SDG 7
- SDG 8
- SDG 9

NATURAL ENVIRONMENT IS PROTECTED AND ENHANCED

- SDG 2.4
- SDG 6.3, 6.6
- SDG 12.2, 12.4
- SDG 13
- SDG 14.2
- SDG 15.1, 15.4, 15.9

Ministerial Declaration of The Hague on Water Security

Ensuring that freshwater, coastal and related ecosystems are protected and improved: that sustainable development and political stability are promoted, that every person has access to enough safe water at an affordable cost to lead a healthy and productive life and that the vulnerable are protected from the risks of water-related hazards

ACCESS TO ENOUGH SAFE WATER AT AN AFFORDABLE COST TO LEAD A HEALTHY AND PRODUCTIVE LIFE

- SDG 1.4
- SDG 2
- SDG 3.3, 3.9
- SDG 5.1, 5.4, 5.5
- SDG 6.1-6.4
- SDG 7
- SDG 8
- SDG 9

ENSURE THAT FRESHWATER, COASTAL AND RELATED ECOSYSTEMS ARE PROTECTED AND IMPROVED

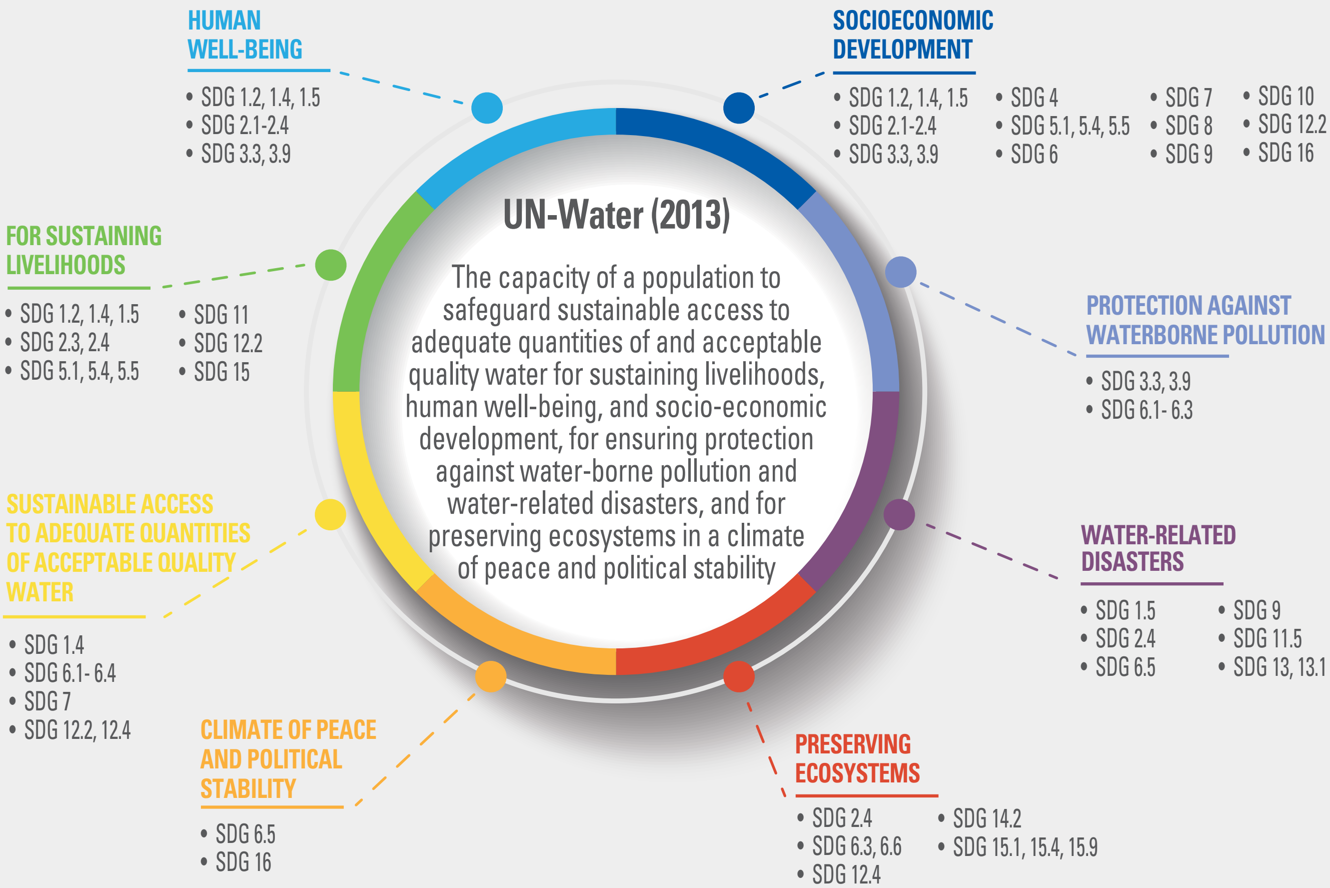
- SDG 2.4
- SDG 6.3, 6.6
- SDG 12.2, 12.4
- SDG 14.2
- SDG 15.1, 15.4, 15.9

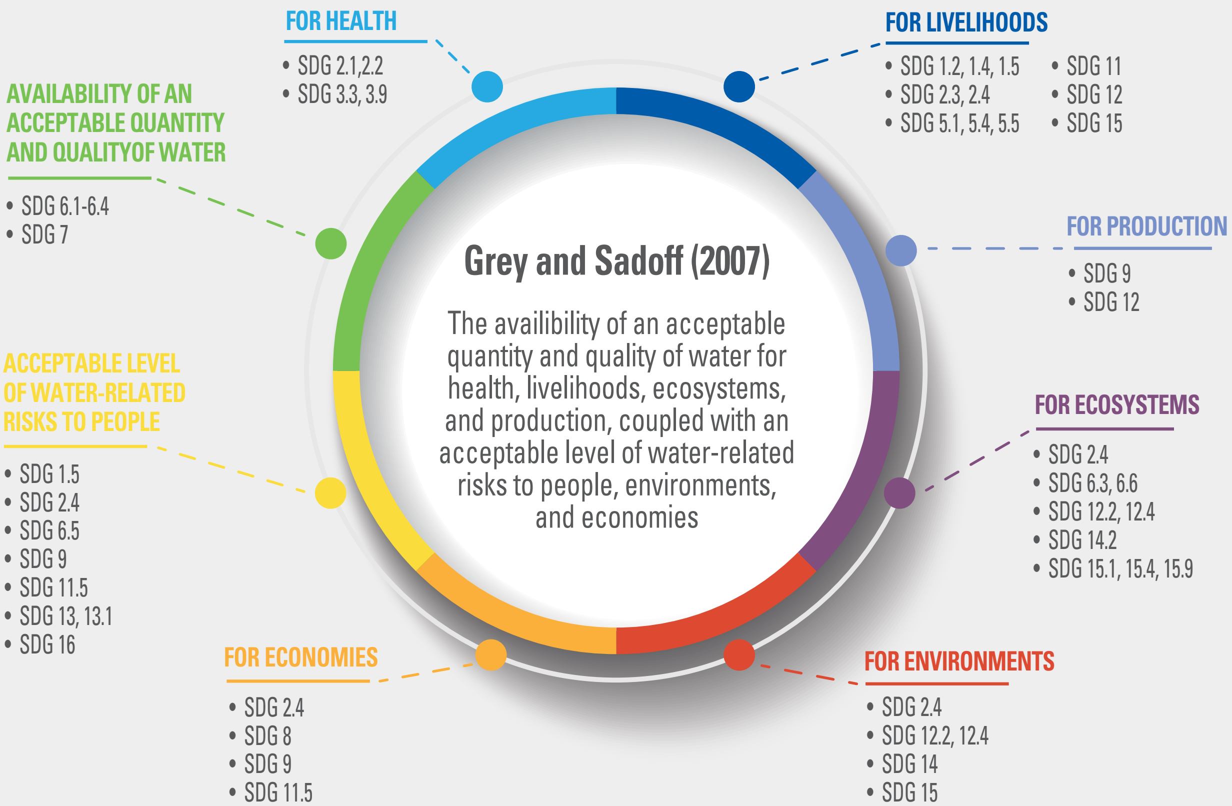
VULNERABLE ARE PROTECTED FROM THE RISKS OF WATER-RELATED HAZARDS

- SDG 1.5
- SDG 6.5
- SDG 9
- SDG 11.5
- SDG 13

SUSTAINABLE DEVELOPMENT AND POLITICAL STABILITY ARE PROMOTED

- All SDGs in general
- SDG 6.5
- SDG 16


UN-Water (2013)
The capacity of a population to safeguard sustainable access to adequate quantities of and acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability
HUMAN WELL-BEING
• SDG 1.2, 1.4, 1.5
• SDG 2.1-2.4
• SDG 3.3, 3.9
SOCIOECONOMIC DEVELOPMENT
• SDG 1.2, 1.4, 1.5
• SDG 2.1-2.4
• SDG 3.3, 3.9
• SDG 4
• SDG 5.1, 5.4, 5.5
• SDG 6
• SDG 7
• SDG 8
• SDG 9
• SDG 10
• SDG 12.2
• SDG 16
FOR SUSTAINING LIVELIHOODS
• SDG 1.2, 1.4, 1.5
• SDG 2.3, 2.4
• SDG 5.1, 5.4, 5.5
• SDG 11
• SDG 12.2
• SDG 15
PROTECTION AGAINST WATERBORNE POLLUTION
• SDG 3.3, 3.9
• SDG 6.1- 6.3
SUSTAINABLE ACCESS TO ADEQUATE QUANTITIES OF ACCEPTABLE QUALITY WATER
• SDG 1.4
• SDG 6.1- 6.4
• SDG 7
• SDG 12.2, 12.4
WATER-RELATED DISASTERS
• SDG 1.5
• SDG 2.4
• SDG 6.5
• SDG 9
• SDG 11.5
• SDG 13, 13.1
CLIMATE OF PEACE AND POLITICAL STABILITY
• SDG 6.5
• SDG 16
PRESERVING ECOSYSTEMS
• SDG 2.4
• SDG 6.3, 6.6
• SDG 12.4
• SDG 14.2
• SDG 15.1, 15.4, 15.9


Grey and Sadoff (2007)
The availibility of an acceptable quantity and quality of water for health, livelihoods, ecosystems, and production, coupled with an acceptable level of water-related risks to people, environments, and economies
FOR HEALTH
• SDG 2.1,2.2
• SDG 3.3, 3.9
FOR LIVELIHOODS
• SDG 1.2, 1.4, 1.5
• SDG 2.3, 2.4
• SDG 5.1, 5.4, 5.5
• SDG 11
• SDG 12
• SDG 15
AVAILABILITY OF AN ACCEPTABLE QUANTITY AND QUALITYOF WATER
• SDG 6.1-6.4
• SDG 7
FOR PRODUCTION
• SDG 9
• SDG 12
ACCEPTABLE LEVEL OF WATER-RELATED RISKS TO PEOPLE
• SDG 1.5
• SDG 2.4
• SDG 6.5
• SDG 9
• SDG 11.5
• SDG 13, 13.1
• SDG 16
FOR ECOSYSTEMS
• SDG 2.4
• SDG 6.3, 6.6
• SDG 12.2, 12.4
• SDG 14.2
• SDG 15.1, 15.4, 15.9
FOR ECONOMIES
• SDG 2.4
• SDG 8
• SDG 9
• SDG 11.5
FOR ENVIRONMENTS
• SDG 2.4
• SDG 12.2, 12.4
• SDG 14
• SDG 15

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Acronyms

ACWUA	Arab Countries Water Utilities Association
AFED	Arab Forum for Environment and Development
AMWC	Arab Ministerial Water Council
BGR	Federal Institute for Geosciences and Natural Resources
CAMRE	Council of Arab Ministers Responsible for the Environment
CEDAW	Convention on the Elimination of All Forms of Discrimination Against Women
ESCWA	United Nations Economic and Social Commission for Western Asia
EWASH	Emergency, Water, Sanitation and Hygiene Group
FAO	Food and Agriculture Organization of the United Nations
GCC	Gulf Cooperation Council
GDP	gross domestic product
GEF	Global Environment Facility
GWP	Global Water Partnership
IDPs	internally displaced persons
IEA-ETSAP	Energy Technology Systems Analysis Program of the International Energy Agency
IGRAC	International Groundwater Resources Assessment Centre
IOM	International Organization for Migration
IRENA	International Renewable Energy Agency
IWRM	integrated water resources management
LDCs	least developed countries
MCM	million cubic metres
MDG	Millennium Development Goal
ODA	official development assistance
OCHA	Office for the Coordination of Humanitarian Affairs
PPP	public-private partnership
RICCAR	Regional Initiative for the Assessment of Climate Change Impacts on Water Resources and Socio-Economic Vulnerability in the Arab Region
RO	reverse osmosis
SDG	Sustainable Development Goal
UN DESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNHCR	United Nations High Commissioner for Refugees
UNISDR	United Nations Office for Disaster Risk Reduction
UNU	United Nations University
UNU-INWEH	United Nations University Institute for Water, Environment and Health
WASH	water, sanitation and hygiene
WHO	World Health Organization
WMO	World Meteorological Organization
WSRC	Water Sector Regulatory Council

1. FRAMING WATER SECURITY IN THE ARAB REGION

A. Scale and scope of analysis for water security in the Arab region
B. Conceptual framework for water security in the Arab region
C. Structure and content

1. Framing Water Security in the Arab Region

Water security is increasingly at the forefront of political and development agendas because of its association with peace and central role in development. In the Arab region, concerns are heightened due to systemic constraints, and States must exert exceptional effort in moving towards achieving water security.

Arab States are among the most water scarce in the world, with 18 out of 22 below the renewable water resources scarcity annual threshold of 1,000 m^3 per capita, and 13 below the absolute water scarcity threshold of 500 m^3 per capita per year.[1] This places nearly 362 million people in the region in countries under water scarcity to absolute scarcity conditions. The freshwater scarcity situation is aggravated by several factors, such as dependency on shared water resources, pollution, climate change impacts and extreme events, non-revenue water losses, intermittency, inefficient use of water and high population growth rates. Occupation and conflict also affect people's ability to access water and sanitation services. In 2015, there were more than 51 million people in the region lacking access to basic drinking water services, and more than 74 million people without access to basic sanitation services.[2] Further, while more than half of the region's population now lives in cities, water use in agriculture remains significant, with the sector continuing to consume most of the freshwater resources.

Water scarcity has been perceived as equivalent to water insecurity in many States. This is more so in countries sharing water resources with other countries, specifically downstream countries. The concept of equating water scarcity to water security was the prevalent concept up to the 1990s. Water security was largely used to express a condition of having sufficient water supply to satisfy the demands of a country's population. More recently there has been a gradual shift to individual water security and away from traditional notions of security and conflict; a shift assisted by the recognition of the human rights to water and sanitation and the advancement of sustainable development agendas.

This scarcity is a major challenge to sustainable development and its economic, social and environmental pillars in the region. The increasing scarce conditions are affecting water security, which in turn has implications for food and energy security, economic development, livelihoods and human health in the region. Water security is thus tied to national and regional security considerations, which must be considered as Arab States seek to pursue commitments to global goals.

A. Scale and scope of analysis for water security in the Arab region

Considerations for water security vary from global and regional/interstate macrolevel to national, local and household microlevel, ranging from those for resources, policies, strategies and plans, to measures, actions and interventions, all alongside human rights and gender considerations. These include:

- At global level: water security issues include climate change, virtual water trade flows, financial regimes, technology transfer, formulating development priorities such as those defined in the 2030 Agenda, and global conventions such as human rights declarations or those on transboundary water resources;

- At regional/interstate level: in addition to the global issues, regional specificities are heightened, such as water endowments, arrangements for fostering regional and interstate cooperation, geopolitics, migration and refugee flows, and strategies such as the Arab Strategy for Water Security in the Arab Region to Meet the Challenges and Future Needs for Sustainable Development 2010-2030.[3] With shared water resources dominant in the region, cooperation arrangements between riparian States must be pursued to ensure an important component of water security. This can be achieved under regional cooperation frameworks, at interstate level, or under global cooperation conventions;

- At national and local levels: water security considerations require States to satisfy the water security needs of their citizens, giving due consideration to universal human rights, specifically the rights to water and sanitation, by balancing national requirements and policy decrees. States must avoid inequity in achieving water security, paying special attention to leaving no one behind and gender equality while ensuring the right of all to water and sanitation. In doing so, a State recognizes the dependency of social development and economic prosperity on the sustainable management of freshwater resources and ecosystems;

- At household level: water security considerations include accessibility to fresh water in sufficient quantity and quality that is affordable, along with access to adequate sanitation. Sustainable consumption and production practices by household members must be factored into water security. Similarly, economic and social development requirements, such as those associated with workers in the agriculture sector, are important considerations at this level for water security.

There has been a tendency to centralize decision-making in security considerations, which has the advantage of utilizing greater resources than normal but the disadvantage of alienating people, specifically vulnerable communities. Ensuring water security at all levels and scales requires engaging all stakeholders to optimize a participatory approach in setting clear objectives and implementation methods. The approach must be inclusive and consultative to achieve consensus on common goals and identify coherent solutions at the various levels. Given water's centrality, water security strategies must be intersectoral to ensure policy coherence and avoid negative trade-offs. This can be facilitated through a human rights-based approach, as reflected in the 2030 Agenda and SDGs. Such an approach uses a common set of principles for goal-setting and policy deliberations across scales and sectors, ensuring no one is left behind.

The 2030 Agenda recognizes that social development and economic prosperity depend on the sustainable management of natural resources of which fresh water is crucial, and this is highlighted in the integrated nature of the SDGs. Achieving water security in the region must acknowledge the symbiotic relationship between water security and sustainable development, and must include consideration of the three pillars of sustainable development – social, economic and environmental – within a human rights-based approach that ensures gender equality and leaves no one behind.

Given the systemic constraints of water scarcity and stress, climate change, and shared water resources, the framing of water security in the region must account for the various scales of analysis. This can be done via a sustainable development perspective and taking a human rights-based approach to achieve the water-related SDGs.

B. Conceptual framework for water security in the Arab region

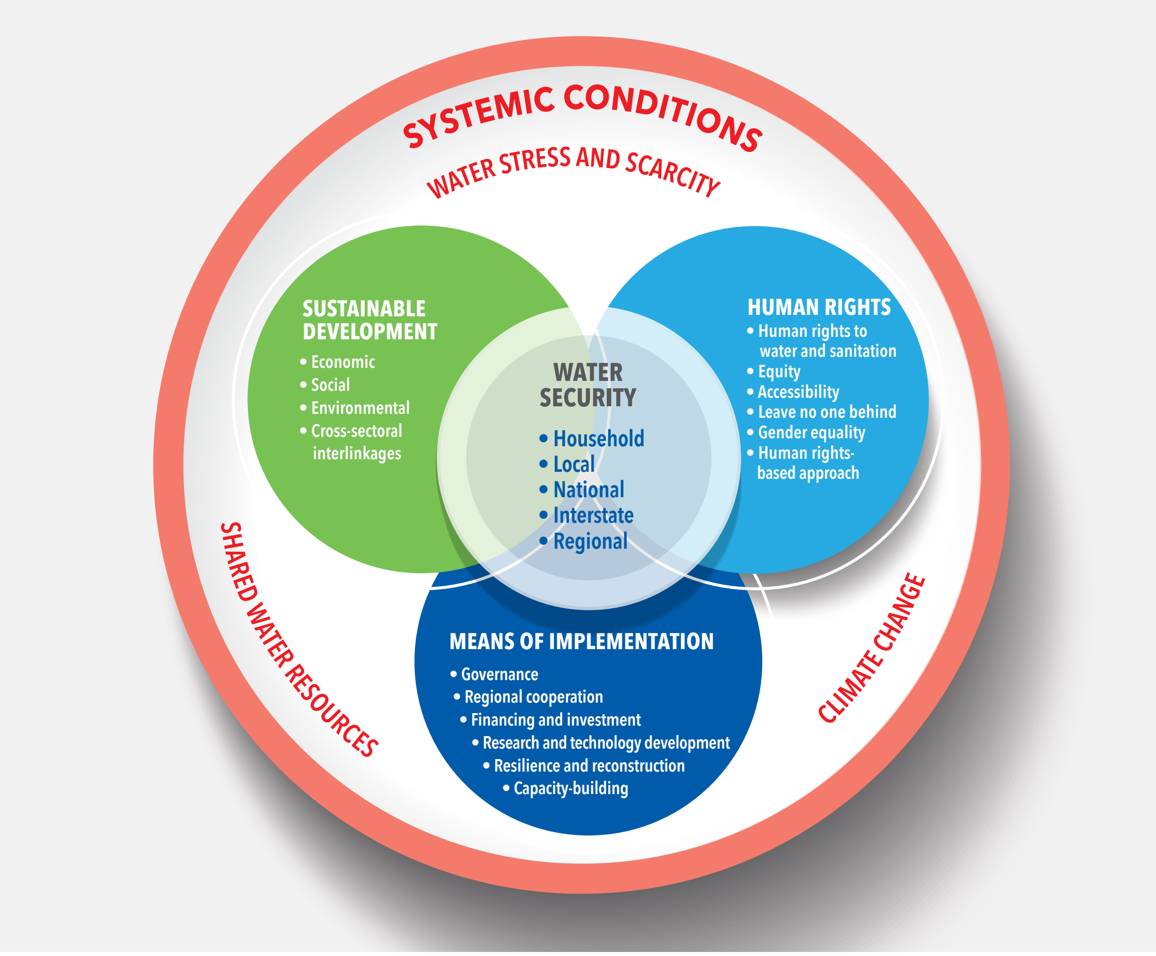
A conceptual framework for moving towards water security requires, first, an understanding of the main systemic conditions that hamper its achievement. These conditions vary in scale and severity, and impact water security at differing levels and scales. They include water stress and scarcity, shared water and climate change. The framework must consider water security at all scales, from regional and national to household scales, through interstate and local levels. Such variance requires a flexible approach grounded in principles that transcend the scales.

A human rights-based approach led by universal rights provides the starting point. Such an approach would be guided by the indivisibility and universality of the right to water, food and development, and relevant conventions, including the Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW), and the consequences of climate change on these rights. Such an approach is cross-sectoral; it considers the implications of water security on human rights, where the achievement of such security and the right to water, for example, do not compromise the right to food or the right to development in other sectors, such as agriculture. It can channel efforts to address the root causes of inequality in the region by empowering stakeholders. It can ensure coherence and consistency at various scales, from global development agendas to regional and national ones.

In conjunction with the universality of human rights, the framework must realize the symbiotic relationship between water security and sustainable development. It acknowledges the criticality of water to all three dimensions of sustainable development and ensures that water security reflects this requirement in seeking to achieve global, regional and national goals. At national level, the framework must provide an opportunity to mainstream water-related priorities across development strategies and plans, maximizing synergies and capturing the momentum from global to regional and national agendas in seeking to achieve water security.

The framework stands to benefit from the sustainable development approach complementing the human rights-based approach, prescribing inclusivity through participation, thereby empowering all people, including women and the most vulnerable, to demand their rights and manage their water resources. The region will gain, as expanding and diversifying the water stakeholder base will provide more resources for managing the sector and resolve stumbling blocks with innovative solutions. Greater consensus and buy-in as a result of stakeholder participation will allow improved project sustainability. The framework allows for greater transparency and accountability, which could facilitate more financing from the private sector and the international community.

Figure 1. Conceptual framework for water security in the Arab region



Source: Authors

Additionally, the framework should identify means of implementation for moving towards achieving water security that are based on priorities for the region, such as those determined at the Regional Preparatory Meeting on Water Issues for the 2018 Arab Forum on Sustainable Development and High-level Political Forum, held in Beirut in March 2018.[4] These include governance, regional cooperation, financing and investment, research and technology development, resilience and reconstruction, and capacity development. It will allow States to adapt to local contexts and address water scarcity through strategies, policies and plans that are tailored to national needs and take into account social, cultural, economic and environmental considerations through a human rights-based approach.

A conceptual framework for the region is presented in figure 1. It accounts for the various scales of analysis in face of the regional systemic constraints of water stress and scarcity, climate change and shared water resources through the symbiotic linkages to sustainable development and the achievement of the water-related SDGs. It is based on the centrality of water to the three pillars of sustainable development. And it stresses the importance of a human rights-based approach that empowers the most vulnerable to ensure that no one is left behind. It does so through an enabling environment based on a set of means of implementation.

C. Structure and content

The components of the conceptual framework for achieving water security in the region are elaborated in the following chapters. The regional priorities and challenges under current and projected conditions of water stress and scarcity, climate change and shared water are explored, and the means of implementation for moving towards water security. The evolution of water security concepts over time and across a range of disciplines is examined, including international water law, human rights and international humanitarian law, as well as the human security literature on global and regional concepts of water security. This is conducted through a sustainable development lens, where water is central to the economic, social and environmental dimensions of development. It is combined with a human rights-based approach to examine the implications of water security at all scales, including community and household level, to ensure that regional water security is grounded in efforts to ensure no one is left behind.

Chapter 2 presents the regional systemic conditions, highlighting the worsening scarcity and its cross-sectoral implications. It reviews the stresses, including increasing urbanization, occupation and conflict, in light of projected climate change impacts on the region and extreme events. Chapter 3 provides an overview of the evolving concept of water security, from traditional ideas and topics, such as violence and interstate conflict, towards a notion of human security, and via international law. Chapter 4 examines water security within the context of sustainable development, in tandem with the 2030 Agenda, and explores other global agendas and areas of complementarity. It presents a human rights-based approach grounding water security in a commitment to meet the needs of the most vulnerable and leave no one behind. Regional water strategies are also explored. Chapter 5 addresses the means of implementation for achieving water security in the region. It focuses on six axes of an enabling environment that include improved governance, regional cooperation, research and technology development, finance, reconstruction and resilience and capacity development. Chapter 6 presents a set of recommendations based on the findings.

2. WATER SECURITY UNDER REGIONAL SYSTEMIC CONDITIONS

A. Water stress and scarcity
B. Shared water resources
C. Impacts of climate change on water resources
D. Water services for all

2. Water Security under Regional Systemic Conditions

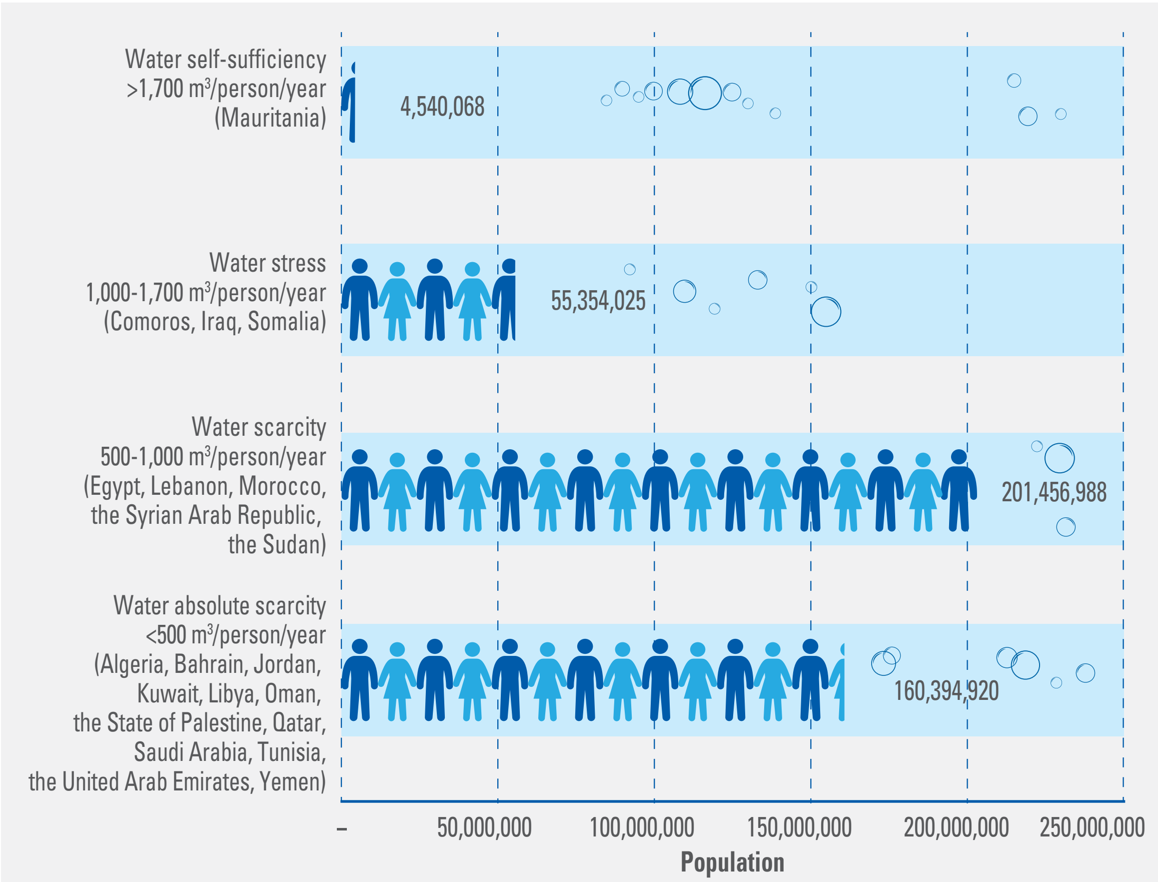
The Arab region is one of the most water-scarce regions in the world, with 18 out of 22 States below the renewable freshwater resources scarcity annual threshold of 1,000 m^3 per capita, and 13 countries below the absolute water scarcity threshold of 500 m^3 per capita.[1] The total renewable water resources available in the region for 2014 range from as low as 5.1 m^3 per capita per year in Kuwait, to 2,802 m^3 in Mauritania.[2] The regional freshwater scarcity situation is aggravated by additional factors, such as dependency on external transboundary water resources, climate change, accessibility constraints and infrastructure damage due to occupation and conflict, declining quality, non-revenue water losses, inefficient use and high population growth. In 2015, there were more than 51 million people in the region who lacked access to basic drinking water services, and more than 74 million people without access to basic sanitation services.[3] Further, while more than 58.9 per cent of the region's population now lives in cities,[4] water for agriculture remains a priority to ensure food security and maintain rural livelihoods in middle- and low-income countries. This is significant as the agricultural sector continues to consume an amount equivalent to 84 per cent of the region's total water withdrawal.[5] The region is projected to experience a rise in temperatures, up to 5 degrees in some parts by the end of the century, with generally decreasing precipitation trends.[6] These changes will impact on freshwater resources, with varying implications for socioeconomic and environmental vulnerability. The energy required for desalinating and pumping water from distant sources and deep groundwater aquifers to satisfy ever-increasing water demands will continue to add to the financial and environmental burden.

A. Water stress and scarcity

1. Freshwater scarcity

Generally, water scarcity has been perceived as equivalent to water insecurity. The Arab region is no exception, with most States suffering from water scarcity. Falkenmark[7] devised an index to assess the level of water scarcity and identified thresholds associated with utilizing water for food security and cash crops, and for the supply of households and industries, from the annual total renewable water available per capita. Three basic thresholds were identified; conditions of water stress for values below 1,700 m^3 per person per year; scarcity for values below 1,000 m^3 per person per year; and absolute scarcity for values below 500 m^3 per person per year. In the region, five countries can be classified within the renewable freshwater resources scarcity threshold and 13 others below the absolute scarcity threshold, as shown in figure 2. This amounts to 38 per cent of the Arab population living in countries under absolute water scarcity, 48 per cent in countries with water scarcity and up to 86 per cent in countries with absolute scarcity to scarcity. It should be noted that there is a risk of oversimplification of results and the Falkenmark index conveys only the general regional to national conditions in the absence of more disaggregated data and indicators. For instance, this indicator is measured at national level and cannot account for spatial variations, within the country or rural versus urban, nor seasonal variability. It also cannot account for water quality issues that may hamper the availability of fresh water, nor for human intervention on shared waters that may affect the share, among other factors, natural and human.

Figure 2. Water scarcity in the Arab region, total annual renewable water resources per capita



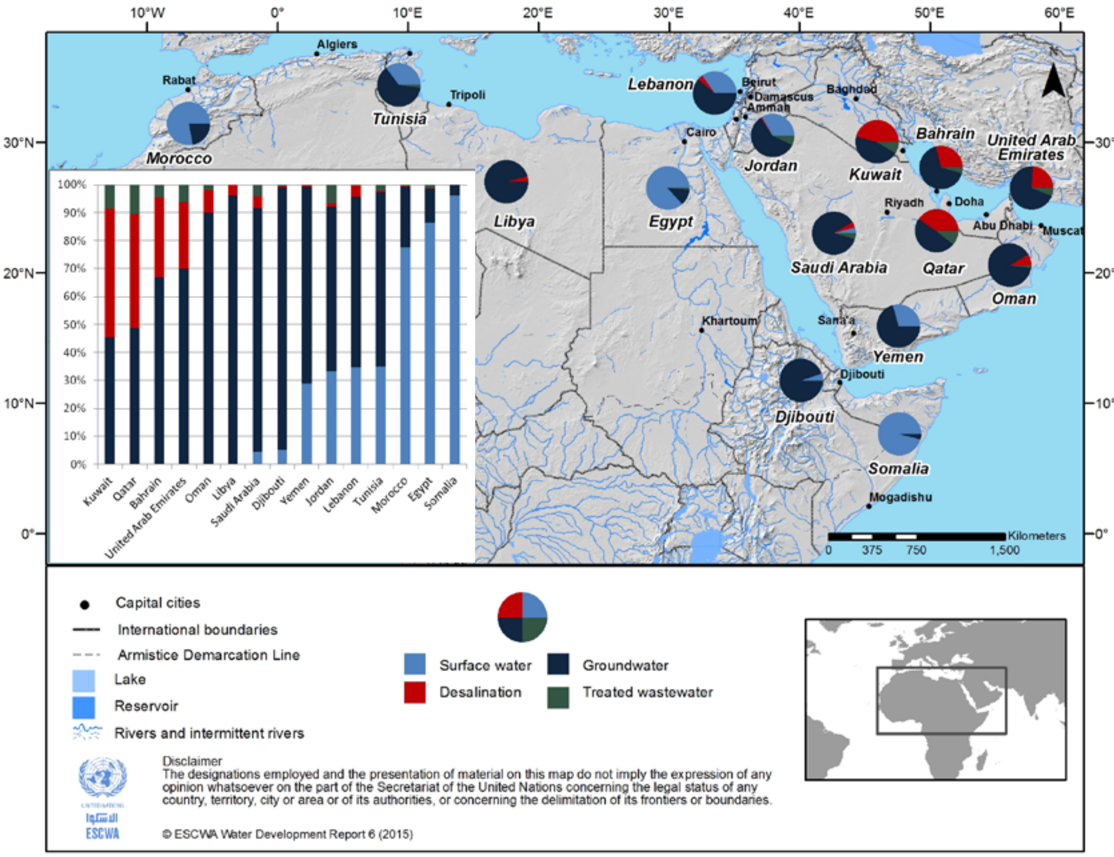
Source: FAO, AQUASTAT database, for the year 2014. Available at http://www.fao.org/nr/water/aquastat/main/index.stm. (accessed on 17 August 2018); UN DESA, Population Division, 2018.

Note: Scarcity classification is based on the Falkenmark water scarcity index for total annual renewable water resources per capita for the year 2014 based on FAO AQUASTAT and national consultations.

A country classified as water scarce or absolute water scarce is at a disadvantage for achieving water security and will need to increase efforts to overcome this barrier, which may involve means reviewed in chapter V. The same is true for countries classified as water stressed or water self-sufficient as this does not automatically equate to water security. Other factors, natural and unnatural, may affect water security. Population growth is a driver of water scarcity. The Arab region has a population growth rate of 2.1 per cent, well above the global average, with the population expected to double in 35 years.[8] Population-driven scarcity implies more people will depend on the same unit of water, resulting in more water scarcity, generally referred to as water crowding. Water scarcity is also demand-driven.[9] The increased difficulty and cost of mobilizing more resources is evident in the Arab region where most countries depend heavily on groundwater and desalination for their supply, both of which are energy intensive and costly (see figure 3). Even countries usually depending on surface water are relying more and more on groundwater and desalination. As a result, groundwater is being depleted, with levels dropping beyond economic limits, notwithstanding that some pumping is done in non-renewable fossil aquifers.

More than 50 per cent of global desalination capacity is in GCC (the Cooperation Council for the Arab States of the Gulf, originally/colloquially the Gulf Cooperation Council) countries, with an increasing trend.[10] Below the absolute water scarcity level and heavily dependent on desalination, countries are also facing growing

Figure 3. Water sources in selected Arab countries



Source: Escwa, 2015b

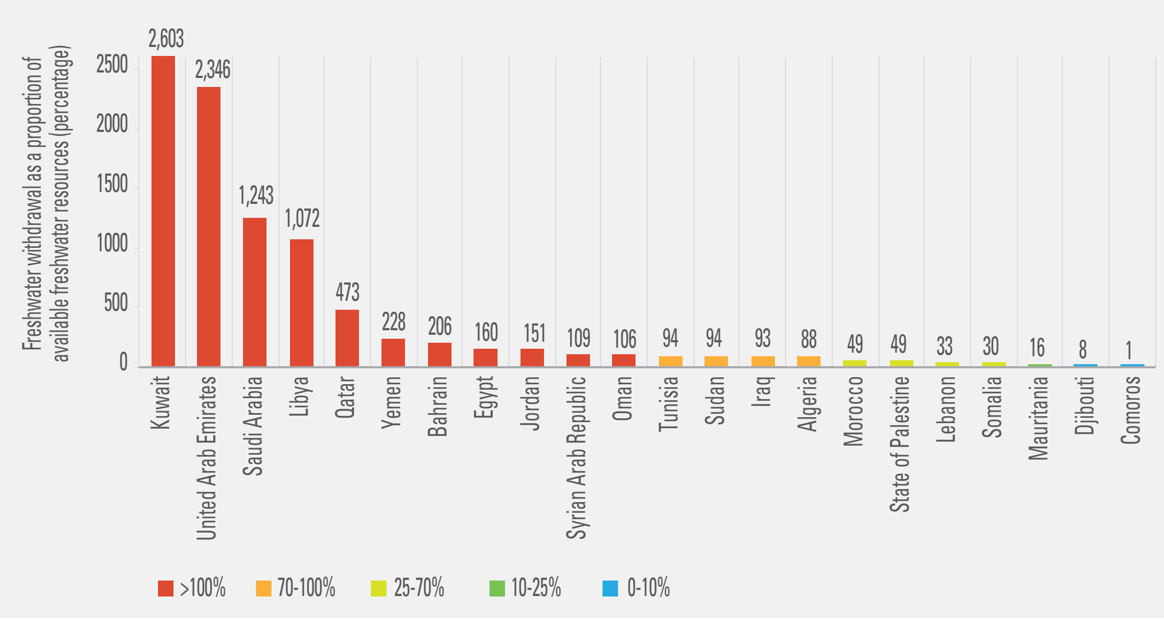
costs for mobilizing water resources. In this sense, Arab States suffer from both water crowding and demand-driven scarcity, which places a greater burden on them in securing water for a growing population at an ever-increasing economic cost.

In addition to the Falkenmark water scarcity index, SDG target 6.4, indicator 2, reports on levels of water stress, measuring freshwater withdrawal as a proportion of available freshwater resources.[11] It shows that in the year 2014, 11 countries in the region utilize more than 100 per cent of their renewable fresh water (see figure 4). The indicator measures withdrawals by all major sectors (agriculture, industrial and domestic use, including environmental water requirements) against the total renewable freshwater resources. Only Comoros, Djibouti and Mauritania are below the 25 per cent water stress level indicating absence of water scarcity. Other countries have varying degrees of scarcity. The indicator takes account of fossil groundwater withdrawal, which may not be sustainable, but not non-conventional water sources, such as desalination.[12] Also, water quality is not factored in the level of water stress as water may be available in volume but not be fit for end-purpose use. Similarly, indicator 6.4.2 reflects the level of water stress at national level; more disaggregated data is required to show subnational or local levels.

In regard to the Occupied Palestinian Territory, the level of water stress is portrayed as better than in countries with more abundant freshwater resources, such as Iraq. But this does not reflect the reality of the water scarcity situation due to the restrictions imposed on access to water resources by the occupation. Indicator 6.4.2 measures only the amount withdrawn (4.08×10^8 m^3/year), and not the actual need, which in this case is much greater. It indicates, first, a lack of access to the freshwater resources (8.37×10^8 m^3/year) and, second, a lack of investment in adequate infrastructure, mainly due to the restrictions and the destruction caused by military operations.

This is a falsity that indicators can project on the condition of water scarcity or water security, which many observers are drawn into due to the

Figure 4. Level of water stress in the Arab region as per SDG indicator 6.4.2



Source: UN DESA, Statistics Division, data for the year 2014. Available at https://unstats.un.org/sdgs/indicators/database/?indicator=6.4.2 (accessed on 17 August 2018).

simplicity of numbers. Countries have a specificity that indicators cannot adequately convey. As such, further investigation is required to fully understand the water security dimensions.

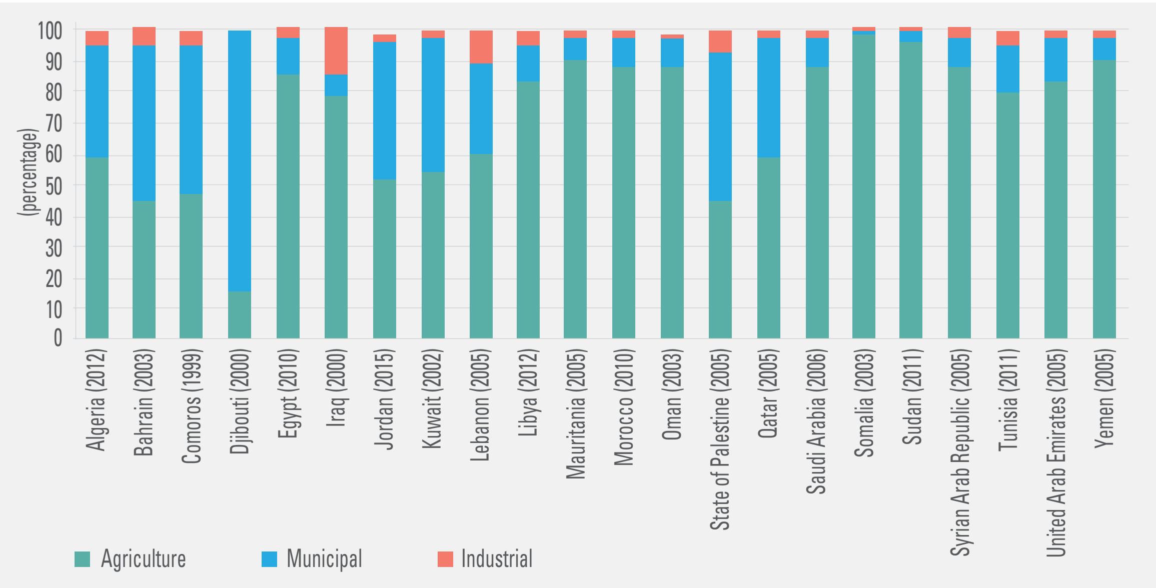
2. Water for food security

Food security is defined as "when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food, which meets their dietary needs and food preferences for an active and healthy life".[13] Its attainment requires a comprehensive approach at varying scales, from local, to national, to regional and global. Food security is not to be confused with food self-sufficiency, whereby countries seek to meet their food needs through local production.

Local food production, and hence agriculture, is the biggest consumer of water in the region, with 84 per cent of all withdrawals going to the sector. Only four countries have a municipal sector water withdrawal share greater than the agriculture sector's share (see figure 5). This agriculture share is comparable with the global average of 80 per cent, yet in the water-scarce Arab region such a share, when combined with relatively low water-use efficiency and low crop productivity, prompts calls for more of that share to be shifted to other, more productive sectors. Such a decision must be weighed against any political, economic and social ramifications for agriculture dominant countries, where millions of low-skilled workers depend on the sector. The demographic shift would be significant, amplifying the urbanization trend in the region. While agriculture is the biggest consumer of freshwater resources, water for agriculture remains a priority to ensure food security and to maintain rural livelihoods in middle- and low-income countries.

The sector's large water share is rooted in historic policies of food self-sufficiency, encouraged by price guarantees and subsidies to drive domestic production.[14] These policies led to general increased development in the sector, accompanied by an increased water share, reduced water-use efficiency and crop productivity, and depletion of water resources. Rampant energy subsidies inadvertently aided

Figure 5. Share of water withdrawal by sectors per cent of total water withdrawal in the Arab region



Source: FAO, AQUASTAT database. Available at http://www.fao.org/nr/water/aquastat/main/index.stm (accessed on 17 August 2018).

Note: Together, the three sectors water withdrawal may not add to 100 per cent due to rounding.

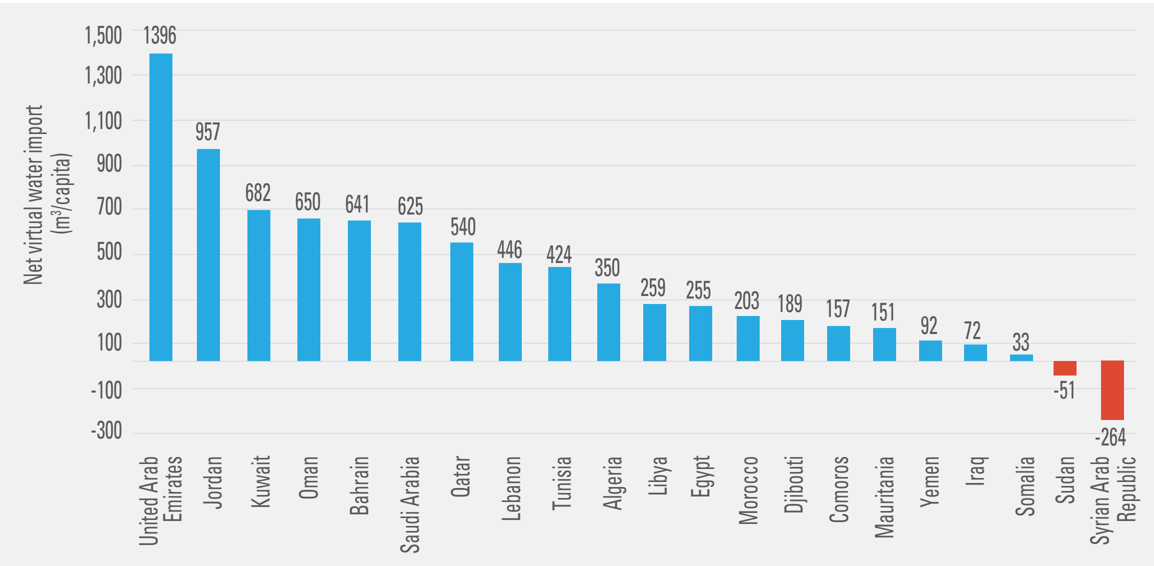
the depletion of water resources, making it cheaper to pump water, which led to significant falls in the groundwater level in many places. An example is the Saq-Ram Aquifer System in the Tabuk area of Saudi Arabia, where from 1983 to 1988 the total water level dropped between 100-160 metres due to overexploitation associated with expanding crop areas and fixed wheat commodity prices.[15] Most groundwater pumping is from non-renewable aquifers as globally most groundwater mining occurs in West Asia and North Africa. Extraction in Libya and Saudi Arabia totals approximately 77 per cent of the global extraction of non-renewable groundwater resources.[16] With the realization that the region is unable to meet its food needs – due to scarce water and land resources at national or regional levels – there has been a shift to a more market-driven approach, with a more high value product-oriented agriculture sector and regulated water use.

Arab countries have increasingly had to rely on trade to fulfil their food and feed gap deficits, leading to the introduction of the concept of virtual water trade. This refers to the water embedded in the production of agricultural goods. A tonne of imported wheat can save a country approximately 1,300 m^3 of its water supply, allowing this water to be used in the production of higher economic value goods or transferred to more productive sectors.[17] As one of the world's major net importers of wheat and cereals, the region, specifically the GCC countries, has much to gain from virtual water trade.[18] The net virtual water imports per capita in the Arab region in the 1990s represented a significant portion of national water needs, and only the Sudan and the Syrian Arab Republic were reported as net exporters (see figure 6). Unfortunately, more recent data are not available, but the trends are expected to be the same in most countries except those affected by recent conflict, such as Yemen and the Syrian Arab Republic, where trade is greatly restricted by imposed embargoes.

3. Water and energy

Ensuring access to clean water and sanitation is an energy-intensive process in general, but more so in the Arab region. This is evident in the heavy reliance on energy-intensive sources of water, such as desalination and groundwater

Figure 6. Net virtual water imports per capita per year in selected Arab countries



Source: Hoekstra, 2003.

(see figure 3). The GCC countries are some of the highest energy gluttons. In Bahrain, desalination alone accounts for 30 per cent of total energy use,[19] and in Saudi Arabia groundwater pumping accounts for 10 per cent of the total fuel consumption in the country.[20] Jordan also relies on groundwater as its major source of water, and the sector consumes approximately 14 per cent of the total annual electricity generated.[21]

Energy in the water production chain is needed for desalination, production, abstraction, transmission, treatment and distribution, and in the wastewater stages for collection, transmission, treatment and discharge. The intensity depends on various factors, including the source of water, vertical and horizontal pumping distance, equipment efficiency, degree of required treatment for water and wastewater, and the overall efficiency of the distribution system. Countries are exploring various means for reducing the energy intensity of the water sector. Some are piloting renewable energy desalination, such as Egypt, Jordan, Morocco and the United Arab Emirates,[22] while Saudi Arabia has built a photovoltaic desalination plant in Khafji using nanotechnology, which has an expected capacity of 60,000 m^3 per day.[23]

Similarly, the energy sector relies on water with the major demands being for cooling, extracting and processing fossil fuels. Water for cooling depends on the technology use, from once-through systems to wet-recirculation and dry cooling, each type having advantages and disadvantages. Significant use is associated with the extraction, production and refining of oil. Water used in the extraction is recaptured with the produced oil, resulting in what is called produced water, which is water of low quality constituting a major waste stream. The ratio of produced water to oil varies between countries and oil fields in the region, with Oman having the highest water-to-oil ratio at 10:1,[24] and the United Arab Emirates the lowest, at 0.35:1.[25]

4. Water for health

The global importance for health of water, sanitation and hygiene is reflected in the 2030 Agenda and its SDGs. SDG 3 concerns ensuring healthy lives and promoting well-being for all, at all ages, and has two water and sanitation-related targets. Target 3.3 is concerned with combatting waterborne diseases, and target 3.9 with substantially reducing the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination.[26] Indicator 2 of target 3.9 specifically monitors the mortality rate attributed to unsafe water, unsafe sanitation and lack of hygiene (exposure to unsafe water, sanitation and hygiene for all, or unsafe WASH services).

Despite progress on certain public health indicators, the burden of waterborne diseases remains high, with prevalence linked to deficiencies in the wastewater and sanitation system, insufficient access to water supply and lack of hygienic facilities.[27] In the region, 74 million people (20 per cent of the population) still lack a basic sanitation service. Of those, 25 million still practise open defecation. Further, 106 million people (27 per cent of the population) lack a basic handwashing facility, and 59 million have no facility.[28]

In most countries, women and young girls are in charge of securing sufficient alternative sources of clean water. They are responsible for collecting water from distant wells and standpoints, resulting in lost productive time and increased vulnerability to harassment and abuse, as well as health implications.[29] The lack of water and hygiene in public schools has been linked to girls dropping out,[30] especially those reaching puberty.[31] Vulnerability to the outbreak of water-related diseases is compounded in cases of tension and armed conflict. This is particularly true for countries such as Iraq, the Sudan, the Syrian Arab Republic and Yemen.

Table 1 shows the mortality rates and numbers of deaths attributable to unsafe WASH services in countries of the region. The least developed countries (LDCs) have the worst figures. In the Mashreq region, conflict-ridden countries, namely Iraq and the Syrian Arab Republic, have the highest mortality rates. In the Arab Maghreb, the highest rates are reported in Algeria and Morocco. The Gulf region has the lowest mortality rates. The available data does not show a significant difference in mortality between male and females.

Table 1. Mortality rate attributed to unsafe water, unsafe sanitation and lack of hygiene (SDG indicator 3.9.2)

Country	Mortality rate attributed to exposure to unsafe WASH services (per 100 000 people, SDG 3.9.2)	SDG indicator 3.9.2 WASH deaths
	2016	**2016**
LDCs		
Comoros	50.7	404
Djibouti	31.3	295
Mauritania	38.6	1 659
Somalia	86.6	12 396
Sudan	17.3	6 856
Yemen	10.2	2 814
Mashreq		
Egypt	2	1 916
Iraq	3	1 129
Jordan	0.6	59
Lebanon	0.8	47
Syrian Arab Republic	3.7	676
Maghreb		
Algeria	1.9	758
Libya	0.6	37
Morocco	1.9	671
Tunisia	1	116
GCC		
Bahrain	<0.1	1
Kuwait	<0.1	1
Oman	<0.1	2
Qatar	<0.1	0
Saudi Arabia	<0.1	30
United Arab Emirates	<0.1	3

Source: WHO, Global Health Observatory (GHO) data for 2016. Available at http://www.who.int/gho/en/ (accessed on 6 September 2018).

Note: Data for the State of Palestine is not available where conditions in Gaza specifically stand out as occupation conditions and embargo may lead to a deterioration in this rate.

5. Water for cities

The region is one of the most urbanized in the world, with more than 58 per cent of the population now living in cities.[32] It has witnessed significant and uneven urban transformations, with some countries undergoing rapid wealth generation, others confronting economic challenges, and several afflicted by conflicts that have led to major displacement and migration of large sections of the population.[33] Such trends place stress on the urban infrastructure, particularly the water infrastructure given the scarcity conditions in the region.

In this context, water infrastructure and services are key to building sustainable, resilient cities as indicated in SDG 11. In many Arab cities, the water infrastructure is old and deteriorating, resulting in losses along the network and impacting the quality of water reaching households. In 2015, only 42 per cent of the urban Arab population reportedly was using safely managed sanitation services, and 94 per cent basic drinking water services. Only seven Arab countries reported on safely managed drinking water services.[34] Moreover, climate change is already exacerbating water-related disasters and putting infrastructure and people at further risk, especially in coastal cities at risk of sea-level rises and floods.

Nevertheless, the fact the agriculture sector, which is largely rural-based, uses about 84 per cent of the available water resources is a major concern when it comes to shifting water resources to other productive sectors, which are usually urban-based. If such moves take place, it could lead to significant demographic changes, amplifying the trend to urbanization and requiring rearrangement and reallocation of available water resources.

B. Shared water resources

Most States rely for their water supply on rivers and/or aquifers that are shared with neighbouring countries, within the region and also countries outside the region. Agreements to manage the shared resources require political will, which in many cases is absent. This is increasingly becoming a source of tension. Thus, high dependency on shared resources complicates the task of achieving water security in many countries, potentially hindering attainment of the SDGs.

The Nile, Tigris, Euphrates and the Senegal, four rivers shared by Arab and non-Arab countries, account for most of the region's surface water. There are a number of shared surface water basins, with 14 of the 22 Arab countries involved as riparian States (see figure 7).[35,36] Some are shared with other Arab countries only, others with non-Arab countries, as shown in table 2. The management of these shared surface water resources and alteration of the natural river flows have allowed for the development of large

Table 2. Shared major surface water basins in the Arab region

Shared among	Shared surface water basin
Arab countries only	An Nahr Al Kabir, Atui, Daoura, Dra, Guir, Medjerda, Oued Bon Naima and Tafna
Arab and non-Arab countries	Orontes, Awash, Baraka, Congo/Zaire, Euphrates, Gash, Jordan, Juba-Shibeli, Lake Chad, Nahr El Kebir, Niger, Nile, Qweik, Senegal and Tigris

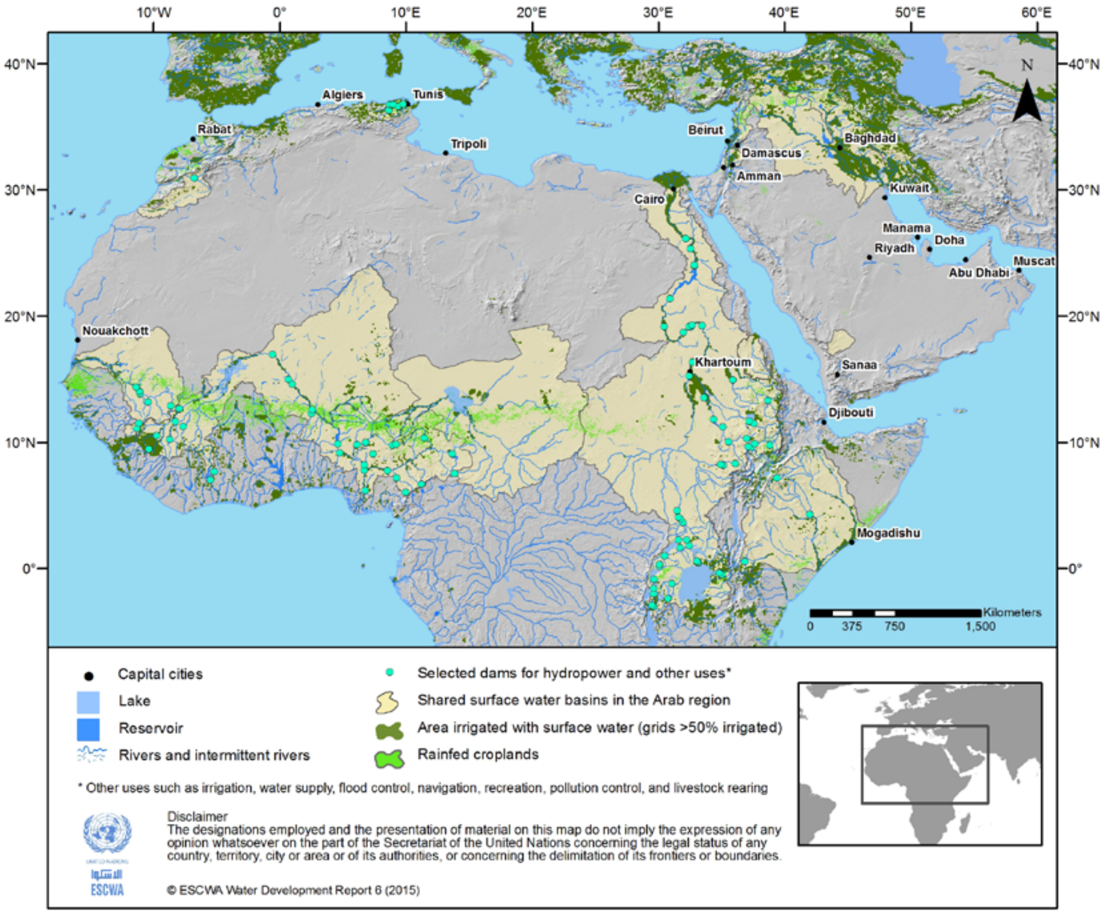
Sources: ESCWA and BGR, 2013; UNEP-DHI and UNEP, 2016.

Note: The UNEP-DHI Partnership is a United Nations Environment Programme centre of expertise dedicated to improving the management, development and use of freshwater resources from local to global level.

irrigation projects, hydropower generation and stored water reserves that can be drawn on to support domestic and agricultural demands. However, the quantity, quality and seasonality of these flows for different and sometimes conflicting purposes must be considered across the States to circumvent potential conflicts caused by upstream management schemes negatively impacting downstream users.

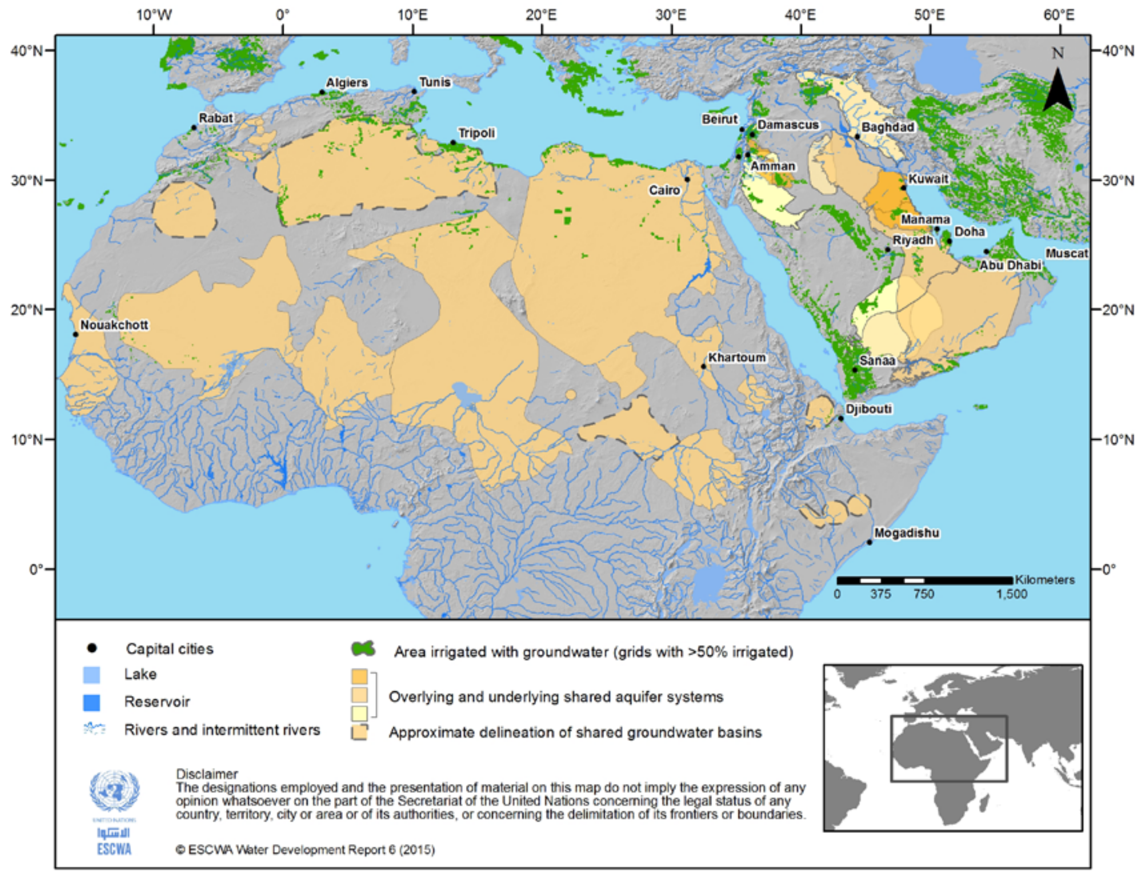
Arab countries also rely heavily on groundwater, which is found in a number of shared aquifers, such as the basalt aquifer system between Jordan and the Syrian Arab Republic, the Palaeogene aquifer shared by Oman and the United Arab Emirates, the Disi sandstone aquifer shared by Jordan and Saudi Arabia, and the Nubian Sandstone Aquifer System shared by Chad, Egypt, Libya and the Sudan. The majority of States share both renewable and non-renewable aquifers. The number of shared groundwater resources outnumbers that of shared surface water basins, with 41 shared aquifers present in 21 of the 22 Arab countries.[37,38] Shared groundwater basins cover almost 58 per cent of the region in terms of area, as shown in figure 8. The extent of the shared groundwater aquifers and advancing pumping technology have led to a reliance on these resources by agriculture sectors and governments pursuing food self-sufficiency, even though large volumes of groundwater are from fossil groundwater reserves and are thus non-renewable.

Figure 7. Shared surface water basins in the Arab region



Source: Escwa, 2015b

Figure 8. Shared groundwater basins in the Arab region



Source: Escwa, 2015b

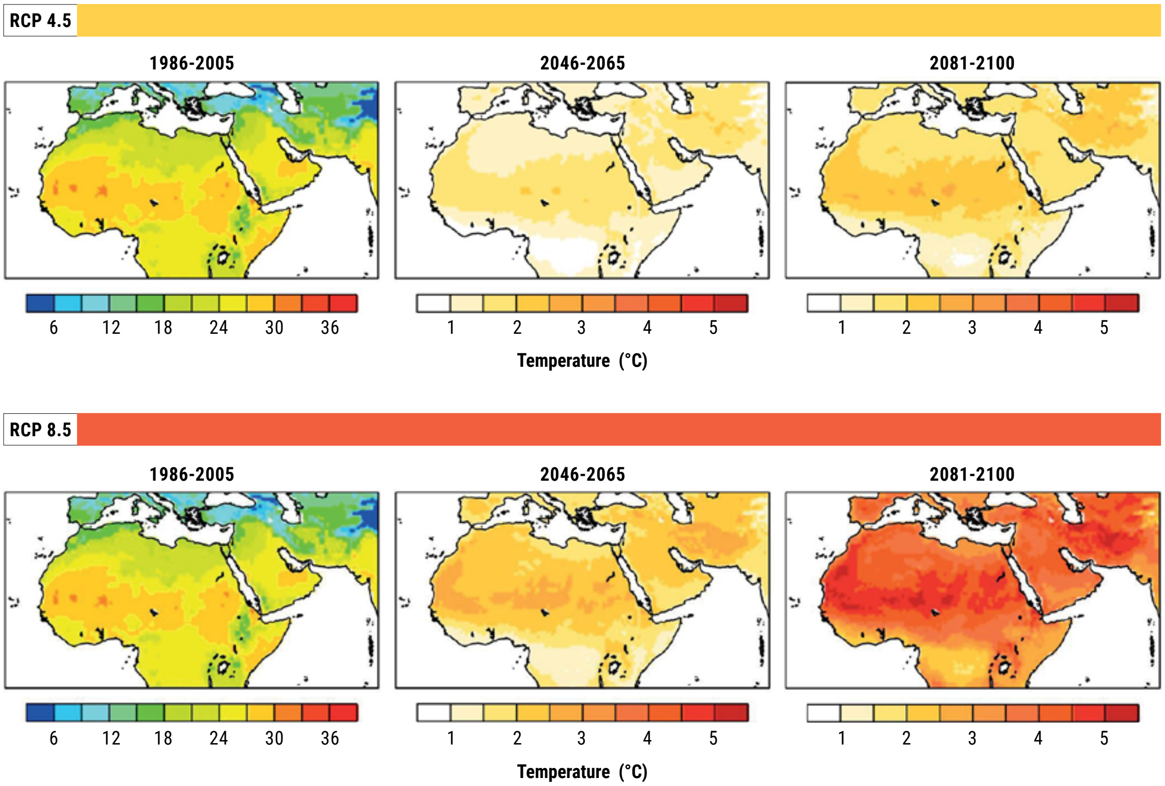
C. Impacts of climate change on water resources

Climate variability and change impose additional pressures, with adverse impacts on the quantity and quality of freshwater resources in an already water-scarce region affecting its ability to ensure food security, sustain rural livelihoods and preserve ecosystems. A higher frequency and intensity of floods, droughts and extreme weather is being experienced in many States. These disasters aggravate the situation of vulnerable communities and have resulted in economic losses and environmental degradation in several parts of the region.

1. Climate change and climate variability, precipitation, temperature and potential impacts

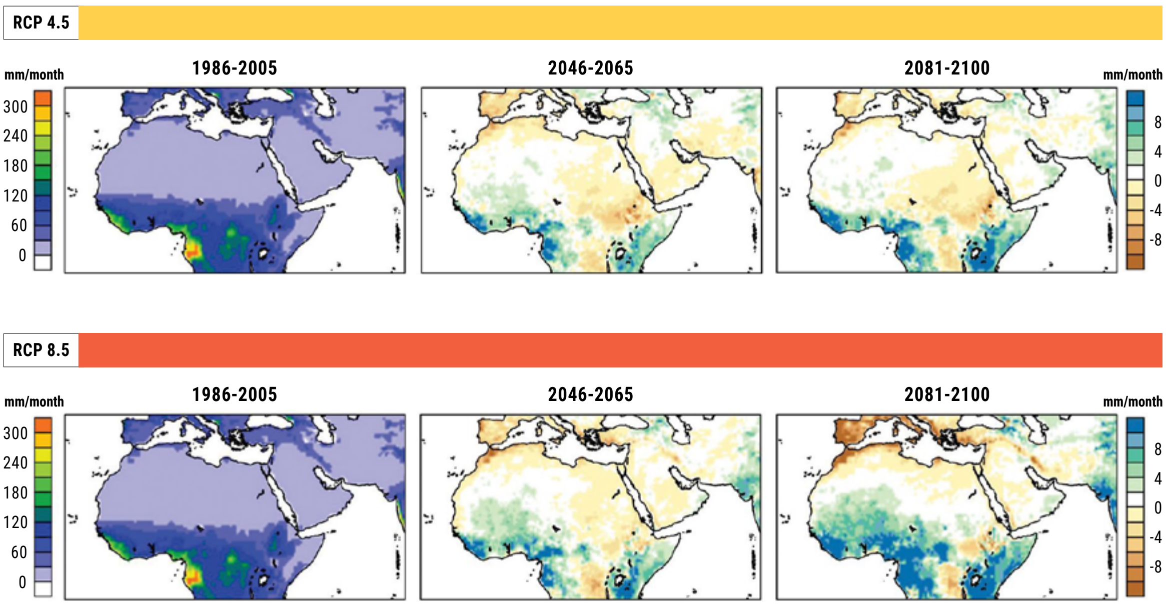
The Regional Initiative for the Assessment of Climate Change Impacts on Water Resources and Socio-Economic Vulnerability in the Arab Region (RICCAR)[39] provided a comprehensive evaluation by generating ensembles of regional climate and hydrological modelling projections up to the year 2100.[40] Three time periods were selected for presenting results, namely the reference period (1986-2005), mid-century (2046-2065) and end-century (2081-2100) periods. Analysis was based on two representative concentration pathways (RCP), with RCP 4.5 being a moderate emissions scenario and RCP 8.5 a high emissions scenario.

Figure 9. Mean projected change in annual temperature compared with reference period



Source: ESCWA and others, 2017b.

Figure 10. Mean projected change in annual precipitation compared with reference period



Source: ESCWA and others, 2017b.

Temperature projections indicate a general rise across the region, with a general change in temperature of 1.5-2.3°C for RCP 4.5, and 3.2-4.8°C for RCP 8.5 by the end of the century.[41] More pronounced changes can be observed in the broader Sahara region and East Africa, including Morocco and Mauritania, and along the western shores of Yemen and Saudi Arabia (see figure 10).

Projections vary considerably across the region, with a reduction of 8-10 mm in average monthly precipitation by the end of the century in coastal areas, mainly around the Atlas Mountains in the west and in the upper Euphrates and Tigris rivers in the east.[42] Projections for other areas indicate an increase in precipitation, such as the south-eastern Arabian Peninsula and some parts of the Sahel (see figure 10).

2. Extreme events and natural disasters: droughts and flooding

Climate change is expected to increase the number and frequency of extreme weather events such as floods and droughts in the region, exacerbating pressure on scarce water resources and food security, not to mention the adverse social and economic effects on vulnerable communities. In recent years, the region has witnessed an increased number of extreme weather events. The severe drought in the Syrian Arab Republic in 2007-2010 caused economic losses and the displacement of 1.5 million people.[43] Saudi Arabia, on the other hand, has experienced major floods since 2009, the most recent in February 2017 causing widespread damage and loss of life.[44]

RICCAR projections for precipitation and the length of dry spells suggest a trend towards drier conditions by the end of the century, with an increase in the number of consecutive dry days for several areas in the region, including the Mediterranean and the western and northern parts of the Arabian Peninsula.[45] This could indicate that the dry summer season is likely to be extended, placing more stress on an already water-scarce region and most likely on groundwater sources already depleted in many countries.

Extreme events impact assessments were performed for three basins as part of RICCAR, including the Nahr el Kabir River basin shared between Lebanon and the Syrian Arab Republic, the Wadi Diqah River basin in Oman, and the Medjerda River basin shared by Algeria and Tunisia. The results can be summarized as follows:[46]

- For the Nahr el Kabir basin, drier conditions are projected with an increase in the occurrence of moderate drought, but with no severe or extreme droughts events projected to occur. For flood conditions, the basin is likely to experience an increase in the magnitude of peak flow and flood frequencies over the twenty-first century;
- For Wadi Diqah basin, there is no projection for severe or extreme droughts over the twenty-first century, but moderate drought conditions are projected to occur with minimal changes compared with the reference period. For flood conditions, the basin is likely to experience a progressive general increase in the magnitude of peak flow over time for both RCPs, together with an increase in the number of extreme flood days at end-century, compared with reference period;
- For the Medjerda basin, drier conditions are projected, with episodes of severe and extreme droughts in addition to moderate drought over time and for both RCPs. For flood conditions, the basin is likely to experience an increase in the magnitude of peak flows for the RCP 4.5, together with a decreasing number of extreme flood events. However, for RCP 8.5 the magnitude of peak flow is projected to decrease.

3. Impacts on shared water resources

The impact of climate change on shared water resources could further complicate the situation for riparian countries. RICCAR evaluated the effect on five shared surface water basins in the region, including the Jordan River basin, the

Medjerda, the Nile, the Senegal River basin and the Tigris and Euphrates. Table 3 summarizes the climate change projections and hydrological modelling findings for each of these basins. The hydrological modelling was performed using the VIC and HYPE hydrological models.[47]

The regional climate and hydrological modelling findings have various impacts for water security in these shared basins. The Jordan River basin has already been at the centre of water disputes and conflict, and a factor in Israeli policies regarding the Occupied Palestinian Territory and the occupied Syrian Golan. Climate change impacts will only add to the complexity.

The potential decrease in precipitation could affect the agriculture sector, the largest consumer of water in the basin, especially in the Occupied Palestinian Territory where most of the agriculture is rain-fed. Further, the decreased precipitation may result in decreased groundwater recharge, affecting the Occupied Palestinian Territory and Jordan, which rely on groundwater for their water supply.

The Medjerda, the principal water supply for more than half of the Tunisian population, could be greatly hit by reduced precipitation and discharge, with significant effects on the supply to domestic and agriculture sectors, and the livelihoods of farmers depending on them. The decreased rainfall in the Nile River basin headwaters could impact on countries that depend on rain-fed agriculture, particularly Ethiopia, Sudan and the upper basin around Lake Victoria. The operation of dams along the river, specifically those built with hydropower generation components, may impact on flow volumes to downstream countries. For the Tigris and Euphrates basins, perhaps the most significant impact is the potential increase in temperature as most of their precipitation originates from spring snowmelt.[48] This will result

Table 3. End of century regional climate and hydrological modelling findings for shared water basins

Basin		Climate change projections		Hydrological modelling findings	
		Mean temperature (ºC)	Mean precipitation (percentage)	Runoff (percentage)	Discharge (percentage)
Jordan River basin	RCP 4.5	+1.5	-7	NCT	NCT
	RCP 8.5	+3.2	-13	NCT	NCT
Medjerda	RCP 4.5	+1.6	-4	NCT	NCT
	RCP 8.5	+3.5	-19	-42 to -41	-60 to -40
Nile	RCP 4.5	+1.8	-5	NCT	NCT
	RCP 8.5	+3.6	-5	NCT	NCT
Senegal River basin	RCP 4.5	+2.1	+2	-3 to -2	NCT
	RCP 8.5	+9	+9	+8 to +18	NCT
Tigris headwaters	RCP 4.5	+2.2	+1	-2 to -1	-5 to -2
	RCP 8.5	+4.5	-4	-15 to -11	-28 to no change
Euphrates headwaters	RCP 4.5	+2.3	+3	2 to 6	NCT
	RCP 8.5	+4.8	no change	-13 to -6	-27 to -4

Source: ESCWA and others, 2017b.

Note: NCT stands for no conclusive trend. Can be perceived due to wide value ranges related to uncertainties resulting from several factors, such as limited hydrological observation data and high human influence on the river system compared with river size.

in an increased flow in the winter season but decreased flow in the summer, when agricultural demand is higher, affecting the sector and forcing greater dependency on groundwater. Finally, the findings for the Senegal basin, with projected variability and associated extreme events of flooding and drought, could have a significant impact on the agriculture sector.

It should be noted that while regional models can provide annual and seasonal analysis that can inform shared water resources cooperation, basin-level analysis is necessary to allow for greater representation of watershed dynamics and the application of basin-specific models. Additional assessments should be pursued to examine the impacts of climate change on shared water resources at a basin scale.

D. Water services for all

The region has made important strides in improving access to water and sanitation services over the past two decades. Between 2000 and 2015, access to basic water services[49] increased from 80 to 87 per cent, and access to basic sanitation services[50] from 75 to 81 per cent.[51] This still means that nearly 51 million people lack access to basic water services, and nearly 74 million to basic sanitation services. Indeed, these numbers do not reflect the inequality of access to services to all. Access to water and sanitation services is lacking in rural areas compared with urban areas. For instance, 23 per cent, or 37 million people, in rural areas still lack basic drinking water service compared with only 6 per cent, or 13 million people, in urban areas. The disparity is even greater for sanitation services, with 32 per cent, or 51 million people, in rural areas lacking basic services compared with 10 per cent, or 22 million, in urban areas. This indicates a need for more balanced investment and development policies giving priority to the unserved in the water and sanitation sector.

It is interesting to note that although water scarcity is a factor in accessibility, countries below the absolute water scarcity threshold, such as the GCC countries with the exception of Oman, have been able to provide 100 per cent access to basic water services. Kuwait, the most water-scarce country in the region, has provided and reported 100 per cent access to safely managed[52] water services. This indicates that high-income GCC countries have been able to overcome water scarcity by allocating adequate financial resources and augmenting the water supply, mostly through costly desalination.

Arab countries that do not have the economic means to access high-cost sources of water to overcome scarcity, or suffer from ongoing conflicts or occupation, have populations that suffer from an intermittent water supply. Figure 11 reflects that in this water-scarce region, having a piped water connection does not ensure having water when it is needed. In many countries, the norm is intermittent supply, with only 76 per cent of the region's population having water available when needed.[53] This leaves nearly 94 million people without available water, perhaps seeking sources that are not safe, and facing the additional economic burden of securing alternatives. Women are usually left to deal with intermittency, having to rearrange work and domestic schedules to match the time water is available, which may mean staying up at night to complete chores or collect supplies.

1. Conflict

Armed conflict in the region has resulted in the destruction of the water and sanitation infrastructure, hampering the provision of safe drinking water and sanitation. In the Syrian Arab Republic, for example, half the water infrastructure was dysfunctional or destroyed, with supply rates reaching 5 to 30 per cent of pre-crisis levels, depending on region.[54] In response to shortages, households resorted to unregulated water vendors relying on compromised resources, such as unprotected wells. In addition, damaged wastewater systems have resulted in river waters and shallow wells becoming contaminated. Water shortages and electricity outages have rendered many health-care facilities non-functional.[55]

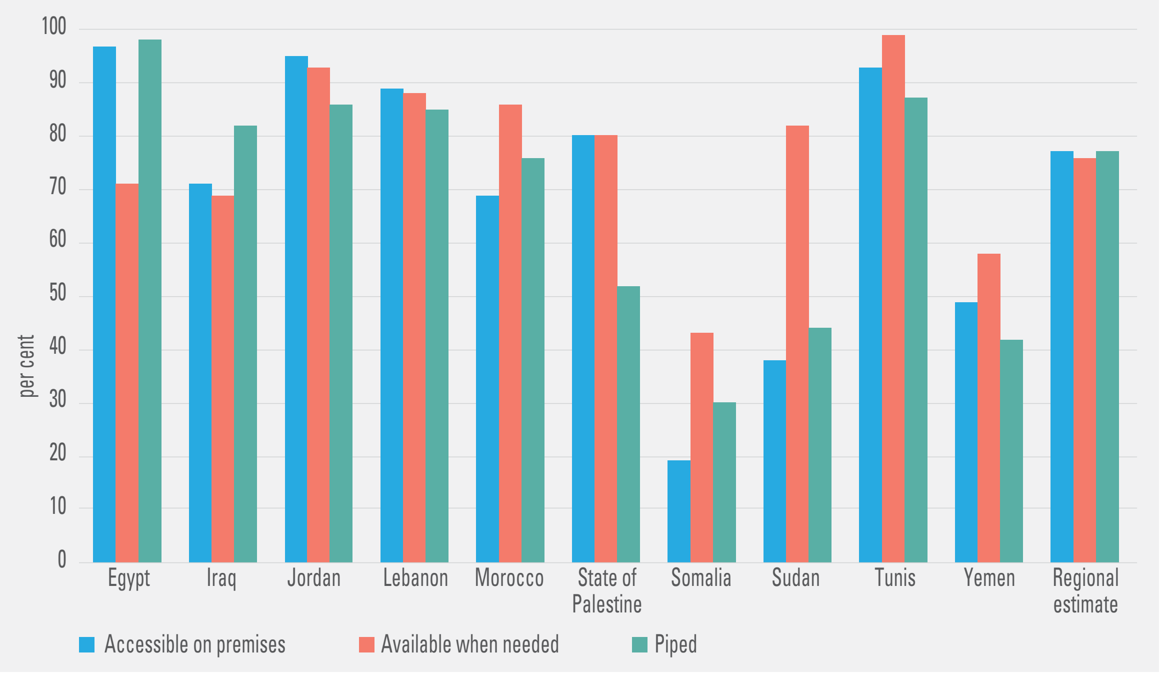
Vulnerability to the outbreak of waterborne diseases, particularly for people living in conflict-affected countries, has greatly increased. In Iraq, cases of cholera were reported in September 2015, threatening a spread to neighbouring countries.[56] Transmission is closely linked to inadequate access to clean water and sanitation facilities. Cholera was also suspected in the Syrian Arab Republic in November 2015. Further, as a result of the continuing war, the country was confirmed as experiencing an increased incidence of waterborne diseases, such as typhoid, dysentery and hepatitis A.[57] The ministry of water resources in Iraq put the cost of damages to water and sanitation infrastructure due to the war against ISIS at $600 million.[58]

The first cases of cholera in Yemen were reported in October 2016. The disease has since spread across the country and has reached 18 governorates.[59] Other waterborne diseases are also spreading, such as acute diarrhoea, which is threatening the lives of 2.5 million children yearly.[60]

2. Conflict-driven displacement

Armed conflicts have resulted in internally displaced populations. The Arab region hosts about 41 per cent of the world's internally displaced people (IDPs). By the end of 2016, the Syrian Arab Republic had more IDPs, 6.3 million, than any country in the world, many of them having endured multiple displacements, followed by the Sudan, with 3.3 million, Iraq, with 3 million, and Yemen, with 2 million.[61] Typically, people live in overcrowded refugee camps lacking basic hygiene services, further exacerbating their vulnerability to outbreaks of waterborne diseases.

Figure 11. Selected Arab countries with water supply intermittency



Source: WHO and UNICEF, 2018.

Note: Accessible on premises is an improved water source located within the dwelling, yard or plot. Piped supplies include sources such as households with tap water in their dwelling, yard or plot, or public standposts.

Conflicts affect neighbouring countries also. The Syrian crisis resulted in 5.4 million registered Syrian refugees in Egypt, Iraq, Jordan, Lebanon and Turkey by the end of 2017.[62] Of these, nearly 1 million were in Lebanon, 650,000 in Jordan, 250,000 in Iraq and 130,000 in Egypt. This sudden influx of people caused increased water crowding, affecting host communities as well as the refugee population, with those in camps, shelters and informal settlements the most vulnerable. To access water and sanitation services requires some refugees to walk long distances. These services are not usually gender-sensitive, with women exposed to violence and sexual harassment.[63] Host countries are mostly water scarce and not able to provide their populations with the necessary services. With refugees concentrated in the most needy and deprived regions due to the lower living costs, the situation deteriorates. For instance, in some areas of Northern Jordan, the per capita water supply has fallen from more than 88 litres per person to below 66 litres since the start of the Syrian refugee crisis in 2011.[64]

Similarly, Lebanon's population increased by nearly 30 per cent due to an influx of refugees fleeing pre-conflict conditions, placing a heavy burden on the country's already fragile water sector. The resulting increase in the demand for water was between 8 and 12 per cent, and between 8 and 14 per cent in generated wastewater.[65] As Lebanon lacks the infrastructure to capture and treat all of its wastewater, there was also an impact on water quality, with an increased volume of untreated wastewater discharged on open lands and into watercourses.

3. Occupation

The Arab region is perhaps the only region in the world still experiencing direct military occupation. The Israeli occupation of Arab territories affects access to water resources and the ability of countries to properly manage and provide the required water and sanitation services, with a ripple effect on food security, health and development in general. Nearly 1.8 million Palestinians need humanitarian water, sanitation and hygiene assistance.[66]

This is most evident in the Occupied Palestinian Territory, particularly Gaza. Access to basic water and sanitation services remains severely restricted, repercussions of the Israeli blockade and recurrent military offensives. Israel continues to restrict imports of goods considered to have a dual military and civilian use, including water and sanitation items, such as pumps, drilling equipment and water treatment chemicals. As a result, nearly 70 per cent of the population in Gaza suffer severe water shortages, with 95 per cent at risk of waterborne diseases.[67] More than 7 per cent of the population are still disconnected from public water networks, and 16.5 per cent of Gaza is not connected to the sewage network.[68]

Over the past 10 years, Gaza has been hit by damaged electricity gridlines and fuel shortages. The ensuing electricity deficit has disrupted the delivery of basic water, sanitation and hygiene services, affecting more than 130 critical water and sanitation facilities.[69] As a result, there has been widespread infiltration of sewage into the coastal aquifer. Because of the deteriorated state of the infrastructure, up to 108 million litres of untreated or partially treated sewage are released into the Mediterranean every day, or discharged into the environment.[70]

As of January 2016, Israel continued to designate more than 70 per cent of the materials needed for water, sanitation and hygiene projects as dual-use items, placing 46 of 53 water and wastewater projects required in Gaza at risk of being suspended or cancelled.[71]

Daily average water consumption in Gaza is 79 litres per person, well below the rate of 100 litres recommended by the World Health Organization (WHO). With the coastal aquifer contaminated, and 97 per cent of the water in the Gaza Strip unsuitable for human consumption,[72] households must purchase drinking water from private companies; that equates to a third of their income on water.[73]

In the West Bank, where Israel discriminatorily allocates water and prevents Palestinians from developing water infrastructure, 22 per cent of the Palestinian population suffer either from lack of access to water or poor-quality water.[74] Average daily water consumption is also well below the WHO recommendation, and much lower than that of Israeli population, which is estimated at 400-600 per cent more. Several communities in Area C face severe water shortages, especially during the summer months, resulting in an average domestic consumption rate among Palestinians of 50 litres per day.[75] Palestinians spend an average of 8 per cent of their monthly expenditure on water, compared with the world average of 3.5 per cent. Families who must rely on expensive tankered water spend as much as half of their monthly expenditure.[76]

In the West Bank and East Jerusalem, Israeli authorities continue to confiscate and demolish Palestinian water infrastructure, with 90 structures including cisterns, latrines and water tanks, knocked down up to the end of September 2016.[77] In East Jerusalem, only 64 per cent of Palestinian households are officially connected to the water infrastructure, and up to a third lack sewage connections, with several locations physically cut off from water and sanitation services by the separation barrier.[78] In the occupied Syrian Golan, Syrians face restricted access to land and resources, including restrictive land, housing and development policies, resulting in overcrowded villages with strained infrastructure and limited resources.[79]

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3. HUMAN RIGHTS FRAMEWORKS FOR UNDERSTANDING WATER SECURITY

A. History and evolution of water security concept
B. Moving towards human security
C Human security and human rights to water and sanitation

3. Human Rights Frameworks for Understanding Water Security

Water security has become a buzz phrase in political analyses of the global South, even more so in the water-scarce Arab region. Commentators frequently predict the region will experience future wars over water. Such claims in newspaper columns and forewords to reports often come as a result of simple calculations.

Only 2.5 per cent of global water resources are fresh water, and of that, only 1 per cent is easily accessible. Further, of the 1 per cent of global usable resources, less than 1 per cent of that is available in the Arab region,[1] which is home to 5 per cent of the world's population.[2] But this on its own does not allow one to conclude that a water scarcity condition exists, let alone water insecurity. It is meaningless without further information on such factors as water supply requirements and use, or consumption rates. Whether a situation of water scarcity ensues from water insecurity is also unclear. This polemic demonstrates the need for clearer definitions of what is meant when such phraseology is employed.

A. History and evolution of water security concept

Water security is a proliferating concept that is "popular but contested".[3] With no agreed universal definition, it has also been referred to as a battleground of ideas.[4] Although there is no linear development of the concept, certain trends can be observed. Up until the 1990s, the term water security was largely used to express the condition of having a water supply sufficient to satisfy the demands of a State's population. Thomas Malthus' thesis from the eighteenth century – that an increase in population size will lead to famine, disease and falling living standards as competition over food resources grows concurrently – was then applied to water.[5] Like food security, water security has come to be seen as describing a condition of sufficient and safe supply.

While the importance of such a condition was nothing novel, it was the writings of Swedish hydrologist Malin Falkenmark in the 1970s that gave fresh impetus to the academic debate. In 1989, she identified thresholds for water stress, water scarcity and absolute water stress.[6] This index of absolute water scarcity as a measurement of supply relative to population size, referred to as the Falkenmark indicator, came to represent the basis for most analyses of water security. Water scarcity was perceived as tantamount to water insecurity. This holds true, in particular, for the Arab region, where a majority of countries fall below the water scarcity threshold. The term emphasized social water demands vis-à-vis physical water stress, which is even more emblematic in the expression water crowding. That defines a measurement of how many people depend on a given resource unit. The Falkenmark indicator is typically applied to countries as a whole, and can only indicate the average water security of a State, not each of its inhabitants.

At the same time, studies linking environmental stress and violent conflicts that had surfaced in the 1980s/1990s were extended to the resource water.[7,8,9] Given the centrality of water to human life, it was argued that a scarcity of safe water would become a matter of national security. Water-scarce countries would be ready to fight over resources as water crowding mounted and resource availability diminished. Transboundary water resources, especially, would increase tensions between riparian countries and even lead to inter-State wars.[10,11] In that, a case was made not only about resource scarcity, but also about dependency on both the resource itself and the policies of other countries with a share in it. This is particularly the case for the Arab region, where the majority of available freshwater resources are transboundary in nature. The resulting dependency on external flows has thus been viewed as a key security issue.

More recent studies have concluded that, in fact, there are more cases of cooperation over shared water resources than conflict,[12] and that its transboundary nature rather furthers a capacity for peacebuilding approaches, even in the Middle East.[13,14] This view was slowly taken up by policymakers. The late Kofi Annan, the former UN Secretary-General, having argued in 2001 that "fierce competition for fresh water may well become a source of conflict and wars in the future",[15] revisited his statement one year later, stating, "the water problems of our world need not be only a cause of tension; they can also be a catalyst for cooperation... If we work together, a secure and sustainable water future can be ours".[16]

This view has generally been adopted today, removing some perceived urgency from the notion of looming water wars. Consequently, although shared water issues are still mentioned often in the literature, it is rarely when defining water security. That there is more cooperation than conflict over international shared water resources does not diminish its importance or relevance for water security, nor its definition. And even if it holds true, it has not yet been confirmed at intra-State level. At subnational level, water conflicts may occur between tribes, communities, different water-using groups, or regions within a country.[17] These arguments, therefore, support the case for integrating a dimension of water conflict into a definition of water security. Some, like Grey and Sadoff,[18] have circumvented a clear mention of conflict and violence over water resources as factors of water insecurity by framing water security as "coupled with an acceptable level of water-related risks". This has the added benefit of comprising risks related to floods and other water-related disasters.

Nevertheless, the question remains whether to include a dimension of national water independence as a criterion for water security, comparable with the concept of food sovereignty. While written definitions of water security rarely include factors such as independence, some attempts at creating numeric indices of water security have done so. Lautze and Manthrithilake, for example, see water security at country level as made up of five components, namely basic household needs, food production, environmental flows, risk management and independence.[19] Likewise, the global risk analytics firm Maplecroft developed a water security risk index, composed of access to improved drinking water and sanitation, the availability of renewable water and the reliance on external supplies, the relationship between available water and supply demands, and the water dependency of each country's economy.[20]

Using these components for water security indices could be interpreted as defining the water security concept. There are, however, issues with these definitions.

While the two indices do not include the scope to be self-critical, Lautze and Manthrithilake do point out several drawbacks with their way of measuring, and hence implicitly, with their definitions of water security. Accordingly, their five components can enable outcomes linked to water security but are insufficient as "ultimate security in these areas … relies on factors over and above those specific to water security", economic factors, for example.[21] Moreover, the specific indicators chosen as measurements for each component of the indices might not be fully representative or indicative for their subsector. Lautze and Manthrithilake further hold that an evaluation of water security conditions at country level is at odds with the practice of water management often being conducted at basin level, and at various timescales. Typically, hydrologists would focus on basin levels in their analyses whereas politicians are concerned with country-level analyses. The authors caution that while a country may have insufficient storage capacity or inflow they may have international agreements with neighbouring countries. Hence, while it might be worthwhile including a notion of independence in a water security definition, in practice it is hard to define.

B. Moving towards human security

Whereas most definitions covered thus far are preoccupied with national water security, traditional notions of security have increasingly fallen away as attention shifts towards individual water security.

Following the end of the Cold War in 1991, security studies were liberated from being almost exclusively State-centred to approaches focused instead on the security of the individual or of ecological systems. Propelled by the publication of the 1994 Global Human Development Report by the United Nations Development Programme (UNDP), which introduced the concept of "human security", the argument was that, while territorial security is important, it is insufficient because it does not necessarily imply the security of all individuals or population groups of a country. This new approach "broadened" the security agenda to consider not just military threats to territorial integrity and national sovereignty, but rather security from a broader range of threats. UNDP categorized these into economic security, food security, health security, environmental security, personal security, community security and political security.[22] Water relates to most of these categories, as well to many of the SDGs. Due to its centrality for human security, water has also come to be regarded as a security issue.

Narrowly defined, water security can imply different focuses. For example, studies in the agricultural area would focus on its quality of influencing agricultural production and food security, while studies in public health would define it as supply security and access to safe water, and focus on preventing and assessing contamination in distribution systems.[23] While these narrow and discipline-specific definitions are not necessarily associated with human security, most of them are, except perhaps those definitions concerned with protection against terrorist attacks or the contamination of drinking water, and hence, they appeal to more traditional conceptions of security.

Several actors have attempted to conceive a comprehensive and integrative definition of water security by fitting in as many of the aspects usually discussed under its umbrella as possible, and addressing various scales of security from regional to household. The most cited and representative definitions are presented in table 4.

Table 4. Most cited definitions of water security

Source	Water security definition
Ministerial Declaration of The Hague on Water Security in the 21st Century (22 March 2000)[a]	Ensuring that freshwater, coastal and related ecosystems are protected and improved; that sustainable development and political stability are promoted, that every person has access to enough safe water at an affordable cost to lead a healthy and productive life and that the vulnerable are protected from the risks of water-related hazards.
Global Water Partnership (2000)[b]	Water security, at any level from the household to the global, means that every person has access to enough safe water at affordable cost to lead a clean, healthy and productive life, while ensuring that the natural environment is protected and enhanced.
Grey and Sadoff (2007)[c]	The availability of an acceptable quantity and quality of water for health, livelihoods, ecosystems and production, coupled with an acceptable level of water-related risks to people, environment and economies.
UN-Water (2013)[d]	The capacity of a population to safeguard sustainable access to adequate quantities of and acceptable quality water for sustaining livelihoods, human well-being, and socioeconomic development, for ensuring protection against waterborne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability.

[a.] Ministerial Declaration of The Hague on Water Security in the 21st Century, 22 March 2000. Available at http://www.worldwatercouncil.org/fileadmin/world_water_council/documents/world_water_forum_2/The_Hague_Declaration.pdf.
[b.] GWP, 2000a.
[c.] Grey and Sadoff, 2007.
[d.] UNU, 2013.

These definitions are clearly not in line with the traditional concept of security. They are concerned with individual security, "every person", "people" and "a population" rather than a State's security. Non-military threats are considered as they are concerned with more than just quantity and quality, but also health, economy/industry and ecosystems. Interdisciplinary elements and the multisectoral dependency of water security are increasingly evident in the language employed. Further, the centrality of water security as a prerequisite for development is brought to the fore.

Some definitions include equity/equitable access as one criterion, but that is the exception. Almost none refer to notions of national independence or self-sufficiency. Human security as a concept, however, does not imply that national security is any less important, only that it is not sufficient on its own; a country may be considered nationally secure but still host individuals who are insecure, and vice versa. Given that national security still matters, a case could be made for such factors being included in a holistic definition of water security, or at least when referring to national water security.

C. Human security and human rights to water and sanitation

Over the years, a clear trend can be identified, away from traditional security topics around water security, such as violence and interstate conflict, towards a notion of human security. Non-governmental organizations, think tanks and international organizations, and also academia, using the term water security today are mainly preoccupied with the security of the individual rather than that of a nation state.

This was likely influenced by a push to recognize water as a human right that started in the 1970s and culminated in July 2010 when the United Nations General Assembly formally recognized the human right to safe and clean drinking water and sanitation in Resolution 64/292 (see figure 12). The 1977 United Nations Conference on Water in Mar del Plata, Argentina, had recognized water as a right for the first time, its action plan declaring: "All peoples, whatever their stage of development and social and economic conditions, have the right to have access to drinking water in quantities and of quality equal to their basic needs". The declaration posits the availability of water as essential both for life and full development, at individual level and as an integral part of society.[24] It references an earlier declaration made at the 1976 United Nations Conference on Human Settlements in Vancouver, Canada, that recognized clean water as a basic human need.[25]

1. Conventions

Two conventions assisted in emphasizing these human rights for women and children. The 1979 Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW) sets out an agenda to end discrimination against women, explicitly referencing water and sanitation.[26] Article 14(2) says: "States Parties shall take all appropriate measures to eliminate discrimination against women in rural areas in order to ensure, on a basis of equality of men and women, that they participate in and benefit from rural development and, in particular, shall ensure to such women the right … (2.h) To enjoy adequate living conditions, particularly in relation to housing, sanitation, electricity and water supply, transport and communications".

Of equal importance is the participatory approach articulated in article 7: "State Parties shall take all appropriate measures to eliminate discrimination against women in the political and public life of the country and, in particular, shall ensure to women, on equal terms with men, the right … (7.b) to participate in the formulation of government policy and the implementation thereof and to hold public office and perform all public functions at all levels of government". Article 14(2.a) also seeks to ensures the right of women to "participate in the elaboration and implementation of development planning at all levels".

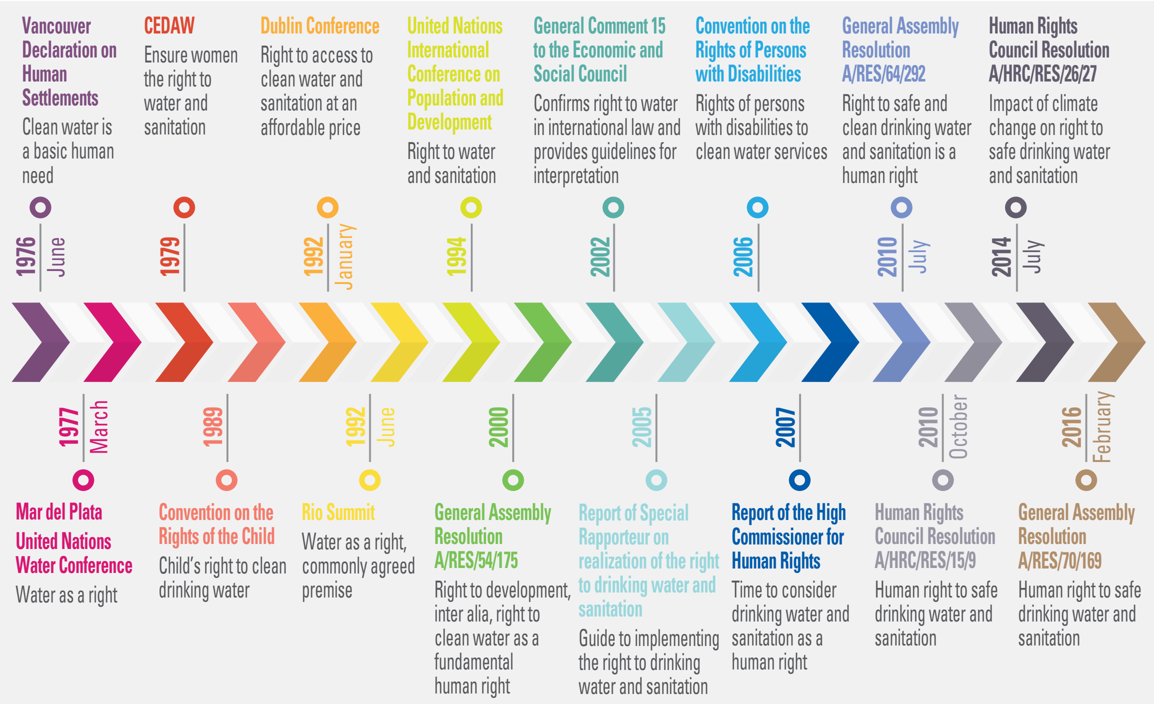
The second milestone was the 1989 Convention on the Rights of the Child, which recognizes the links between health and the environment, and specifically clean drinking water. Article 24(2) declares: "States Parties shall pursue full implementation of this right and, in particular, shall take appropriate measures … (2.c) to combat disease and malnutrition, including within the framework of primary health care, through, inter alia, the application of readily available technology and through the provision of adequate nutritious foods and clean drinking-water, taking into consideration the dangers and risks of environmental pollution".[27] The right to water was also included in the Convention on the Rights of Persons with Disabilities but later, in 2006,[28] its article 28 recognizing the right of persons with disabilities to an adequate standard of living and including measures "… to ensure equal access by persons with disabilities to clean water".

2. Conferences

In 1992 two landmark conferences took place, in Dublin and in Rio, on sustainable development. The Dublin Statement on Water and Sustainable Development referred to four guiding principles, Principle 4 stating "… it is vital to recognize first the basic right of all human beings to have access to clean water and sanitation at an affordable price".[29] This informed the United Nations Conference on Environment and Development in Rio de Janeiro, which also endorsed the Mar del Plata resolution that all people have the right to have access to drinking water, calling this "the commonly agreed premise" in chapter 18 of Agenda 21.[30]

Dublin and Rio were followed in 1994 by the United Nations International Conference on Population and Development in Cairo, which in its Programme

Figure 12. Major milestones to the recognition of the human rights to water and sanitation



Source: Authors.

of Action recognized that all individuals "… have the right to an adequate standard of living for themselves and their families, including adequate food, clothing, housing, water and sanitation".[31] The interlinkage between water and development was proclaimed in the General Assembly Resolution on the Right to Development in 2000. Article 12 affirmed that "in full realization of the right to development, inter alia: (a) The rights to food and clean water are fundamental human rights and their promotion constitutes a moral imperative both for national Governments and for the international community".[32]

3. United Nations instruments

The United Nations General Comment No. 15, adopted in 2002, helped clarify the scope of the right to water. It explains the 1966 International Covenant on Economic, Social and Cultural Rights confirming the right to water in international law. The Comment provides guidelines for the interpretation of the right to water, framing it within two articles, article 11, the right to an adequate standard of living, and article 12, the right to the highest attainable standard of health.[33]

More precisely, in defining the legal base of the right to water, the Comment references access to water for agriculture rights to realize the right to adequate food, referring specifically to women farmers. It sets out factors that apply under all circumstances to the right to water, including availability, quality, acceptability, physical accessibility, affordability, participation and non-discrimination, and information accessibility concerning water issues for accountability (see box 1). Under non-discrimination and equality, it stresses that women should not be excluded from decision-making processes concerning water resources and entitlements. Further, it clearly sets out the State parties' obligations to uphold the right, defines actions that would constitute a violation and prescribes means of implementation at national level. Two international obligations addressing shared water, occupation and conflicts are particularly relevant to the Arab region.

Box 1. General Comment No. 15 and the right to water

The 2002 General Comment No. 15 defined the factors that apply in all circumstances under the right to water:

1. Availability where each person must have sufficient and continuous water supply for personal and domestic uses, which ordinarily include drinking, personal sanitation, washing of clothes, food preparation, and personal and household hygiene.

2. Quality where the water must be safe for personal or domestic use in terms of being free from microorganisms, chemical substances and radiological hazards that constitute a threat to a person's health and must be acceptable in colour, odour and taste for each use.

3. Accessibility where water, including water facilities and services, are accessible to everyone without discrimination based on the following criteria:
   a. Physical accessibility where sufficient, safe and acceptable water must be accessible within or in the immediate vicinity of each household, educational institution and workplace, and all water facilities and services must be of sufficient quality, culturally appropriate and sensitive to gender, life cycle and privacy requirements. In addition, physical security should not be threatened during access to water facilities and services;
   b. Economic accessibility in the sense that water and related facilities and services must be affordable for all and not compromise the realization of other covenant rights;
   c. Non-discriminatory where water and related water facilities and services must be accessible to all in law and in fact.

4. Information accessibility, including the right to seek, receive and impart information concerning water issues facilitating accountability.

Source: United Nations Economic and Social Council, 2002a.

The first, on shared water, declares that, "State parties have to respect the enjoyment of the right in other countries". It states that any action taken in one state "should not deprive another country of the ability to realize the right to water for persons in its jurisdiction".[34] This is specifically relevant to Arab downstream countries in shared basins like Egypt, Iraq, Jordan, the Sudan and the Syrian Arab Republic. The second international obligation requires States to refrain "from imposing embargoes or similar measures, that prevent the supply of water, as well as goods and services essential for securing the right to water". This is applicable to the Occupied Palestinian Territory and countries under conflict and facing sanctions, such as the Syrian Arab Republic. The Comment is in keeping with the report of the Special Rapporteur on the relationship between the enjoyment of economic, social and cultural rights and the promotion of the realization of the right to drinking water supply and sanitation. Issued earlier in 2002, the report set the legal argument for recognizing the right to water and sanitation as a human right.[35]

Several steps followed that led to the right to water and sanitation being recognized. In 2004, the Sub-Commission on the Promotion and Protection of Human Rights requested the Special Rapporteur to the United Nations Economic and Social Council, El Hadji Guissé, prepare draft guidelines for realizing the right to drinking water supply and sanitation. Submitted in 2005, these were intended to assist government policymakers, international agencies and members of civil society working in the water and sanitation sector to implement the right to drinking water and sanitation. They also sought to help formulate and implement human rights policies, including those pertaining to relevant international documents on the right to water.[36]

The guidelines do not legally define the right to water and sanitation, but provide guidance on: its implementation across levels of government; the need to prevent discrimination and address the needs of vulnerable groups; availability and equitable distribution of water; improving access, affordability, quality, participatory rights particularly for women; remedies and monitoring; and international obligations. They build on elements introduced in General Comment No. 15 and previous reports in shifting from a strict right to drink water to a more comprehensive right to water and sanitation that stretches beyond the classical water sector to encompass other rights and sectors.

The quest for formal recognition was taken up by the Human Rights Council in 2006 in its Decision 2/104. It requested that the Office of the United Nations High Commissioner for Human Rights conduct "a detailed study on the scope and content of the relevant human rights obligations related to equitable access to safe drinking water and sanitation under international human rights instruments".[37] The report, which was completed in 2007, concluded: "It is now time to consider access to safe drinking water and sanitation as a human right, defined as the right to equal and non-discriminatory access to a sufficient amount of safe drinking water for personal and domestic uses … to sustain life and health".[38]

It recommended that States prioritize these personal and domestic water uses over other uses. The mandate restricted the report to "safe drinking water", which explains the limited definition included in the recommendation. Realizing the need for clarification and to focus on local and national perspectives in considering the right to water and sanitation, the Human Rights Council in 2007 appointed an independent expert on human rights obligations. Along with further explaining the obligations, the expert was tasked with making recommendations to advance the Millennium Development Goals (MDGs) that were established in 2000 and to apply a gender perspective. This is interesting as it broadened the scope to include the role of water in achieving development.

4. United Nations resolutions

In July 2010, for the first time, the United Nations General Assembly, in Resolution A/RES/64/292, formally recognized the right to water and sanitation and acknowledged that clean drinking water and sanitation are essential to the realisation of all human rights.[39] The resolution called on States and international organizations to provide financial resources, and build capacity and technology transfer to help countries, in particular developing countries, realize this right for all. Further, the resolution called on the independent expert to report on the challenges to realizing this right and their impact on achieving the MDGs, again highlighting the links between the development agenda and all human rights.

The Human Rights Council in October 2012 affirmed that "the human right to safe drinking water and sanitation is derived from the right to an adequate standard of living and inextricably related to the right to the highest attainable standard of physical and mental health, as well as the right to life and human dignity".[40] This was followed by several resolutions from both the General Assembly and the Human Rights Council emphasizing the requirements to fully realize obligations on access to safe drinking water and sanitation, and their importance to the development agenda.[41]

In 2015, the General Assembly adopted a resolution recognizing access to safe drinking water and sanitation as two rights that are closely related but with distinct features that justify their separate treatment in order to address specific challenges in their implementation.[42] This acknowledged that sanitation, when addressed with water, is usually neglected, and that the MDG 7 sanitation component had been missed. The resolution also stressed the importance of promoting leadership roles for women, in addition to full and equal participation in decision-making in water and sanitation management.

It should be noted that the Human Rights Council, in adopting a resolution linking climate change and human rights, emphasized that "the adverse effects of climate change have a range of implications, both direct and indirect, for the effective enjoyment of human rights, including, inter alia, the right to life, the right to adequate food, the right to the highest attainable standard of health, the right to adequate housing, the right to self-determination, the right to development and the right to safe drinking water and sanitation, and recalling that in no case may a people be deprived of its own means of subsistence".[43]

It is evident that these milestones in human rights also address, explicitly or implicitly, aspects of water security with implications at different scales, from regional, to national, to household.

Most components of water security presented in the definitions in table 4 are addressed either directly by the factors set out under human rights to water and sanitation, or in principles that consider human rights to be universal, indivisible and interdependent; they are thus addressed by the centrality of water to the achievement of other rights.

5. Regional and national water right tools

At regional level, the Arab Charter of Human Rights refers to the right of water under articles 38 and 39 as follows:[44]

- Article 38: "Every person has the right to an adequate standard of living for himself and his family, which ensures their well-being and a decent life, including food, clothing, housing, services and the right to a healthy environment. The State Parties shall take the necessary measures commensurate with their resources to guarantee these rights";
- Article 39, parts 2e and 2f: "… the measures taken by States shall include the following, 'Provision of basic nutrition and safe drinking water for all' and 'Combating environmental pollution and providing proper sanitation systems'".

The charter came into force in 2008 after ratification by the seventh member of the League of Arab States. Currently it is ratified by 13 States (Algeria, Bahrain, Jordan, Kuwait, Lebanon, Libya, the State of Palestine, Qatar, Saudi Arabia, the Sudan, the Syrian Arab Republic, the United Arab Emirates and Yemen).

At national level, several States have recognized the right to water in their constitutions, such as:

- Egypt (2014), article 79: "Each citizen has the right to healthy, sufficient amounts of food and clean water";
- Morocco (2011), article 31: "The State, the public establishments and the territorial collectivities work for the mobilization of all the means available to facilitate the equal access of the citizens to conditions that permit their enjoyment of the right: to the access to water and to a healthy environment";
- Tunisia (2014), article 44: "The right to water shall be guaranteed. The conservation and rational use of water is a duty of the state and of society".

Other countries have recognized this right in law; for example, Lebanon and the recent Water Law, which under article 5 recognizes the right to water and sanitation. It notes the right to water is the right to obtain adequate quantities to meet essential life needs, which justifies enforcing beneficiaries to pay fees for water use. This, however, fails in assuring that those who cannot afford the service have the means to access water, and there is no reference to water quality.[45]

The State of Palestine, similarly, recognised the right to water access in article 5 of the Water Law of 2014, which states that "every person has the right to obtain his needs of suitable quality drinking water for utilization at specific prices set in accordance with the Tariff Regulation issued by the Cabinet of Ministers".[46]

4. WATER SECURITY FOR SUSTAINABLE DEVELOPMENT

4. Water Security for Sustainable Development

A. Global frameworks

In the 1980s, the notion of sustainable development was propagated, in particular by the United Nations-tasked Brundtland Commission (formerly the World Commission on Environment and Development), notably in its 1987 final report, Our common future. It emphasized the need for sustainable development that "meets the needs of the present without compromising the ability of future generations to meet their own needs".[1] The commission proposed three pillars for human well-being: economic, sociopolitical and environmental/ecological dimensions of development. The premise was to put in place policies and measures to spur economic and social development, particularly for people in developing countries and those most vulnerable, while maintaining environmental integrity for future generations (see box 2). The proposed implementation exposes the links between sectors and the pillars of sustainable development, focusing on a participatory approach and utilizing technology and international assistance to advance development on the basis of inclusivity and leaving no one behind. The principle of a participatory approach was reconfirmed in the outcome document of the Rio+20 Conference, "The future we want", under number 12 of Our common vision, which recognized "that opportunities for people to influence their lives and future, participate in decision-making and voice their concerns are fundamental for sustainable development".[2]

1. Intergenerational aspect

Only sustainable resource management can safeguard a continued existence of water resources. Applied to freshwater resources, this raises concerns about the overabstraction of renewable groundwater or the use of non-renewable fossil groundwater resources, for example in the GCC countries (see table 5).

It has been argued that diminishing water availability is not a concern if new technologies such as desalination can help increase supply. But trusting in future ingenuity is a gamble,

Box 2. Common future

The report of the Brundtland Commission, Our common future, set out the following requirements for pursuing sustainable development:

- Political system securing effective citizen participation in decision-making;
- Economic system able to generate surpluses and technical knowledge on a self-reliant, sustained basis;
- Social system providing solutions for tensions arising from disharmonious development;
- Production system respecting the obligation to preserve the ecological base for development;
- Technological system that can search continuously for new solutions;
- International system fostering sustainable patterns of trade and finance;
- Administrative system that is flexible and has the capacity for self-correction.

Source: United Nations, General Assembly, 1987.

Table 5. Overabstraction of groundwater resources in GCC States

State	Annual renewable groundwater volume (MCM)	Abstraction volume in 2010 (MCM)	Abstraction (percentage) of renewable volume
Bahrain	110	103	93
Kuwait	160	491	307
Oman	900	1 216	135
Qatar	50	248	496
Saudi Arabia	3 850	12 340	321
United Arab Emirates	190	2 300	1 210
Total	5 260	16 698	317

Source: Al-Zubari and others, 2017.

and also a shirking of responsibility. Such an approach transfers the responsibility of a potential water-scarce situation to future generations. Including a sustainability component in a definition of water security is thus a question of intergenerational justice.

To favour sustainable management does not discredit the role of technology. Should a technology exist to increase freshwater supplies, it should be used. This is a call to reason, preferring certainty to uncertainty, even if this might involve higher costs and effort. It can be compared to an insurance policy; it might be better to accept the economic opportunity costs related to not overexploiting groundwater resources beyond sustainable rates to avoid ending up with too little or no groundwater resources in the future. The fact water cannot be substituted, as well as the uncertainty and irreversibility related to its overexploitation, make a case for strong sustainability vis-à-vis weak sustainability.[3]

2. Water centrality in sustainable development

Water's critical role in sustainable development, and its economic, social and environmental dimensions, has been recognized in conferences and outcome documents from the Mar de Plata United Nations Water Conference in 1977, to the Dublin Statement (also known as the Dublin Principles) and *Agenda 21* of the Rio Summit in 1992, to the 2012 Rio+20 outcome document and launch by the United Nations General Assembly in 2018 of the International Decade for Action (see box 3).

Water is essential for agriculture, by far the largest consumer in the region, with all the corresponding economic and social implications.

Water plays other roles in the economy; in the industrial sector in the production of goods, in the services and tourist sectors, and in the production of energy. Economic activities benefit from water security; the reliable supplies that have a low vulnerability to water scarcity and water-related disasters, such as droughts and floods. Water security plays an important role in the economic resilience of many States, not to mention political stability. Interlinkages between water and sanitation and the health sector are also visible.

Box 3. Centrality of water to sustainable development

Mar de Plata Action Plan

The Mar de Plata Action Plan recognizes available water resources are essential for “full development, both as an individual and as an integral part of society”.

Dublin Statement on Water and Sustainable Development

Principle 1 of the Dublin Statement stresses that water is “essential to sustain life, development and the environment” and that its effective management requires a holistic approach linking “social and economic development with protection of natural ecosystems”.

Rio Conference, *Agenda 21*

Chapter 18.6 of Agenda 21 acknowledged “all social and economic activities rely heavily on the supply and quality of fresh water” and that due to population and economic growth, many countries are reaching “water scarcity or facing limits to economic development”. In article 18.7, the overall objective is set as the satisfaction of “the fresh water needs of all countries for their sustainable development”.

The United Nations Conference on Sustainable Development (Rio+20), outcome document, “The future we want”

The outcome document of Rio+20 recognized that “water is at the core of sustainable development”. It reiterated “the importance of integrating water into sustainable development”, and underlined “the critical importance of water and sanitation within the three dimensions of sustainable development”.

International Decade for Action on Water for Sustainable Development, 2018-2028

The International Decade for Action emphasized the criticality of water “for sustainable development and the eradication of poverty and hunger, that water, energy, food security and nutrition are linked, and that water is indispensable for human development, health and well-being and a vital element of achieving the Sustainable Development Goals and other relevant goals in the social, environmental and economic fields”.

Sources: United Nations, 1977; WMO, 1992; United Nations Division for Sustainable Development, 1992; United Nations, General Assembly, 2012 and 2016b.

It can be argued that the relationship between water and sustainable development is mutually beneficial. As water security or the availability of water is central to sustainable development, so can sustainable development assist in improving water security. Certainly, countries with high economic development like those in the GCC are better able to deal with the risks of water security, and perhaps achieve a level of water security that natural water resources would not normally afford. GCC countries use their economic development to offset water resource shortages and obtain water through desalination. The social and environmental dimensions of sustainable development are also important factors in water security and averting associated risks.

3. The future we want

The Rio+20 outcome document[4] provided a common vision to guide collective global action in accelerating the achievement of internationally agreed development goals such as the MDGs, or the SDGs that replaced them in 2015. With water and sanitation, this vision highlighted the importance of achieving access to safe and affordable drinking water and sanitation for all, integrated water resource management, water efficiency plans, capacity-building, mobilization of resources, technology transfer, protection and management of ecosystems, reduction of water pollution, improvement of wastewater treatment, and addressing floods, droughts and water scarcity. These were further elaborated in the 2030 Agenda, with goals, targets and indicators assigned.[5]

B. Water security within the 2030 Agenda

The United Nations General Assembly adopted the 2030 Agenda for Sustainable Development in September 2015 through a consultation process with civil society and other stakeholders within countries and at regional and global levels. Through the Agenda, the international community reaffirmed its commitment to the human right to clean drinking water and sanitation that is founded on the Universal Declaration of Human Rights[6] and informed by the United Nations Declaration on the Right to Development.[7]

The 2030 Agenda includes 17 SDGs and 169 targets, which are universal, people-centred, and seek to realize the human rights of all and to achieve gender equality and the empowerment of women and girls. The SDGs are integrated and indivisible, and balance the economic, social and environmental dimensions of sustainable development. The Agenda called for an approach based on integrated solutions that are sustainable and inclusive. This resonates with the integrated water resources management (IWRM) approach, which was based on the four principles articulated in the Dublin Statement:[8]

1. Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment.
2. Water development and management should be based on a participatory approach, involving users, planners and policymakers at all levels.
3. Women play a central part in the provision, management and safeguarding of water.
4. Water has an economic value in all its competing uses and should be recognized as an economic good.

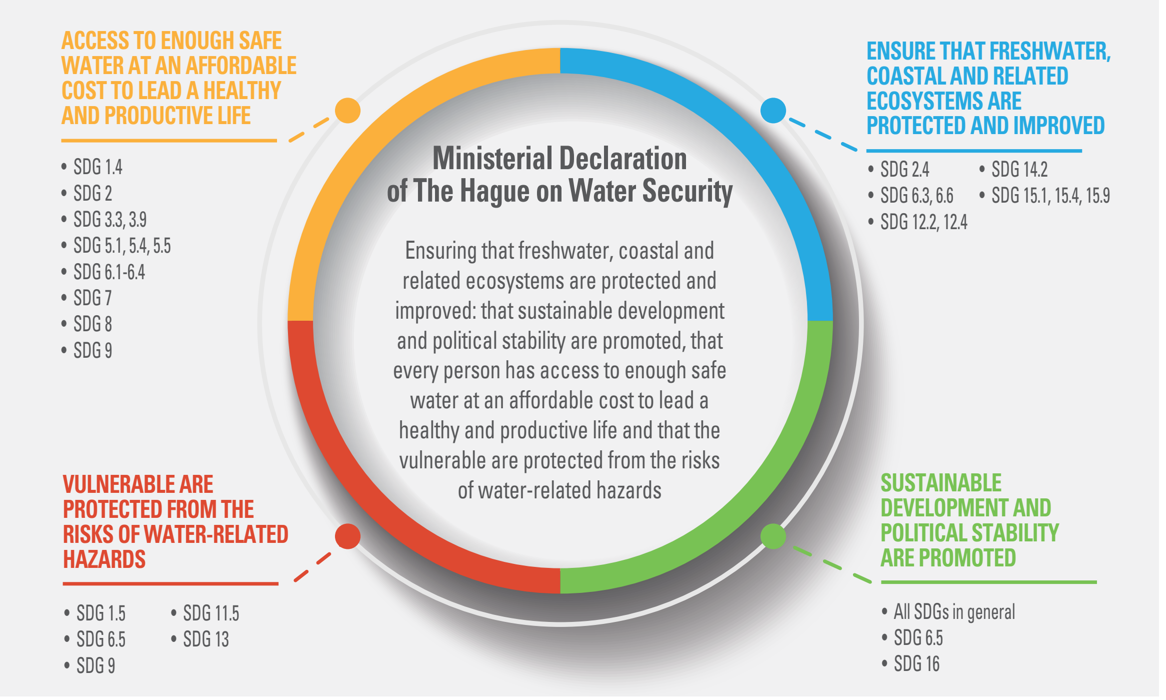
The 2030 Agenda set a water-dedicated goal, SDG 6, aiming to ensure availability and sustainable management of water and sanitation It has six associated targets and two means of implementation dealing with various aspects of water (see table 6). It should be stressed, however, that water extends beyond SDG 6 and is central to several goals and targets.

The SDG 6 targets go beyond the requirement of the human right to clean drinking water and adequate sanitation, and include treatment of wastewater and wastewater reuse, water-use efficiency across all sectors, addressing water scarcity, IWRM, transboundary cooperation, and protecting and restoring water-related ecosystems. These extend to aspects of water security as listed in the most cited definitions in table 4. A mapping across the SDGs and their targets demonstrates the linkages with water security (see figures 13 to 16). Note that this mapping was completed at both goal and target level; the target level was listed when water was explicitly related to certain targets, the goal level when water was implicitly related to most targets within that goal. Water security cannot be limited to SDG 6 but is essential for ending poverty and for food security, healthy lives, economic growth and adapting to climate change, among other goals. Similarly, many goals are essential for achieving water security, such as empowering women, as articulated in the Dublin Statement's third principle, and ensuring access to reliable modern energy.

Table 6. Water-dedicated SDG 6[9]

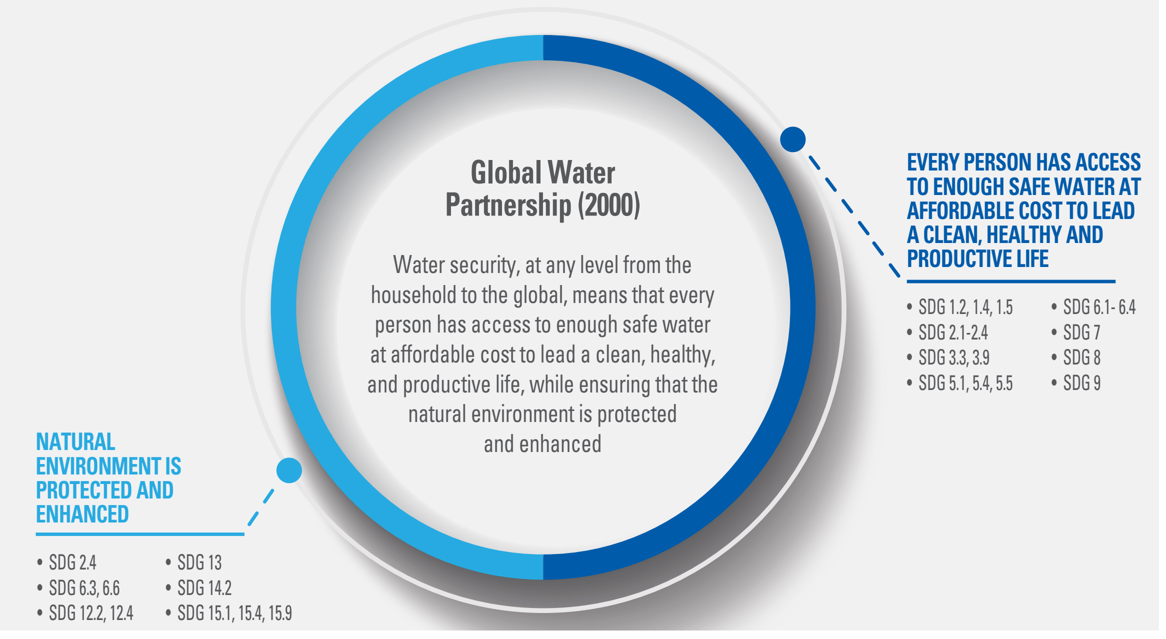
SDG 6	Target	Means of implementation
6 CLEAN WATER AND SANITATION Ensure availability and sustainable management of water and sanitation for all	6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all 6.2 By 2030, achieve access to adequate and equitable sanitation 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

Figure 13. Mapping linkages between Ministerial Declaration on water security and SDGs and their targets



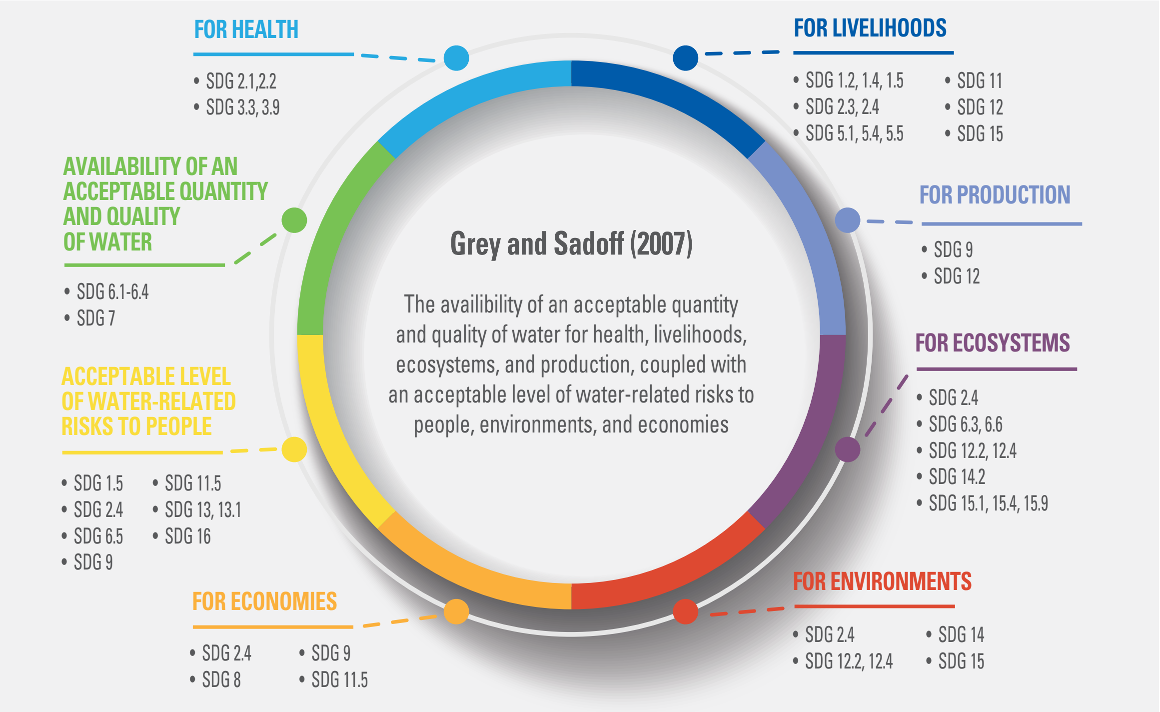
Source: Authors.

Figure 14. Mapping linkages between Global Water Partnership definition of water security and SDGs and their targets



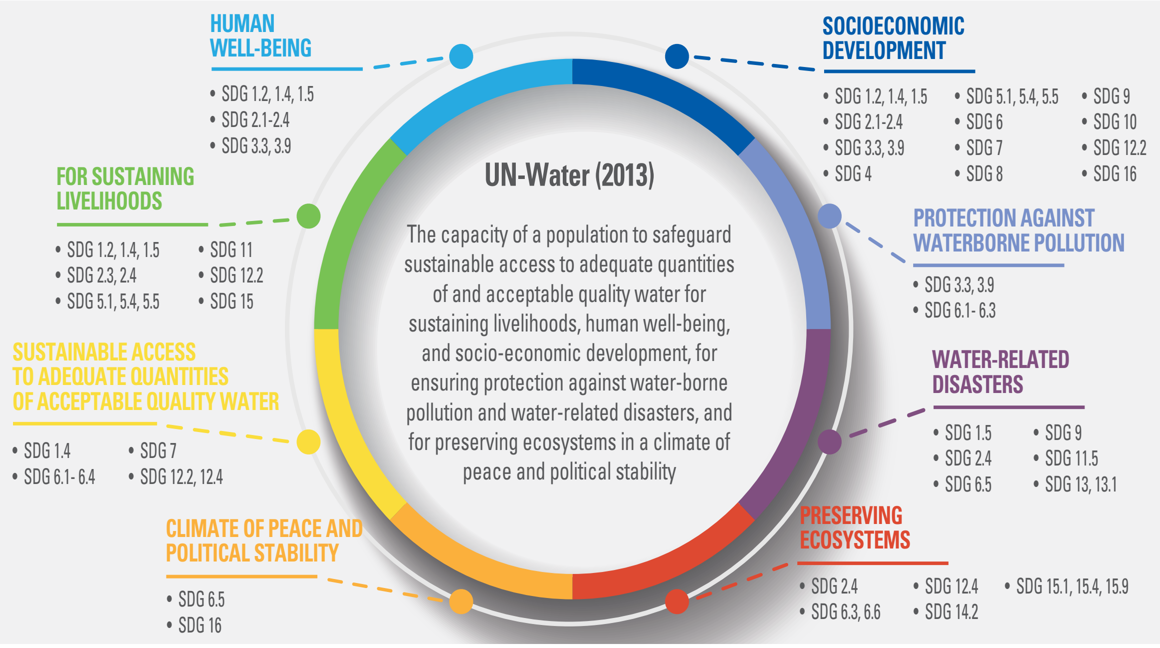
Source: Authors.

Figure 15. Mapping linkages between Grey and Sadoff definition of water security and SDGs and their targets



Source: Authors.

Figure 16. Mapping linkages between UN-Water definition of water security and SDGs and their targets



Source: Authors.

1. Means of implementation for water security with the 2030 Agenda

The 2030 Agenda set out means of implementation for achieving each of the goals, with SDG 17 dedicated to strengthening the means of implementation.

SDG 6 has two means of implementation. The first, 6.a, calls for international cooperation and capacity-building support to be expanded for developing countries in water and sanitation-related activities, with programmes highlighting such activities as water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies. These activities are extremely relevant to the water-scarce Arab region and help obtain additional resources through non-conventional means. The idea is to encourage cooperation through external aid and grants or loans, including official development assistance. It is not meant to replace domestic spending but to provide support to developing countries where the needs are greatest. The second means of implementation is geared towards getting stakeholders to participate in water and sanitation planning and management in local communities. This will ensure inclusivity in proposed solutions that, when implemented, will be owned locally and context-specific.

SDG 17 proposes focus areas to strengthen the means of implementation to achieve sustainable development, including:

- Finance;
- Technology;
- Capacity-building;
- Trade;
- Policy and institutional coherence;
- Multi-stakeholder partnership;
- Data, monitoring and accountability.

These are not only relevant for sustainable development but will also strengthen water security at various scales of analysis. For example, SDG 6.a is more likely to improve water security at national level with a trickle-down effect to local communities, whereas, SDG 6.b has more direct effect at the local community level with a trickle-down effect to households.

C. Human rights-based approach for water security and sustainable development

Although the 2030 Agenda does not directly stipulate a human rights-based approach to development, such an approach is manifested in the universality of the 17 SDGs. The language in the preamble is indicative of this, where the SDGs "… seek to realize the human rights of all and to achieve gender equality and the empowerment of all women", in the introduction, where the Heads of State and government resolve to "protect human rights and promote gender equality and the empowerment of women and girls",[10] and also in the Agenda's shared global vision.

A human rights-based approach to sustainable development and water security is one that anchors analysis, policies, plans and projects in a system of rights and obligations established by international law. It seeks to address inequalities by empowering people to participate in policy formulation and to hold accountable those responsible. Such an approach would look beyond the regional or national achievement of SDGs or water security and address the root causes of poor accessibility, water quality and water scarcity at local and household scale, exposing inequalities. This requires interventions at all stages of governance – from policies and legislation, to regulations to budgets – to achieve water security for all and at all scales with a view across all sectors where rights are indivisible, interdependent and non-discriminatory. This requires States to use funds more efficiently, making sure undertakings help achieve water security for all and not just the privileged. Water security for the domestic sector cannot mean depriving the agriculture sector and those depending on it; similarly, water security for urban areas cannot deprive rural areas. In terms of indivisibility of rights at the core of this approach, the right to safe drinking water is equal to the right to food and to development, not a right that can be compromised in achieving another. This assures a holistic approach to water security that is normally lacking when considering issues of national security, where the field of vision is often narrowed.

Although there is no consensus on how to apply a human rights-based approach, United Nations agencies have agreed on a number of principles that should be met; namely, to assist in the realization of human rights, guided by international rights at all stages of development, and build the capacity of rights-holders and duty bearers in meeting their entitlements and obligations, respectively (see box 4).

This participatory approach lends itself to gender equality and the empowerment of women, and recognizes the indivisibility of rights. It integrates international women's rights in every stage of efforts to achieve water security or development.

D. Post-2015 global frameworks

1. The Paris Agreement

In 2015, at the Paris Climate Conference (officially the 21st Conference of the Parties, or COP 21, to the United Nations Framework Convention on Climate Change), the international community agreed to undertake efforts to combat climate change and adapt to its effects, with enhanced support to assist developing countries to do so.[11] The impact of climate change on water-related sectors is evident in the Arab region, and adaptation measures under the Paris Agreement assist the achievement of water security. Article 7 establishes a goal of "enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view to contributing to sustainable development and ensuring an adequate adaptation response".[12] It calls for a gender-responsive, participatory and transparent approach that considers local specificities, which is in line with sustainable development and the human rights-based approaches that may guide the way to achieving regional water security. Water sector plans in the region stand to benefit from integrated planning that includes adaptation measures, which may be financed via the Paris Agreement.

Financial support to developing countries is addressed under article 9 of the agreement, while articles 10 and 11 address technology and capacity-building support to improve resilience to climate change. These are key aspects to adaptation in the sector for enhancing water security in the region.

Box 4. Common understanding among United Nations agencies on a human rights-based approach

1. All programmes of development cooperation, policies and technical assistance should further the realization of human rights as laid down in the Universal Declaration of Human Rights and other international human rights instruments.

2. Human rights standards contained in and principles derived from the Universal Declaration of Human Rights and other international human rights instruments guide all development cooperation and programming in all sectors and all phases of the programming process.

3. Development cooperation contributes to the development of the capacities of duty bearers to meet their obligations and of rights-holders to claim their rights.

Source: United Nations, Office of the United Nations High Commissioner for Human Rights, 2006.

2. The Sendai Framework for Disaster Risk Reduction 2015-2030

The Sendai Framework for Disaster Risk Reduction was adopted at the third World Conference on Disaster Risk Reduction in Sendai, Japan, in 2015.[13] Its main goal is to "prevent new and reduce existing disaster risk through the implementation of integrated and inclusive economic, structural, legal, social, health, cultural, educational, environmental, technological, political and institutional measures that prevent and reduce hazard exposure and vulnerability to disaster, increase preparedness for response and recovery, and thus strengthen resilience".[14] The focus is risk reduction through an integrated cross-sectoral approach strengthening resilience. The framework established seven targets to monitor global progress.

Definitions of water security by The Hague in 2000, Grey and Sadoff in 2007 and UN-Water in 2013 all list protection from water-related disasters as a pre-condition. Thus, water security frameworks stand to benefit from synergies provided through the Sendai framework in terms of disaster risk reduction, whether it is risks to water-related infrastructures or water quality, or through building resilience and ensuring recovery preparedness. Targeted means of implementation and actions proposed under the Sendai framework can also achieve water security in the region. This may be mainstreamed under the four priority areas identified by the framework, helping to build synergies and complementarity between water security and global agendas. For instance, under priority 4, enhancing disaster preparedness for effective response and to "build back better" in recovery, rehabilitation and reconstruction, the Sendai framework at national and local levels looks to "promote the resilience of new and existing critical infrastructure, including water, transportation and telecommunications infrastructure … to ensure that they remain safe, effective and operational during and after disasters in order to provide live-saving and essential services". Similarly, priority 3, investing in disaster risk reduction for resilience, may benefit water security in obtaining funding for improving the resilience of water infrastructure, and through incorporating sector priorities in disaster risk reduction strategies, policies, plans and regulations.

As with other global frameworks, the Sendai framework emphasizes that women and their participation are critical to "effectively managing disaster risk and designing, resourcing and implementing gender-sensitive disaster risk reduction policies, plans and programmes", and that capacity must be built to prepare and empower them.[15]

E. Regional frameworks

As with the global frameworks, a water security framework should allow for several regional strategies in its approach to achieving water security in building synergies and coherence. Several key regional strategies are addressed below.

1. The Arab Strategy for Water Security in the Arab Region to Meet the Challenges and Future Needs for Sustainable Development 2010-2030

In 2011, the Arab Ministerial Water Council (AMWC), part of the League of Arab States, adopted the Arab Strategy for Water Security in the Arab Region to Meet the Challenges and Future Needs for Sustainable Development 2010-2030.[16] The priority is to address sustainable development challenges through a workplan that tackles aspects of water resources management, including capacity-building, research and development, providing drinking and irrigation water services, unconventional water resources and integrated water resources management. It is meant to unify and guide Arab efforts in managing water resources.

Table 7. Challenges, pillars and objectives, Arab strategy for water security 2010-2030[17]

Challenges	Key pillars	Expected outcomes
• Inability to secure water needs • Exacerbation of social and political impacts of the food crisis and increased poverty • Low water usage efficiency • Shared water resources • Absence of a holistic approach to water sector management • Population growth and increased demand for water • Lack of individual and societal awareness of water issues • Impact of climate change • Water in occupied Arab territories • Increasing role of water in economic development • Finance of water projects and private sector participation • Insufficient institutional and human capacity in the water sector • Inadequate role and contribution of scientific research and technology transfer in the water sector • Weak legal and legislative frameworks • Lack of service provision for clean drinking water and sanitation	• Follow up of regional studies on the status of water resources in the region and establishment of an integrated Arab water information system • Scientific research and transfer and localisation of modern technology • Tackling climate change impacts on water resources in the region, and adopting adaptation measures • Implementing the principles of IWRM • Achieving the MDGs • Availing necessary funding for water projects • Increasing the efficiency of water use • Protection of water rights for States in terms of water shared with non-Arab States, water rights in the occupied Arab territories and water shared between Arab States • Build institutional and human capacity in the water sector • Raise awareness of water and environmental issues among all members of the community • Protection of the coastal aquatic environment • Expansion in the use of non-conventional water • Institutional development and water legislation and laws • Integration between the Arab strategy for water security and other relevant Arab strategies	• Optimize use of available water resources of all kinds • Provide safe drinking water and sanitation services in line with the MDGs • Protect groundwater and surface-water resources against pollution and depletion • Confront and adapt to potential impacts of climate change on available water resources • Anchor the principles of IWRM as a key element in water policies in States • Capacity development of human resources in the water sector • Protect Arab water rights in waters shared with non-Arab States • Protect water rights in occupied Arab territories • Strengthen cooperation among Arab States to manage shared water resources • Attract Arab capital for investment in water projects. • Exploit the comparative advantages of Arab States in the field of water resources • Localise and support industries/modern technologies for desalination and water treatment, with the aim of expanding their use in the region. • Strengthen the role of scientific research in water resources management • Develop conventional and non-conventional water resources. • Enhance cooperation and exchange of experiences and information between Arab States • Raise awareness among all segments of society, including civil society organizations, on issues of water and the environment, involve them in decision-making processes related to water projects and deepen the culture of environmental protection

The strategy identified several challenges, key pillars and objectives that are summarized in table 7. It did not, however, provide a regional definition for water security, but rather, stressed water scarcity, shared water resources and climate change as the dominant challenges in the region. It can be inferred from the title that the main objective is to meet the challenges and future needs of sustainable development. This would encompass the three pillars of development – social, economic and environmental – and thus align with recent definitions that centre on human security and sustainable development. Further, there is a specific objective to meet the global development goal of safe drinking water and sanitation services, though the Arab strategy was adopted at the time of the MDGs, now is being updated to transition to the SDGs. The participatory approach was included in a goal that calls for the all society to be involved in the decision-making processes of the water sector.

An action plan approved by the AMWC in May 2014 put the strategy into operation.[18] The plan was designed for the period up to 2020, to be reviewed and updated every five years. It is based on the following means of implementation:

1. Developing access to updated information on the status of water resources in the region.
2. Improving application of IWRM principles.
3. Strengthening the scientific, technological and industrial base.
4. Increasing funding for water projects.
5. Enhancing capacity to evaluate vulnerability and adapt to emerging impacts of climate change.
6. Establishing the means to protect Arab water rights within shared international water rights.

Each of the main means of implementation has submeans, with expected accomplishments, outcomes and performance of indicators. Arab States and key actors report progress towards each means to the AMWC annually. In 2017, the AMWC requested that the Arab Center for the Studies of Arid zones and Dry lands (ACSAD) initiate a process with partner organizations and Arab States to update the strategy in line with recent developments, such as the 2030 Agenda, and progress made. This provides an opportunity for States to reflect appropriate global principles in the strategy if it will help achieve water security in the region.

2. GCC Unified Water Strategy (2016-2035)

The vision of the Unified Water Strategy is that by 2035, GCC countries will have established efficient, equitable and secure water resources management systems that contribute to their sustainable socioeconomic development.[19] That this highlights sustainable, equitable systems, again in harmony with modern concepts of water security, is interesting. The exception is the concern over protecting against war and terrorist attack, or the contamination of drinking water, which appeal to more traditional conceptions of security. In addition to some of the challenges highlighted in the Arab strategy for water security, the GCC strategy stresses the growing dependency on desalination and the overexploitation and deterioration of both renewable and non-renewable groundwater.

The GCC strategy has five strategic pillars, each provided with one or more strategic objectives to put the strategy into operation. The five are as follows:

1. Development and sustainability of water resources.
2. Efficient and equitable water resources utilization.
3. Enhanced municipal water supply security.
4. effective water governance and awareness.
5. economic efficiency and financial sustainability.

An implementation plan has been developed, with associated targets and key performance indicators up to the year 2035. The more recent GCC strategy should be considered when the

Arab strategy is updated, to reflect on synergies and the means of integration.

3. Arab Framework Action Plan on Climate Change for 2010-2020

The Arab Framework Action Plan on Climate Change (AFAPCC)[20] was prepared under the auspices of the Council of Arab Ministers Responsible for the Environment (CAMRE) at the League of Arab States and other United Nations and Arab organizations. The action plan was designed to enhance country capacity to take appropriate measures for addressing climate change while achieving the MDGs (which were superseded in 2015 by the SDGs) and sustainable development targets in the region. Its objectives include:

- Reducing the risks of climate change and preparing to counter potential impacts through mitigation and adaptation programmes;
- Preserving natural and human resources and ensuring an adequate standard of living for Arab citizens;
- Promoting the pace of sustainable development in Arab countries;
- Strengthening and building national and regional institutional capacity to deal with climate change and disaster response;
- Creating favourable conditions to stimulate regional and international cooperation to support national programmes.

The action plan includes adaptation and mitigation programmes covering several sectors, including water, land and biological diversity, agriculture and forestry, energy, population and human settlements, seas and coastal areas, climate and health. In addition, a set of cross-cutting issues are covered by the following means of implementation programmes and include awareness, legislation, financial instruments and disaster risk reduction. With 2020 approaching, it is expected the AFAPCC will be reviewed by the League of Arab States to inform the next steps in dealing with climate change in the region.

4. Arab Strategy for Disaster Risk Reduction 2030

The Arab Strategy for Disaster Risk Reduction (ASDRR)[21] was adopted by the League of Arab States in April 2018. Along with a commitment to the SDGs, it is based on: the priorities of the Sendai Framework for Disaster Risk Reduction 2015-2030; outcomes of the 2015 Third United Nations World Conference on Disaster Risk Reduction; outcomes and recommendations of the first Arab Conference on Disaster Risk Reduction in Aqaba in 2013, the second in Sharm El-Sheikh in 2014, and the third in Doha in 2017; and results from national reports on the progress of the Hyogo Framework for Action completed by Arab States between 2007 and 2015, and from the 2015 Arab region meeting on implementing the Sendai framework. The purpose is to enhance institutional and coordination mechanisms, and monitoring arrangements, at regional, national and local level through a plan of action. The ASDRR outlines a set of strategic directions under the following themes:

- Understanding disaster risk;
- Strengthening disaster risk governance to manage disaster risk;
- Investing in disaster risk reduction for resilience;
- Enhancing disaster preparedness for effective response and to “build back better” in recovery, rehabilitation and reconstruction.

Institutional, financial and coordination arrangements are also emphasized for effectively implementing the strategy.

5. Arab Strategy for Housing and Sustainable Urban Development 2030

The Arab Strategy for Housing and Sustainable Urban Development 2030[22] builds on the achievements of MDGs in the region, and seeks to fulfil the SDGs, particularly SDG 11 on cities. Considered a framework for joint Arab action on housing and sustainable urban development, the strategy aims to ensure “integrated and sustainable human settlements that are resilient, competitive, and capable of providing better life standards”. Based on urban circumstances in the region, challenges were identified according to housing, basic services and infrastructure, and include water and sanitation services, urban demographics, land and planning, urban administration and legislation, urban environmental sustainability and climate change, and productivity and urban economy. The main objectives are as follows:

1. Ensure access to adequate, safe, affordable housing and basic services, and prosperous living for all.
2. Ensure equity and social integration.
3. Plan integrated and sustainable human settlements in all States in the region.
4. Apply principles of good urban management and capacity-building for planning and managing human settlements.
5. Improve urban environmental sustainability and resilience against climate change, and preserve natural resources.
6. Enhance the productivity of cities to achieve economic growth and sustainable development at national and regional levels.

To achieve the objectives, implementation mechanisms are to be undertaken at national and regional levels. Each country is expected to develop a national plan for implementing the strategy through a participatory approach, according to its conditions and characteristics.

This strategy is particularly important given the rate of urbanization in the region, and its effects on water services and security.

5. MEANS OF IMPLEMENTATION FOR MOVING TOWARDS WATER SECURITY

A. Governance
B. Regional cooperation
C. Research and technology development
D. Financing
E. Reconstruction and resilience
F. Capacity development

5. Means of Implementation for Moving towards Water Security

At the Regional Preparatory Meeting on Water Issues for the 2018 Arab Forum on Sustainable Development and High-level Political Forum that was held in Beirut in March 2018, representatives of ESCWA member States, the AMWC and from national, regional and international institutions and civil society organizations agreed integrated water resources management (IWRM) can support achievement of the 2030 Agenda through the following means of implementation:[1]

- Regional cooperation;
- National coherence and coordination across sectors through a participatory approach;
- Technology transfer;
- Financing and investment;
- Capacity development.

These means of implementation were proposed to advance the four regional priorities identified during the meeting, which were as follows:

- Strengthening integrated water resources management to cope with water scarcity;
- Enhancing cooperation on shared water resources;
- Water is a core component of climate change adaptation and natural disaster risk reduction;
- Access to water services for all through improving water-related infrastructure.

This chapter builds on the regional priorities and means of implementation to propose the means of implementation for moving towards water security. These will additionally tackle the systemic conditions that hamper water security in the region, mainly water stress and scarcity, climate change and shared water resources. They will span more than one systemic condition and are briefly discussed here. A holistic water security framework needs to address them in an integrated manner, therefore they are not listed in order of importance but with contextually appropriate sequencing and selectivity. It is expected that States will find some means more appropriate or applicable, depending on their situation.

A. Governance

Governance is a broad subject that refers to various systems – administrative, economic, political, social – that here determine water resources management and use. The actors are not just State actors but include civil society and the private sector. The UNDP-SIWI (Stockholm International Water Institute) Water Governance Facility (WGF) proposes four dimensions of water governance dynamics, as follows:[2]

- Social: addressing the equitable distribution of water resources and services;
- Economic: addressing efficiency in water allocation and the use and role of water in economic growth;
- Political: addressing equal rights and opportunities for stakeholders in the decision-making process;
- Environmental: addressing the sustainable aspect of water use and related ecosystems.

The Organisation for Economic Co-operation and Development (OECD) in turn proposed three dimensions, namely:[3]

- Effectiveness, which relates to defining clear roles and responsibilities, ensuring policy coherence across sectors, management at appropriate scales within basin systems and developing water sector capacity;
- Efficiency, which relates to the availability of data and information, financing, regulatory frameworks and innovative governance;
- Trust and engagement, which relates to monitoring and evaluation, trade-offs, stakeholder engagement and integrity and transparency.

The common principles of these dimensions, and others such as the Dublin Principles, include a holistic approach that is inclusive, participatory, transparent and accountable in ensuring equitable access to water. They are covered in the 2030 Agenda and in human rights-based approaches.

There is no one-size-fits-all approach to governance that can be applied in all Arab States. Various elements of governance may be applied in different ways at various scales of analysis. States have to adapt them to the local context; the available resources, economic conditions and social realities. In a water-scarce region, governance is not the be-all and end-all of water security but it can help achieve water security in a harmonized, more efficient manner, while allowing gains to be sustained.

1. National coherence and coordination across sectors

All governance approaches emphasize the importance of a holistic approach that ensures coherence within the water sector and across sectors. Coherence can be facilitated by defining roles within the water sector, both horizontally and vertically. Duties and obligations must be clearly explained for all actors, ranging from policymakers, planners and service providers to regulators and oversight bodies (see box 5). This must be balanced against the risk of working in insolation from others, in so-called silos. A participatory approach that engages stakeholders at all scales would help break silos, ensure coherence and inclusivity, and would allow for the sustainability of measures taken through improved buy-in.

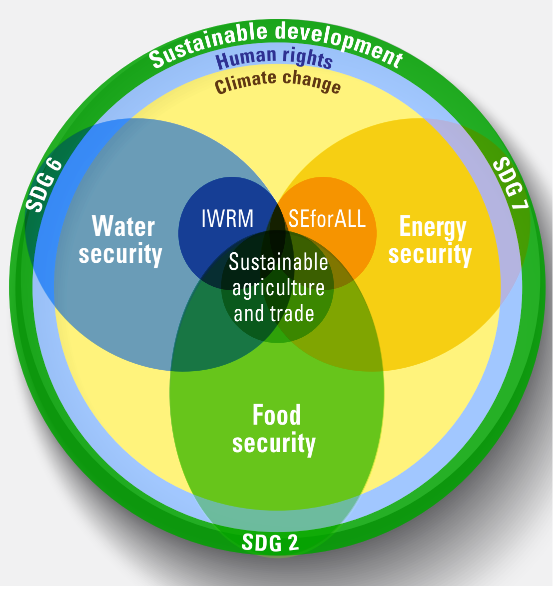
Coherence across sectors may be facilitated by clear coordination mechanisms and dialogue among sectors and between water users of different sectors to define priorities at national level. To be successful, this must be supported at a political level that promotes national coordination and consistent policies across sectors. Coherence can assist in balancing competing demands for water among various sectors and users.

Stakeholders must define agreed goals and targets that guide policy coherence efforts. The SDGs can provide such a common platform. The integrated nature of the SDGs and the centrality of water to development lend themselves to this approach. It will require support through a human rights-based approach providing safeguards against inequalities resulting from competing demands. Clear linkages across goals and targets, including quantification of these linkages, where possible, would be beneficial. Once identified, they can be mainstreamed into national development strategies and plans that support the achievement of security across water sectors.

Coherence is not just required within and across sectors, but also between international and national contexts. Global agendas must meet national goals, for instance, while national planning must take account of agreed international commitments. Coherence is also required between global agendas and processes – for example, the 2030 Agenda, the Sendai framework and the Paris Agreement – and also within agendas, such as coherence between the three pillars of sustainable development. Finally, coherence is needed between diverse sources of funding, including public, private, national and international.

ESCWA has proposed a water-energy-food security nexus that considers the linkages affecting their achievement and that of the SDGs, with a view to mitigating climate change and ensuring access to food, water and sustainable energy for all in the context of a human rights-based approach (see figure 17).[4] This framework can be followed within a local context to facilitate coherence across sectors.

Figure 17. ESCWA water-energy-food security nexus



Source: ESCWA, 2015b.
Note: SEforALL is sustainable energy for all.

Box 5. Water Sector Regulatory Council, the State of Palestine

As part of water sector reform in the Occupied Palestinian Territory, the Water Sector Regulatory Council (WSRC) was established in accordance with Palestinian Water Law, Decree No. 14 for 2014. The council's priority is to monitor the operations of all water service providers, including production, transportation, distribution, consumption and wastewater, to ensure efficient, quality water and wastewater services are provided to consumers at a reasonable price.

According to the law, the WSRC's main responsibilities include approving water and wastewater service prices, licensing service providers, monitoring and inspection, developing performance incentive programmes, establishing a database for technical, financial and statistical information and its publication, and resolving customer complaints. It must also set the basis for regulating local authorities' participation in the general assemblies of water utilities.

The WSRC, which is obliged by law to submit semi-annual reports to the Cabinet of Ministers, assists in improving transparency, accountability, participation and cooperation in the Palestinian water sector. The Water Law goes further, setting the roles of all actors in the sector, including the water authority, the national water company and the regional water utilities.

Source: State of Palestine, Palestinian Water Authority, 2014.

2. Enhancing IWRM

Many States have chosen IWRM as a governance path to achieve water security. Based on the Dublin Principles, IWRM takes an integrated, people-centred participatory approach highlighting the central role of women in the provision, management and safeguarding of water, with coordinated development and management of land and related resources. It aims to achieve this in an equitable manner without compromising the sustainability of the environment but maximizing economic and social welfare. While IWRM realizes the interconnected nature of water use across sectors and calls for integrated policy, regulatory and institutional frameworks, its application has been water-centred and driven by the sector. This has resulted in its failure to garner the necessary support across sectors and move the concept beyond the water sector. This has been due to the failure of governments to realize the centrality of water to development and mainstream it in national development plans in an integrated manner that involves actors from outside the sector.

It should be noted that IWRM is not a ready-made product that can be implemented instantly. It is a process based on a set of principles and elements; a single blueprint for its application does not exist. Arab States must first evaluate their national context in terms of governance structure, water users, stakeholders, social structure, economic conditions, available water resources and environmental and other factors, even externalities to national factors such as shared water, climate change or conflict. Once these are assessed, States must proceed with IWRM, using an iterative building process, custom-designed for the national context and at a suitable scale. There is a tendency to implement IWRM at the smallest level, which is the basin level. This may be suitable in some cases but not in many Arab countries. The basin scale is irrelevant, for example, in GCC countries that depend on desalination, whereas the IWRM principles and approach may still be applicable. Similarly, IWRM at the basin level is not applicable where out-of-basin water transfers are the norm, such as the Disi aquifer shared between Jordan and Saudi Arabia, where water is pumped several hundred kilometres to supply the Amman region's drinking water.

Out-of-basin transfers are becoming the norm to supply thirsty cities and will continue to be so with the increasing urbanization trend. This may be expanded beyond the water box, to out-of-basin transfer of hydropower or virtual water through agriculture or industrial products. This stresses the importance of Arab States adapting a flexible approach to IWRM in terms of scale of analysis and applying IWRM principles and elements as appropriate to local context.

The Global Water Partnership (GWP) defines three elements for applying IWRM, as follows:[5]

- An enabling environment that includes national policies, legislation and regulations and information for water resources management stakeholders;
- Management instruments that include operational tools enabling decision-makers to make informed choices;
- Institutional roles and functions clearly defined for various levels and stakeholders.

It must be stressed that the IWRM approach is a people-centred participatory one that highlights the need for inclusiveness, specifically the positive role of women in the water sector. It is important for States to take an active role, with practical action to involve women and men equally in the management of water and sanitation, and access-related issues. This will undoubtedly improve water management and make use of human capacity that is normally sidelined (see box 6), while ensuring that women's needs are addressed at all levels and gender issues properly framed. Actions might include enforcing quotas for women in the water sector; for example, setting a minimum limit of 30 per cent employment for both men and women in State institutions. Another approach would be to make scholarships available for women in water-related specializations,

Box 6. Women's involvement in resolving conflicts over water, Yemen

In Yemen, tribal disputes over the sharing of the Malaka dam waters have led to armed clashes. To end the trouble, communities reached an agreement consolidated in a tribal decree banning the use of the water by any person, for any type of use; in effect it became forbidden water. Built in 2002, the Malaka dam has a capacity of 170,000 m^3, sufficient to supply the three nearby villages with water for irrigation and livestock drinking needs.

To resolve the decade-long dispute, and make the water available for use, the women's association Al Malaka (WUA) has taken the lead, organizing a series of meetings between community leaders and sheikhs representing the tribes, overseen by WUA members and FAO experts. Following several rounds of discussions, it was agreed that the disputed water should be piped via gravity flow to a series of shallow groundwater wells dug in the proximity of the dam, hence without any human intervention.

This has helped decrease evaporation and replenish the declining groundwater table. Water gathered in the wells is used by farmers for their cattle and irrigation.

The experience has shown how communities are willing to accept leading roles for women in resolving conflict over water resources. Women were also involved in water-related financial management and infrastructure works, traditionally perceived as the sole responsibility of men.

Source: Saleh, 2018.

which would equip them to engage in the sector. Women's involvement in water must move away the traditional role of fetching and managing water in the household.

The 2030 Agenda recognized the importance of integrated water resources management, and dedicated SDG target 6.5 to ensuring it is implemented all levels, including through transboundary cooperation where appropriate. States may wish to utilize the momentum of the development agenda to accelerate applying IWRM as appropriate to their national context. Indicator 6.5.1 monitors progress on four aspects of IWRM, which include the enabling environment, institutions and participation, management instruments and financing. The monitoring and reporting process can be used by States to set national targets and discern strengths and weakness, and areas that need to be improved.

IWRM potentially offers a holistic approach to moving towards water security as it links the water sector with other sectors (such as agriculture), and balances competing demands (such as rural versus urban, livelihoods versus ecosystems). Such an approach, however, must not be exclusively water-centred, but complemented by the cross-sectoral influence of the nexus approach, and the equitability, inclusivity, empowerment, transparency and accountability of the human rights-based approach.

B. Regional cooperation

The region's heavy reliance on shared water means working together is a vital means of implementation for achieving water security. States can draw on global frameworks or regional processes for cooperation. At global level, several legal frameworks are available for the management of shared water resources, including the United Nations Convention on the Law of the Non-navigational

Uses of International Watercourses,[6] the draft articles on the Law of Transboundary Aquifers[7] and the United Nations Economic Commission for Europe's Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention).[8]

The dedicated SDG target 6.5 encourages transboundary cooperation, as a means for implementing integrated water resources management at all levels. The target includes a second indicator, SDG 6.5.2, that encourages reporting on the status of operational arrangements for transboundary water cooperation, should they exist.

At regional level, a Draft Framework Convention on Shared Water Resources in the Arab Region that supports shared water resources management between States was prepared and reviewed by the League of Arab States under the auspices of the AMWC. Resolutions adopted in 2017 called for the legal instrument to be reformulated into a set of common guidance principles for shared water cooperation and improved regional capacity for shared water resources management. This demonstrates the interest of member States in shared water resources management. Political will at national and regional scale, coupled with regional and international support, is required to advance cooperation in this area.

Other forms of collaboration may be less formal, and involve specific activities at bilateral or basin level that can lead to more formal cooperation. This may include capacity-building, data monitoring and sharing, common studies for improved knowledge on shared water resources, knowledge exchange missions and study tours between riparian countries. For instance, though the Nubian Sandstone Aquifer System agreement is about establishing a Joint Authority for the study and development of the aquifer waters, it is not about water management. In Formulation of an Action Programme for the Integrated Management of the Shared Nubian Aquifer, funded by the Global Environment Facility Trust Fund, implemented by UNDP and executed by the International Atomic Energy Agency, member countries of the Joint Authority collaborated and exchanged data to inform and carry out common policies. One outcome was the Regional Strategic Action Programme for the Nubian Sandstone Aquifer System (SAP), which was signed by the Chair of the Joint Authority and water resources ministers of the four member countries. Its main focus is to strengthen and extend competence through the Joint Authority to new areas of cooperation such as ecosystems, biodiversity and climate change. A new project to implement SAP and further develop cooperation has been submitted for funding by the Global Environment Facility Trust Fund and execution by United Nations Educational, Scientific and Cultural Organization (UNESCO).[9]

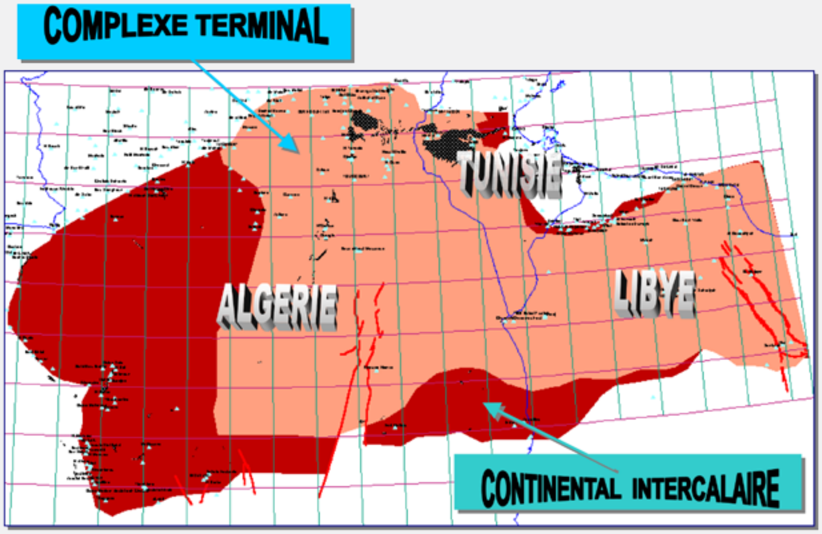
More advanced activities might include setting up shared water basin consultation mechanisms. Algeria, Libya and Tunisia, the three countries of the North Western Sahara Aquifer System, have a history of technical and scientific cooperation through internationally funded joint projects. To sustain results, the countries decided on a cooperation framework. In 2008, with the support of the Sahara and Sahel Observatory (OSS), which assists member States in the sustainable management of their natural resources, they set up the North Western Sahara Aquifer System Consultation Mechanism, and have continued to exchange data. The common database and the model of the aquifer system are also being updated (see box 7). This is an example of the international community supporting countries to develop and establish mechanisms of cooperation.

Countries and supporting regional or international organizations need to be innovative in fostering cooperation beyond classical, rigid legal water-share distribution agreements. Indicator 6.5.2 may be used as an entry point to foster dialogue on water cooperation. In other instances, linkages beyond the water sector may need to be explored, such as those utilized

Box 7. Cooperation on the North Western Sahara Aquifer System

The North Western Sahara Aquifer System (NWSAS) is shared between Algeria, Libya and Tunisia. The aquifer system receives very little recharge and is therefore considered non-renewable. A census in 2001 identified 8,800 wells tapping the NWSAS, which represents the only source of water for 5 million people. This heavy exploitation has resulted in signs of serious deterioration, including water salinization, disappearance of artesian flow wells, drying springs and excessive drawdown in pumping wells.

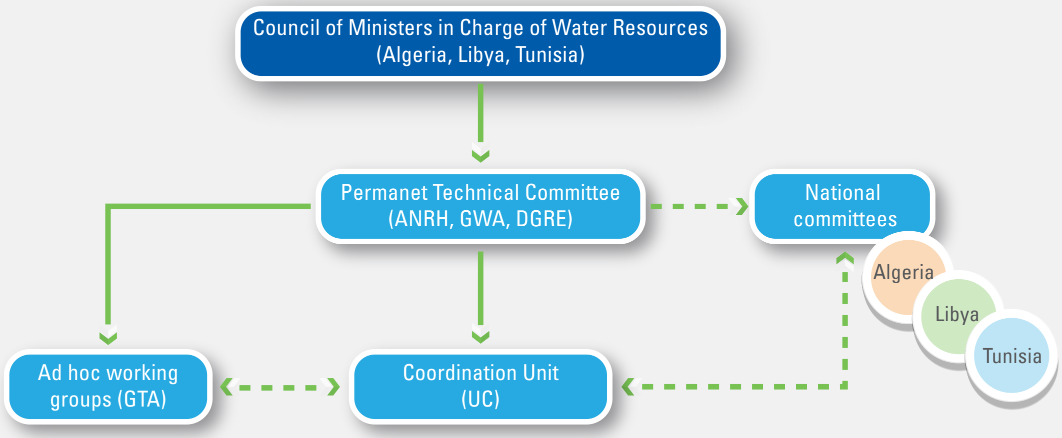
The North Western Sahara Aquifer System



Source: Chulli, 2017.

Under the supervision of the Sahara and Sahel Observatory (OSS), a regional organization based in Tunis, from 1998 till 2002 the three countries sharing the system engaged in a first project. This resulted in a common database and a mathematical model of the aquifer system that allowed the development of scenarios and simulations. To sustain these results and ensure updates, the countries agreed to establish a consultation mechanism hosted by OSS. Ministers signed a declaration in 2006, and the mechanism was created in 2008 with the following structure.

The NWSAS Consultation Mechanism



Note: ANRH is Agence Nationale des Ressources Hydrauliques (Algeria); GWA is General Water Authority (Libya); DGRE is Direction Générale des Ressources en Eau (Tunisia); GTA is groupes des travail ad hoc; UC is Unité de Coordination.

A head coordinator is nominated every two years by one of the three countries, on a rotating basis. The mission is to offer a frame for exchange and cooperation by:

- Producing indicators on the resource and water demand;
- Elaborating management scenarios;
- Updating the common database via exchange of information;
- Developing and managing common monitoring systems.

After 11 years, the mechanism has achieved most of its aims, and is considered one of the few cases of successful cooperation on a shared aquifer.

Sources: Foster and Loucks, 2006; Machard de Gramont and others, 2011; OSS, 2003.

by the water-energy-food security nexus. They may provide an incentive for cooperation beyond water, building on the strengths of riparian countries across sectors to boost trust. While this initially relies on the will of States, working together within the framework of a project, and with regional or international support, initiates cooperation, which is a long and progressive road.

C. Research and technology development

Compared with other regions of the world, the Arab region allocates limited resources to research and development.[10] For the majority of States, spending is less than 1 per cent of gross domestic product (GDP).[11] As a result, most are primarily consumers of imported technologies and make little effort to localize technological solutions. States need to facilitate the development, adoption and dissemination of appropriate technologies for achieving water security through an enabling framework that builds on domestic, regional and international cooperation and partnerships. Technologies need to be appropriate to the local context, taking into account the available economic, institutional and human capacities.

ESCWA defines the essential components of a national innovation system as the following:[12]

- Core engine linking education, research centres and the country's productive system; where technology and knowledge transfers occur;
- Innovation framework based on an institutional and regulatory environment;
- Innovation infrastructures;
- Economic environment for innovation, including government incentives and taxation;
- Socioeconomic environment for innovation;
- Measurement and policy monitoring system.

As research and technology development are not restricted to water security or the water sector, it is important to prioritize key water security issues. This may be facilitated with targeted financing instruments and initiatives. Mainstreaming these priorities into the national development agenda should enhance collaboration and achieve cross-sectoral synergies, such as those between water and energy, or water and agriculture.

Water scarcity and the reliance on non-conventional water resources make the role of research and technology development crucial for advancing water security. This could be via improving efficiencies and increasing productivity, accessing new water sources, lowering treatment costs and the sector's energy demands, and allowing for better monitoring and management of water through technologies such as remote sensing. The vital role of technology is central to implementing the 2030 Agenda, and directly referenced in several SDG targets and means of implementation. The region must develop and enhance the use of appropriate technologies and innovative methods for water supply, desalination, and wastewater treatment and other non-conventional sources, such as rain-water harvesting and managed aquifer recharge. Advances are urgently required in the agriculture sector, the major water user. New and efficient agricultural and irrigation systems and techniques must be developed and used, and productivity increased. Renewable energy applications have the potential to support the drive to achieve water and food security through lower energy costs. National priorities must target key areas for research and technology development where financing can be directed for the greatest impact.

1. Agriculture sector

The agriculture sector is by far the largest consumer of water in the region, and there are two approaches for using research and technology development to help address this. The first is improving water use efficiency in the sector, and the second, increasing water productivity. More efficient, smart irrigation systems use controllers to tailor watering schedules for specific landscape needs, and weather and site conditions to determine how much water to apply, which can significantly reduce consumption. Savings in the sector are not always easy to capture and transfer to other sectors and at a large scale, the basin scale, for example. Losses from irrigation usually return to the hydrological cycle as recharge to groundwater or flow to rivers, among others, and the only water lost from the hydrologic cycle is water evaporated from land or plant surface and water consumed by crops. Greater benefit could be gained from increasing water productivity, and setting limits on water withdrawal or consumption.

2. Desalination

The region, specifically the GCC countries, relies heavily on desalination to meet its water needs. Water produced through desalination represents the primary water resource for some Arab cities in the more water-scarce States, and for an increasingly higher number of cities in the region. The three most common desalination technologies are multi-stage flash distillation (MSF), reverse osmosis (RO) and multi-effect distillation (MED). MSF and MED are distillation-based plants, whereas RO uses membranes to separate salts from water. Seawater desalination is a high energy-intensity process that has been economically prohibitive for non-oil producing States.

The advancement of RO technologies and nanotechnologies presents an alternative, less energy-intensive option. RO technology applications are expanding across the region, especially for the desalination of brackish water for municipal uses and for small-scale plants in areas of newly expanded developments located away from primary water sources. Desalination as a major source of domestic water supply will continue to increase in the region, with most of the expansion relying on RO.

Energy costs account for a major portion of total costs incurred during desalination. In Bahrain, for example, desalination accounts for 30 per cent of total energy use.[13] Thus, efforts in localizing desalination technologies should focus on examining the most appropriate methodologies and configurations to harness the region's abundant solar power.

Concentrated solar power (CSP) desalination is estimated to increase exponentially over the coming decades. It has many advantages over other renewable energies.[14] The modular nature of the CSP units provides flexibility and can be easily upscaled to accommodate small and large desalination units. Further, it is the only available renewable energy technology that can ensure continuity of supply through storage and demand-based delivery while remaining economically feasible. It is assumed that CSP presents a considerable potential for additional technological improvement that implies enhanced financial feasibility. The main disadvantage compared with photovoltaic (PV) and wind technologies is that it requires water for cooling and steam generation.

Box 8. Masdar Renewable Energy Water Desalination Programme

The United Arab Emirates is pioneering work to improve the cost-effectiveness and sustainability of desalination. At the centre of efforts is Masdar's institute support of the Global Clean Water Desalination Alliance, H_20 minus CO_2. Launched at the 2015 United Nations Climate Change Conference in Paris, the alliance is part of the Lima-Paris Action Plan and aims to reduce CO_2 emissions in the desalination industry.

The Masdar Renewable Energy Water Desalination Pilot Programme has been leading research to advance sustainable desalination technologies specific to the particularities of the Arab region, building on knowledge and experience of local and global stakeholders. The methodology adopted considers the entire desalination value chain, from education to research and development, and investment through to the commercialization of renewable energy desalination options. Over the period 2013-2017, five pilot projects were commissioned and implemented to test several innovative desalination technologies and configurations, as follows:

- RO system using an ultrafiltration system and self-cleaning cartridge filters for the pre-treatment of seawater;
- RO system combined with a brine treatment system with energy recovery device;
- Off-grid solar-powered desalination arrangement for remote areas;
- Forward osmosis (FO) desalination system where a proprietary draw solution absorbs the fresh water from seawater;
- Combined dissolved air flotation (DAF) and gravity dual media filtration in one single unit for the pre-treatment of the seawater with energy recovery device.

The outcomes of the pilots have demonstrated that combining reverse osmosis with solar power presents a commercial, sustainable option for mainstream water generation in water-scarce countries of the Gulf region. The experience has also established a baseline reference for efficient configurations combining renewable energy to advanced desalination technologies for one of the most challenging feed water in the world. Seawater desalination of solar-powered reverse osmosis was confirmed as the most efficient technology, with 75 per cent improvement in energy consumption compared with current practices.

Source: Masdar (n.d.).

Tremendous efforts in research and development are being undertaken at global level to improve membrane-based desalination technologies. These advanced technologies include membrane distillation, carbon nanotube membranes, aquaporin (biomimetics) membranes, thin film nano-composite membranes, forward osmosis and electro-dialysis/deionization. There is still uncertainty over their application in the Arab region context.[15] An approach with particular interest, however, is the Fertilizer Drawn Forward Osmosis used in generating water for irrigation.[16] The process consists of maintaining both the feed seawater solution and a highly concentrated fertilizer draw solution across a membrane. Osmotic pressure across the membrane pushes the fresh water out of the saline solution into the fertilizer to generate a more dilute fertilizer solution that can be directly applied to irrigated crops.

Despite heavy reliance on desalination, States have exerted little effort in scientific research to develop or adapt desalination technologies to local contexts. Investment for localizing desalination technologies to the specificities of the Arab region are not commensurate with the increased demand for desalination, and only a few initiatives have been evident in the Gulf region, such as the renewable energy desalination pilot programme by Masdar (see box 8).

3. Wastewater reuse

Investment in wastewater treatment in the region has increased to offset water scarcity constraints. In countries such as Bahrain, Kuwait, Qatar, Saudi Arabia and the United Arab Emirates safely treated wastewater exceeds renewable freshwater resources. Advancing technologies have a key role in improving the rates of wastewater reuse.

Recently, the use of renewable energy in wastewater treatment has been expanded. Alternatives to conventional sources of power include solar, wind, biomass and biofuel-related sources. Plentiful solar radiation makes solar power particularly attractive. Solar radiation can also be used directly for treatment and solar detoxification. Biofuels are usually generated by anaerobic digestion of sludge resulting from primary and secondary wastewater treatment stages. The biogas typically consists of a mixture of methane and carbon dioxide and can be used to operate secondary and tertiary treatment phases.

The As-Samra wastewater treatment plant in Jordan was designed to generate part of the energy consumed on site by treating sludge through anaerobic digestion. In addition to the primary and secondary settling tanks, well aeration tanks and anaerobic sludge digesters were also included, along with biogas generators. The plant is the only one in the region to generate 80 per cent of its needs through the energy generated by gas turbines powered by digestion biogas hydraulic turbines and hydraulic energy generated at the plant inlet and outlet. As well as private, donor and government sources, the project benefited from a viability gap funding, a grant deployed in the case of large infrastructure projects, which despite being economically feasible in the long term, might not be commercially viable, and hence not attract private investment. This unique arrangement has resulted in affordable tariffs for water consumers and encouraged the use of treated water for irrigation purposes. As-Samra presents a model for flexible technology that can be equally considered at the planning and construction phases of wastewater treatment plants, and retrofitted to existing ones.[17]

4. Monitoring and evaluation technology systems

One of the biggest challenges for the water sector in the region is the lack of monitoring data combined with poor know-how in using multiple data sources to make better informed decisions. Monitoring and evaluation technology systems can fill this gap; they can improve governance in the water sector, especially given the multitude and scale of data sources, and the emerging trend of big data analysis. Such systems need to improve the availability of information. This can be from simple in situ technologies, such as water level measurement devices or water meters, both bulk and at individual household level, to data loggers and the inclusion of remote sensing and satellite data that feed into models and can combine multisectoral data, such as those from the agriculture sector, or socioeconomic information. This would allow water systems to be monitored and system losses identified, such as non-revenue water, which would allow managers, in due time, to rectify.

Such systems must be transparent and participatory, allowing stakeholders to access relevant information in a timely manner to inform decisions. Provision must be made for internet-related technologies to monitor and collect data through such initiatives as citizen science. This would help empower local communities and vulnerable groups to obtain the information they need, while at the same time allowing them the possibility of collecting data and reflecting on conditions in socioeconomically or geographically neglected areas.

5. Research and development initiatives

Arab States, particularly the GCC countries, increasingly recognize the importance of diversifying local economies away from oil and natural gas dependence towards a more knowledge-based economy. Governments across the region have been directing an increasing share of their national expenditures to reforming and updating education systems. The aim is to generate expertise and skills in line with what local employers require. Central to these reforms is the establishment of technology parks in many countries. In this, Tunisia is leading the Maghreb region. The Borj Cedria Science and Technology Park, established in 2005, focuses on developing water and environmental technologies, and renewable energy solutions, among others, and the business and industrial communities are kept regularly informed on research findings. Similarly, Morocco's InnovAct programme, launched in 2011, engages university graduates in research by industries on water and environmental technology, and biotechnology and nanotechnology.[18] Many research parks incorporate a platform for exchange and communication on technological advancements and research commercialization in the fields of water, renewable energy and the environment.

States must develop and strengthen national and regional knowledge hubs and exchange programmes for technology development, transfer and localization through incentives such as seed financing or cooperation agreements. This would assist in expanding technology transfer beyond the supply of hardware to include knowledge-sharing and technology localization, along with the associated management and capacity development demands. Gaps in technologies are unfortunately not limited to those between countries but are also evident within countries, across socioeconomic groups and between men and women. These gaps are normally associated with cultural dogmas that limit access and capacities. Capacity development programmes targeting vulnerable groups and women, combined with appropriate science education funding, would help increase technological capacities. The private sector has an important role in capacity development, and this should be reflected in the regulatory frameworks for public-private partnerships (PPPs) through proper tasks and incentives. This may be encouraged by donors to support or replace the classical technical assistance programmes that lack innovation, local ownership and sustainability. Building productive capacity will help develop domestic technologies based on innovative ideas for water security that also take into account traditional knowledge.

To achieve water security, a participatory approach is crucial. All relevant stakeholders must be involved and feel ownership to tackle the multifaceted challenges facing the sector. Scientists, engineers, government institutions, private companies, non-governmental organizations and relevant end-users of technological systems must be involved and empowered through a true partnership aimed at tackling water security through dialogue, mutual learning, innovation, cooperative priority-setting, policymaking and problem-solving.

D. Financing

One of the biggest challenges in meeting water security in the region has been in financing water and sanitation-related infrastructure. Meeting the cost of the water-related SDG targets 6.1 and 6.2 globally has been estimated at $114 billion (range $74 billion to $166 billion).[19] This will not meet all concerns but gives a sense of the magnitude of the investment required. Additionally, there are operating and maintenance costs that determine the sustainability of water infrastructures. There is also the cost of reconstruction, which has been significant due to conflict in countries such as Iraq, the Syrian Arab Republic and Yemen. As mentioned, in Iraq alone, the cost of reconstructing water and sanitation infrastructure due to the latest ISIS conflict has been estimated at $600 million.[20]

The huge challenge of financing water security and development is widely acknowledged, and was addressed by the Addis Ababa Action Agenda of the Third International Conference on Financing for Development in 2015. The agenda identified several action areas, including:[21]

- Domestic public resources;
- Domestic and international private business and finance;
- International development cooperation (vital for countries with limited national resources);
- International trade as an engine for development;
- Debt and debt sustainability for financing investment;
- Addressing systemic issues that hinder financing;
- Science, technology, innovation and capacity-building as drivers of economic growth.

Although these action areas were intended for financing sustainable development, they also apply to achieving water security, given how critical water is to sustainable development and the need to mainstream water security concerns within national development agendas. Thus, capitalizing on financing earmarked for achieving the water-related SDGs would serve the dual purpose of achieving water security. Financing could be domestic, international, public or private, or combinations of these.

Domestic public resources would be considered the primary resource to achieving water security or the water-related SDGs. This would also reflect heightened ownership of the goal to achieve water security. Given the substantial financing required, however, States would need to increase the amount available for water security, either by increasing spending if possible, or shifting it from elsewhere, such as the military budget. It is worth noting that in 2014, military expenditures in the region amounted to 6.84 per cent of GDP, three times the global average and higher than military spending in any other region.[22] If water security is a national priority then spending should reflect this. In all cases, States must use financing resources more efficiently – do more with less – particularly in light of shrinking external financing. This will have indirect benefits, such as improving creditworthiness and attracting additional financing sources, especially private commercial.

The domestic sector must not only cover the initial investment cost, but also the life-cycle maintenance and operational costs to ensure investment sustainability. The domestic revenues directly related to the water sector are usually tariffs collected for water and wastewater services. Two major hurdles to cost recovery are ageing water systems and non-targeted subsidies.

The water infrastructure system in the Arab region is old and, in many States, not properly maintained. Damages incurred by continuous armed conflict in many parts of the region have caused further deterioration of the water-related infrastructure. This has resulted in a high ratio of non-revenue water associated within illegal connections, leakages throughout the water systems and administrative losses. In Jordan, the share of unaccounted for water as a percentage of the total water generated by water utilities reaches as high as 50 per cent.[23]

Water in the region is heavily subsidized and attempts by governments to increase water tariffs for better cost recovery have traditionally met with public opposition. The issue with increasing charges is mainly one of affordability, where water is a basic human right and increased tariffs could result in an additional economic burden on the poor. Some countries have initiated tariff schemes to improve water services cost recovery while preserving accessibility for the poor. The increasing block tariffs (IBT) approach seems to present a potential solution. For example, Tunisia has identified seven blocks of growing water consumption ranges associated with increasing tariff rates for units of volume delivered.[24] The tariff for the lowest block is set to recover 21 per cent of the average cost, increasing gradually to 146 per cent for the highest water-consuming block. Another approach calls for non-targeted subsidies to be removed and allows higher cost recovery while providing targeted subsidies or financial assistance to the poor and most vulnerable. Any tariff restructuring must take account of affordability for the poor.

Regarding external financing, official development assistance (ODA) is an important source of aid in the form of grants and loans for countries with limited national resources. SDG indicator 6.a.1 is meant to monitor the amount of water and sanitation-related official development assistance that is part of a government-coordinated spending plan. The condition that ODA is part of a government-coordinated plan is to ensure alignment, coordination and coherence between donors and recipient countries. Since 2005, the global water sector-dedicated ODA has remained constant, at about 5 per cent as a proportion of total ODA.[25] This implies the water and sanitation sectors failed to garner the necessary extra support. Following regional volatility in 2011, the total ODA provided to the region has increased.[26] But this is tied to several crises that saw an increase of ODA flow to refugees. The water supply and sanitation sector share between 2010 and 2016 remained relatively steady at 5 per cent, with a low of 3.21 per cent in 2013 and a high in 2010 of 6.95 per cent.[27] This clearly does not match the required increase in effort needed to meet the challenges of water security or sustainable development. States need to maximize benefits from ODA by improving coordination with donors and mainstreaming it into national plans that may attract other sources of financing. Additionally, States should encourage a component of new technologies transfer and capacity development with this foreign assistance.

The importance of regional financing and cooperation should not be understated. The cumulative ODA provided by various Arab development funds to States between 1970 and 2016 amounted to nearly $100 billion, and this does not account for the bilateral aid, mostly from the GCC countries.[28] In addition to improving water security, a portion of this regional aid should be directed to enhancing regional cooperation, specifically in shared water basins.

With the effects of climate change on water security already evident in the region, it will be less expensive to ensure water infrastructure is designed to be climate resilient rather than adapt it later.

This, however, will not be sufficient, and States should step up efforts to access adaptation funds for the water sector. The Green Climate Fund (GCF) is the largest dedicated fund financing mitigation and adaptation projects in developing countries, although it has financed more mitigation than adaptation projects. The GCF and other multilateral funds established under the United Nations Framework Convention on Climate Change (UNFCCC), including the Global Environment Facility (GEF) Trust Fund, Special Climate Change Fund, Least Developed Countries Fund and Adaptation Fund, represented just 3 per cent ($1.6 billion) of the estimated $55.7 billion in public climate finance flows from developed to developing countries in 2016. Bilateral and regional flows, as well as funds by multilateral development banks, account for most public international climate finance flows. In a partial dataset of bilateral and regional climate finance flows to the Middle East and North Africa (the MENA region) in 2016 (accounting for one third of flows), 25 per cent went to adaptation projects.[29] A smaller share of finance by multilateral development banks is dedicated to adaptation globally, and grants represent only a small share of the finance provided, but flows still represent important potential sources of financing. In 2017, banks provided approximately $500 million in adaptation finance to the MENA region, of which approximately 60 per cent was committed to water and wastewater systems.[30] This does not include co-investment by the public or private sector, which can exceed the total amount directly provided by banks.

Private financing and investment are a funding source underutilized in the Arab region, specifically in the water and sanitation sectors. In some cases, there may be a commercially viable investment opportunity that makes it possible to attract private sector finance or investment.

Attracting the private sector can unlock access to additional sources of finance and expertise, and may lead to sustainable market-based solutions that reduce the fiscal burden on the public sector. Debt is the most common type of private finance at scale, although equity and hybrid instruments can also play valuable roles and be best suited to certain funding needs.

Not all required investments in water security will have commercially viable investment opportunities that are aligned with water security objectives. Global trends show that private sector engagement has had more success in the energy sector than in the water sector, suggesting opportunities may be limited and complex.[31] For example, watershed conservation and reforestation activities may be critical to long-term water security but may not offer a commercially viable source of liquidity to repay private investors. This is particularly likely when investment in public goods or common pool goods is required, such as dams or aquifer conservation.[32]

Key considerations for private sector engagement will be to ensure that water security objectives remain the primary objective, that negative social externalities are not passed on to the public, and that any involvement of the private sector does not compromise the human right of affordable access to safe, clean water. While the private sector can provide important expertise and scale capital that are well aligned with water security objectives – for example through smart-cities technology to improve the efficiency of municipal water systems – privatization of water sources may also pose a risk to water security if access or affordability are compromised, such as among poor and marginalized populations. Good governance is particularly critical, as bad governance can undermine social outcomes even when financial and economic incentives would otherwise be aligned.

It should be noted that water systems and infrastructure that serve and ensure water security for marginal and rural populations often have higher operating costs per household served. Privatized models may be more likely to pass these higher operating costs on to the household, potentially resulting in absolute costs to vulnerable households in marginal areas that are well above average, and are even higher relative to total household income. Such an outcome would be contrary to a human rights-led approach to development, which emphasizes accessibility and affordability, as well as to the 2030 Agenda, which emphasizes that no one should be left behind.

Any engagement with the private sector as part of water security policy necessarily requires creating the proper enabling environment, both to ensure a human rights-based approach to development is maintained and a functioning investment climate aligned with policy objectives; for example, through water sector reforms as required to create transparent stable regulatory frameworks for private sector participation. These frameworks must convey to the private sector a stable investment environment, with proper enforcement of rules and policies, clear standards and fair competition open to all.

When the private sector is engaged, it may be effective and important to engage medium- and small-size entities, not just multinational or large ones, which often allow more engagement by women. In this sense, States should encourage their engagement in the water sector through government guaranteed loans for women entrepreneurs, especially in rural areas and for small-scale initiatives.

One approach to engage the private sector, advocated by the 2015 Addis Ababa Action Agenda, is through blended finance, which "combines concessional public finance with non-concessional private finance and expertise from the public and private sector" under clear accountability mechanisms. This includes many PPPs. When public climate finance is committed to blended finance, including PPPs, the blended instrument should further the adaptation or mitigation outcomes.

Box 9. New Cairo Wastewater Treatment Plant, Egypt

The New Cairo Wastewater Treatment Plant is Egypt's first public-private partnership (PPP) project. Put in place in March 2012, the project was financed by an estimated $140 million loan provided by a group of four Egyptian banks, which will cover most of the engineering, procurement and construction expenses.

Under a 20-year concession arrangement, a consortium of Egypt's Orascom Construction industries and Spain's Aqualia – known as Orasqualia – will be in charge of operating and maintaining the new plant. The government has guaranteed cost recovery of the project through the payment of a sewage treatment charge.

With a capacity of 250,000 m3 per day, the plant is designed to produce treated wastewater of suitable quality to irrigate agricultural and urban green areas. This allows the fresh water that was used for irrigation to be shifted to other uses and reduces pollutants entering the Nile River.

Source: Salvador and others, 2016.

Many States are consolidating laws and bylaws related to private sector participation in comprehensive legal and regulatory frameworks, which demonstrates the political commitment to engaging the private sector. For example, Egypt enacted a PPP law in 2010, and also established the Public Private Partnership Central Unit at the Ministry of Finance to encourage and mobilize private sector participation (see box 9). Similarly, Morocco enacted a PPP law in 2014, followed by the establishment of the Department of Public Enterprises and Privatization at the Ministry of Economy and Finance, to oversee implementation of the PPP arrangements.[33] Tunisia is in a transitional phase, whereby the government is developing a PPP law that provides a set of simplified procedures for small-scale private sector involvement. The existing concession law was amended by decree in November 2013, broadening the scope of private sector involvement to cover a wide variety of PPP arrangements.[34]

The type and sources of financing required will depend on the need. Large capital investments in the near term will be required for repairing damaged infrastructure and investing in upgraded or new climate-resistant infrastructure, as well as sustainable long-term finance to ensure proper maintenance. Grant finance is preferred, but it is often easier to access debt finance. Given its relative scarcity, astute policymakers will seek to direct available grant finance to projects unsuited to debt finance, while reserving debt finance for projects that are commercially viable and aligned with water security objectives. Debt finance may provide resources for up-front capital expenditure to repair damaged infrastructure, while user fees may generate sufficient liquidity to repay it over the long term. The regional history of political instability and poor maintenance, however, may make such investments high risk, and investors may request concessional public subsidies, guarantees or other blended instruments before they are willing to invest.

Other innovative forms of financing that have had varying degrees of success include philanthropic donations, green bonds, sovereignty bonds, sukuk[35] and crowdfunding. As with other forms of finance, these will require water sector reforms to become attractive, conveying public trust for such funding. A first step would be to formulate clear, strategic financial and investment plans for the sector.

E. Reconstruction and resilience

Resilience as a means of implementation for water security is made necessary by disruptive events that may be short or long term; short-term events include a flood, a burst pipe due to ageing infrastructure, power outage or conflict, while long-term events might include drought, pollution, sanctions or dams built outside a country's border. These events disrupt water services and infrastructure, and the sectors that rely on them. The effects could be limited – service disruption to a limited number of customers, for example – or have far-reaching effects on the environment. The difficulty lies in the uncertainty, but the likelihood of the increase of such events is high, specifically for those related to climate change.

Reconstruction as a means of implementation for water security is necessary in the region because of conflict and, sometimes, natural disasters, such as earthquakes. Timescales vary in length and severity, but the result is the destruction of water-related infrastructure, and possibly the loss of human life. Reconstruction must be rapid as it affects the functioning of water-reliant sectors and the lives of all, but it also needs to improve on the previous system, and be well planned and efficient, economically and timewise. The repercussions of reconstruction extend, in some cases, beyond national borders, as without water and sanitation services, refugees and IDPs are not able to return to their homes, and therefore continue to affect host countries.

Rapid response is essential, given the lives and sectors affected. This necessitates a preparedness, not only in improved plans for local needs, with a view of regional dimensions, but also in the capacity and financing to deliver such a response, and in the institutional setups managing all sectors, particularly those providing essential services. This requires strong partnerships within the national context and at regional and international scales. Capacity, especially in conflict situations, is affected by loss of life and the so-called brain drain.

Reconstruction should be phased in terms of balancing urgent actions that re-secure basic services and those that benefit from longer time frames, allowing for proper design and improvement planning, and more resilience than the original system might have allowed for.

Increasing resilience could be achieved through non-structural measures in terms of adaptive management; for example, an integrated water resources management plan, or climate change resilience and adaptation plans, policies, emergency response plans, or capacity development. It is beneficial to integrate climate change adaptation in these plans, as it helps mainstream it in the water sector (see box 10). These non-structural measures gain in importance in shared water resources settings where cooperation facilitates resilience for all riparian countries. In this sense, any agreement must include resilience measures, and in terms of water allocation be flexible enough to accommodate such resilience by including, for instance, percentage allocations instead of fixed quantities.

Structural measures refer to infrastructure projects to: increase storage capacity, such as dams; increase sources, such as more groundwater wells or desalination plants; system decentralization; and redundancy infrastructure. Costs are variable and States, particularly non-oil producing States, are more likely to select low-cost no-regret options over costly infrastructure ones, especially when risks and related costs and benefits are not well understood or calculable. This is further complicated when considering that risks and costs are cross-sectoral. A compromise would be to include a mix of the two options, and/or incorporate, as much as is feasible, modular components in the water system that can be extended in response to changing climatic or socioeconomic conditions. Low-risk no-regret options may also include proper maintenance of water-related infrastructure and also planning for the replacement of ageing infrastructure with newer, more efficient models and systems that may afford increased flexibility and resilience by accounting for and better adapting to potential risks.

Box 10. Resilience in climate and water policies, Jordan

One of the driest countries in the world, Jordan suffers from severe water scarcity. It is expected the country's water sector will be significantly impacted by climate change. By the end of the century, this will potentially cause a reduction in rainfall and an increase in mean and maximum temperatures, and the period of dry seasons, thus decreasing water availability.

Jordan has responded to the threatened implications of climate change, especially on the water sector, by enhancing resilience. One of the long-term goals of the National Climate Change Policy of the Hashemite Kingdom of Jordan 2013-2020 is to achieve a "pro-active, climate risk-resilient Jordan" by enhancing the health and sustainability of communities, ecosystems and water and agricultural resources. Moreover, resilience is articulated in the country's 2016 Climate Change Policy for a Resilient Water Sector, where it is defined as the absorption of shocks and disturbances while maintaining structure and function. The policy gives three levels of resilience, namely persistence, adaptability and transformability. By defining its priorities in the light of posed climate impacts, and finding the optimal solutions in the water sector according to the resilience level that is needed and is manageable, Jordan is thus guided by the principle of resilience.

The Government of Jordan has emphasized adaptation as the most important consideration and main pillar of its climate change policy. Hence, building adaptive capacity is the way to build the resilience of the water sector and all water-dependent sectors. The following are selected priority measures for the water sector from the national policy:

- Establish structural institutional exchange and cooperation between planners in the water sector and other sectors on climate change impact and adaptation;
- Further mainstream climate change considerations in water sector strategies, policies and planning documents at all levels, including adopting legally binding principles for water sector management, such as for water allocation to sectors and appropriate water tariffs, and incentives for introducing water savings to promote economic efficiency in water supply and use. The balance between drinking water needs and industrial and irrigation water demands to be further rationalized and regulated;
- Incorporate the potential climate change impact on precipitation level and patterns in mid- and long-term planning of water demand and supply, and in the underlying research;
- Cap and regulate irrigated agriculture in the highlands and reinforce by-laws;
- Address the use of treated/recycled wastewater in the regulations/directives on the demand-side, such as grey water, as part of codes and regulations for buildings, including high-rise and high-density buildings;
- Pursue implementation of the Disi water conveyance and the Red-Dead conveyance projects with due consideration for the environmental and social sustainability;
- Improve international transboundary management of water resources as far as is possible within the region's difficult political conditions;
- Develop proposals for financing from international funds for water-sector adaptation.

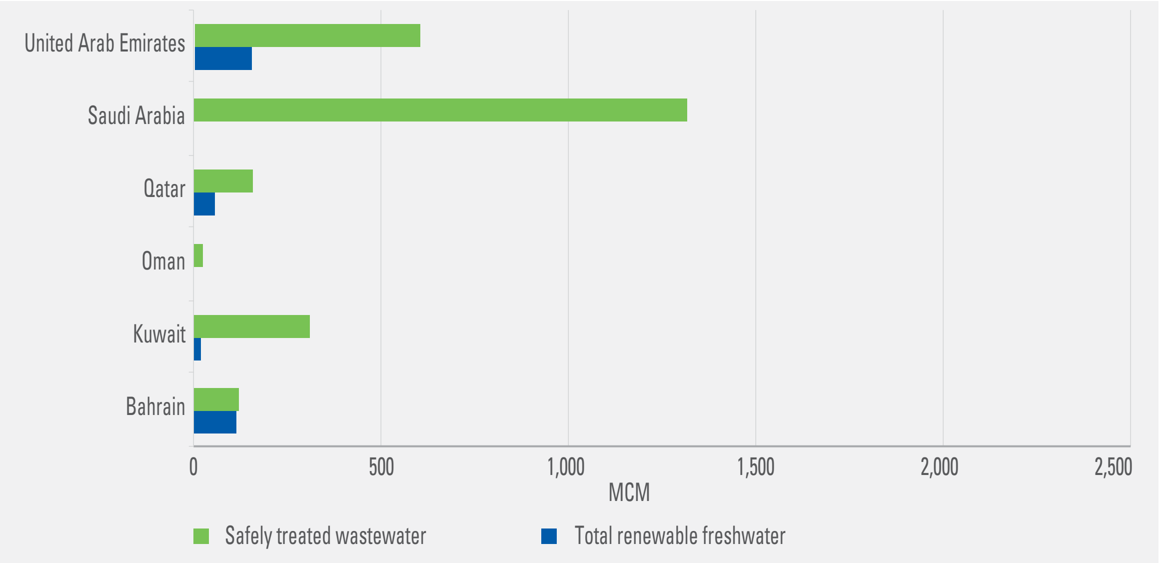
Sources: Jordan, Ministry of Environment, 2013; Jordan, Ministry of Water and Irrigation, 2016b.

Resilience can also be improved by increasing the water sector's flexibility through diversification of water sources; if one source is disrupted it may be compensated for by another. In addition to diversifying sources, improved resilience may include obtaining more water through relatively low-cost measures, such as grey-water reuse, leakage detection and repair, demand management, and improved efficiency and productivity. Higher cost measures for diversification may include increased storage capacity through surface dams and managed aquifer recharge, and through non-traditional measures such as desalination and wastewater reuse. Desalination has the advantage of being perhaps one of the few drought-proof additional potable water resources but with associated economic costs and heavy interlinkages to energy, which may be offset with solar energy sources.

Wastewater reuse has the potential to offset water scarcity constraints and provide diversification of water sources. In many countries in the region, specifically the GCC countries, safely treated wastewater exceeds renewable freshwater resources (see figure 18). More than two thirds of the collected wastewater in the region is safely treated, at tertiary level. Regionally, only a quarter of this is used for subsequent purposes, predominantly in the agricultural sector, though, in many Gulf countries, including Kuwait, Oman and Qatar, most of the treated wastewater is used. Jordan is leading the Arab world in the use of treated wastewater, with 100 per cent use in 2013. There is, however, significant potential for expanding the use of safely treated wastewater in other parts of the region.[36]

Resilience and reconstruction must be transparent and based on stakeholder participation. Increasing both in conflict areas greatly benefits from stakeholder engagement, resulting in buy-in and ownership. The human factor in resilience is as important as any structural factor, and may allow more flexibility. Further, a transparent participatory approach raises societal awareness and preparedness for possible risk factors. In cases of reconstruction, this can help mobilize additional resources, including international assistance that stresses transparency and accountability. A participatory approach can enhance and speed up the needs assessment process following conflict or any other extreme event, ensuring that the needs of all are properly reflected, especially those of vulnerable groups and women.

Figure 18. Safely treated wastewater in relation to renewable freshwater resources in GCC countries



Source: League of Arab States, ESCWA and ACWUA, 2016; FAO 2016, Aquastat data for 2014. Available at http://www.fao.org/nr/water/aquastat/main/index.stm.

F. Capacity development

Capacity-building is one of the recurring means of implementation across sectors and within sectors, and at all levels. It is a core means of implementation in the 2030 Agenda, and resonates in almost all the SDGs. In SDG 6, means of implementation 6.a, the need for capacity-building tied to international cooperation in water and sanitation-related activities and programmes is clearly recognized, including water harvesting, desalination, water efficiency, wastewater treatment and recycling and reuse technologies. Building capacity is also listed under SDG 17 with the means of implementation to achieve sustainable development. Capacity-building is a component of all proposed means of implementation in this report. It is part of good governance, and essential for it, as it is for research and technology development, and resilience. This is stressed in the United Nations University (UNU) recommendation to nest capacity development within all scales of institutional reform, with emphasis on transferable skills that can be used for sustainable development across all SDGs.[37]

Ideally, capacity development in the region should follow a dedicated assessment to identify gaps in water-related sectors. These gaps can then be targeted, ensuring inclusiveness of all stakeholders in strategies, particularly women (see box 11). Capacity development must span all scales, from local, to national, to regional, specifically designed for varying requirements. It should also cover the three levels of individual, institutional and societal; at individual level for professionals to allow people to build the necessary knowledge and skills, at institutional level to allow organizational development, and at societal level to allow community understanding of issues and empower community members to take part in water-sector management, which is part of the human rights-based approach. This requires a long-term strategy and investment that may be facilitated through international partnerships and cooperation. Knowledge exchange and sharing of good practices, led by regional institutions, can help bridge the capacity gap between States.

As part of building capacity at community level, targeting parliamentarians, academics, business, civil society and the media on relevant issues will impact on their willingness to act and support water security priorities, and help create a momentum in policies, institutions and national development towards achieving water security. Areas of focus could include water conservation and demand management, climate change and adaptation, sustainable water use and management, sustainable consumption and production, wastewater reuse and roles, and the duties and rights of stakeholders.

Capacity-building must create a pathway to greater cooperation at all levels within countries and between countries, especially those sharing water basins. It must not only include technical skills but also address social skills, negotiation, dialogue and conflict-resolution. Building such capacity among shared water basin commissions and governing bodies could enhance cooperation on water resources.

On financing, capacity-building is needed to enable institutions to better leverage funds; more specifically, innovative blended funding and to access global climate, sustainability and green funds. Capacity-building must cover such topics as water economics and financing, economic evaluation methods, economic implications of water policies, and cost recovery and financial sustainability. The challenge may be that the capacities for an enabling environment require a shift in the staffing strategies of water sector institutions in the region that are dominated by engineers and water specialists. That is why capacity-building must be matched by a proper staffing strategy and capacity gap assessment. As part of the enabling environment, capacity-building must also tackle improvements in accountability and transparency, and ensure an effective participatory approach to water management. Too often institutions are aware of the right to water and sanitation but not of the related implications and how to monitor them.

Capacity development is also required in the area of climate change adaptation and improving resilience, through measures that take account of the projected impacts on the water and related sectors. These may include capacity-building on demand management, improving water system efficiency and buffering capacities, increasing storage potential, such as through managed aquifer recharge, building the sector's capacity for better predicting change, and infrastructure design to account for climate uncertainties and rapid adaptation techniques.

It is necessary to strengthen emergency management and preparedness plans so the sector can respond to extreme events, which are predicted to increase, whether they be flooding or droughts.

The water sector also needs capacity-building in inter-agency collaboration to draft joint response plans to extreme events that stretch beyond the water sector. This means working with other sectors such as civil defence, health and energy, among others, and necessitates a skill set that goes beyond the business-as-usual skills used in long-term planning and water-sector strategies.

The emerging and recurring conflicts in the region also require a new set of skills. Disrupted services due to damaged infrastructure, energy output or loss of control, and the resulting humanitarian crises, must be dealt with and rapid recovery provided. Capacity-building is required for emergency planning, and recovery, repair and reconstruction, that would account for operating under conflict, redundancy in services, providing humanitarian care, and repairing and rebuilding after conflict in a rapid, responsive manner to

Box 11. Role of women in water conservation

Jordan's Water Wise Women initiative has demonstrated the role that women can play as agents of change in water management and conservation. Initiated in 2014 to raise awareness, the project trains women to become plumbers. More than 3,000 women living in vulnerable areas have been taught specialities related to plumbing and water conservation technology. These cover eradicating water leaks, water harvesting, rationalizing water use and improving hygiene practices within households. The initiative was implemented by the Germany Agency for International Cooperation (GIZ) with the Ministry of Water and Irrigation and the Jordanian Hashemite Fund for Human Development (JOHUD).

The outcomes have not been limited to raising awareness and plumbing training, but have also empowered women, helping to transform social behaviour, attitudes and perceptions, and further supporting sustainable water-use patterns. Consumption at household level has decreased by 40 per cent in the regions covered by the project. Outreach has also resulted in better knowledge among more than 15,000 community members on the importance of water conservation and locally adapted technologies.

The experience has shown that women's capabilities and skills can match those of men in delivering quality services, challenging traditional perceptions of male-dominated professions. Further, women participating in the initiative have expressed a greater sense of confidence and self-respect. Consequently, a society for Water Wise Women was established. It has a central role in guiding government institutions in their policymaking, based on personal knowledge and understanding of water concerns and issues at household and community level.

Source: GIZ and JOHUD, 2015. Water Wise Women in Jordan. Available at http://cmsdata.iucn.org/downloads/wwwi_case_study_may_12_2015.pdf.

restore services to pre-conflict levels. This could be in countries other than those experiencing conflict, such as Jordan and Lebanon during the Syrian crisis. There is a wealth of regional experience to be exchanged that can significantly help to build such capacity.

Finally, capacity development on monitoring, data management and analysis for understanding water security at appropriate scales must not be neglected. This is necessitated by the multitude of data sources and scales, both in and outside the extent of the water sector. Capacities to utilize innovative sources are needed, such as remote sensing and satellite data, to complement in situ and other traditional data. States need to be able to analyse and use the data available in national monitoring systems and big data in a way that is useful to policymakers.

6. CONCLUSION

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Conclusion

This report has explored the conceptual understanding of water security through various perspectives, from traditional national security to human security concepts. The relationships between sustainable development and other global agendas have also been addressed to help envisage a framework for moving towards water security in a region constrained by challenging systemic conditions.

The scarcity of water resources, combined with population growth, urbanization trends, conflict, occupation, shared water resources and the impact of climate change, justify a holistic framework. Approaches to water security thus far have failed to alleviate persistent inequalities and conflicting requirements; inequalities in access to water and sanitation services between rural and urban areas, the poor and the rich, or between people according to their national identities in the case of occupied territories. And in the burden on women to deal with water scarcity and intermittency without empowerment; a lack of water rights, tied to a lack of land ownership rights, or lack of a true participatory approach that involves women at all levels and in all roles, from valued stakeholder to manager and decision-maker.

The region is facing increased difficulty and cost in mobilizing more water resources to satisfy the increasing demand. More States are depending on deeper non-renewable groundwater resources and on desalination, increasing the costs of investment, and operation and maintenance, making cost recovery more difficult. This demand-driven scarcity has implications on the sustainable development of a country, affecting all its dimensions; economic growth is constrained, social development hampered, and the environmental dimension is neglected, with ecosystems suffering from increased pollution and dwindling water.

Climate change will further complicate water security in the region, with projections for a general rise in temperatures, more hot summer days and decreasing average monthly rainfall increasing stress on already scarce water resources. Impacts of climate change are cross-sectoral, and affect water resources directly and indirectly through other sectors, such as the agriculture sector, which is already the greatest consumer of water in the region. This brings water security-food security linkages and the apparent competing demands between sectors to the fore. A balance must be achieved when distributing water between sectors, respecting the three pillars of sustainable development and the inherent human rights implications. When water is taken from agriculture, the loss of employment and economic potential, specifically among women, must be considered.

Further, regional geopolitical realities, including conflict, displacement and occupation, as well as regional inter-State tensions, complicate water security. In fact, political disputes tend to impede regional cooperation or inter-State agreements affecting shared water resources.

A human rights-based approach that empowers the rights-holders and holds accountable the duty bearers, and is based on the indivisibility of universal human rights, would help in weighing conflicting water uses and setting the right priorities at multiple levels, from household through to national and regional level. This affords a holistic understanding through all stages, ensuring an equitable, inclusive and participatory approach to achieving water security.

The centrality of water to sustainable development in its three dimensions stresses the importance of a holistic attitude to achieving water security. The 2030 Agenda and the integrated nature of the SDGs guide this ambition. Moving towards water security not only help to advance sustainable development, but sustainable development assists in achieving water security.

The economic, social and environmental dimensions of sustainable development must be considered in any approach to water security. For example, environmental sustainability demands that achieving water security respects the water quality and availability to the environment at large by avoiding overabstraction and pollution. At the same time, economic sustainability would require that investment, operation and maintenance costs are properly accounted for in any project life cycle through various financial means, while ensuring sufficient water for economic development. In return this must not overlook the affordability aspect for the poorest segment of the population. The social dimension requires an inclusive participatory approach that ensures equitability.

Recommendations

Any approach to water security must recognize that people are at the centre of all water issues and security. The conceptual framework proposed provides the basis for such an approach, putting people first and ensuring no one is left behind.

The region must adapt its approach to achieving water security in the face of mounting and new systemic challenges. It must also match the local context of available water resources, strengths and challenges. Universal blueprints for water security are non-existent, especially for a water-scarce region such as the Arab region, and water security approaches must match country specificities.

Centrality of decision-making within the water sector and a silos approach have failed to move the region towards achieving water security. It is vital that any approach sets goals and achieves consensus through participation that engages and empowers a range of stakeholders beyond water stakeholders. Women have a critical role to play in achieving water security at all scales.

States should facilitate empowering women and engaging them in the water sector through targeted initiatives, such as enforcing employment quotas for women in State water institutions. This would better address gender issues in water management strategies and plans that need to be gender mainstreamed. A human rights-based approach facilitates this while providing a wider lens of analysis based on international human rights principles.

Water security approaches must first recognize the systemic conditions in the region and advance action to cope with water stress and scarcity, improve cooperation on shared water resources, and improve resilience to cope with the impacts of climate change, natural disasters and conflict. The means of implementation are varied and address several systemic conditions simultaneously. However, these need to be mainstreamed within national development strategies to maximize synergies across sectors and build coherence at all levels. States must recognize the criticality of policy integration and harmonization, horizontally and vertically, at national level between sectors, at regional level between regional and national strategies and at global level between water-related agendas and national goals and targets.

As most water resources in the region are shared water, regional cooperation is vital in moving towards water security. Traditional cooperation approaches focused only on water shares have failed to build trust and partnerships. Innovative initiatives that build on iterative success and perhaps expand beyond the classical limits of the water sector are needed to improve cooperation.

Water scarcity in the region makes governance to achieve water security using traditional management tools of water-abundant countries a challenge. Arab States need to develop the national and regional research and development capacities combined with technological innovations to meet increasing water demands. Technological innovations to lower the cost or energy requirements of desalination or wastewater treatment, or to improve water-use efficiency while increasing agricultural productivity, could be of great benefit. Regional and national water research and development centres must be engaged to take the lead in providing regionally and nationally appropriate technologies supporting the development of non-conventional resources.

Efforts to finance water security and the water-related SDGs must be increased through improved national and innovative funding. Attracting more funding requires a proper enabling environment. States should adopt the necessary policies and regulations to attract new funding and partnerships with the private sector. More needs to be done with less; States should be more financially efficient in all stages in their water security, from planning and implementation through to operation and maintenance. Transparency and accountability are two key pillars to attracting new funding sources, successful private sector participation and increased efficiency. Independent regulatory authorities have an important role to play here. States should seek to benefit from global funding mechanisms that indirectly support water security under different agendas, such as those earmarked for climate change adaptation under the Paris Agreement.

Capacity development at all scales and levels to accompany the momentous effort needed to achieve water security cannot be emphasized enough. Institutional capacity as a whole must be improved, in tandem with the capacity of individuals. Institutional capacity must meet the systemic challenges, such as climate change impacts, through a multitude of measures. The capacity of shared water basin organizations must be developed to deal with situations that stretch across sectors, and perhaps beyond the limits of the actual shared water basin. Empowering women through capacity development must be stressed, preparing them to truly lead in the water sector.

As Arab States move towards achieving water security, due diligence should be given to improving resilience – in facing water scarcity, climate change impacts, natural disasters and conflicts, and sustainably developing and diversifying water sources by managing demand, improving efficiency and productivity and by adaptive management aided through technology. Due diligence should also be given to improving water infrastructure – through properly maintaining and refurbishing to build efficiency and lower operation and maintenance costs, and by rapid, timely reconstruction of water-related infrastructure damaged by conflict or occupation, free of embargoes and without financial constraints.

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Endnotes

Executive Summary

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Chapter 1

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Arab States are among the most water scarce in the world, with nearly 362 million people in the Arab region living in conditions that range from water scarcity to absolute scarcity. The freshwater scarcity situation in the region is aggravated by several factors, such as dependency on shared water resources, occupation and conflict affecting people's ability to access water and sanitation services, climate change impacts and extreme events, water pollution, non-revenue water losses from ageing water systems, intermittency, inefficient use of water and high population growth rates. Constructing a conceptual framework for moving towards achieving water security in the Arab region requires, first, putting people at the centre of water issues, and second, a solid understanding of the main systemic conditions that hamper its achievement. The systemic conditions vary in scale and severity, and their impacts affect water security at various levels and scales. This variance in scale requires a flexible approach, but one grounded in principles that transcend scales of analysis.

This report presents a conceptual framework for achieving water security in the Arab region. It considers the regional systemic conditions of water stress and scarcity, shared water and climate change that hinder the achievement of water security. This is done through a sustainable development lens, whereby water is central to the three dimensions of sustainable development, namely economic, social and environmental. This is combined with a human rights-based approach to examine water security implications at all scales, including at the community and household level, so that water security in the Arab region is grounded in efforts to ensure that no one is left behind. It does so in view of an enabling environment, based on a set of means of implementation addressing systemic conditions at various scales.

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