

# 3<sup>rd</sup> State of the Water Report for the Arab Region (Executive Summary)





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Uniting against Poverty

## Foreword



The Arab Region is facing one of the severest water scarcity crises in the world. Most of the Arab region lies in the arid and semi-arid zones. Rainfall is low, variable and unpredictable in most of the area. Several Arab countries are suffering from water deficiency and others are heading that way, with an annual population growth of about 3%. Above all, rising levels of water consumption due to socio-economic development have created a challenge of the first magnitude. Moreover, depletion of the non-renewable groundwater is extensive and the remaining water resources are polluted. Salt-water intrusion in many of the coastal aquifers is common. Conflicts in the region on shared international waters are higher than anywhere else in the world. Evidently, the world water crises of the future are already here in the Arab countries.

Today, in those countries, the question is whether a water crisis can be averted or whether water can be made more productive. The answer to this question relies on the way we are using and managing water resources in all water use sectors and the irrigation one in particular.

Improved water resources management and access to safe water and sanitation for all is hence essential for eradicating poverty, building peaceful and prosperous societies, and ensuring that “no one is left behind” on the path towards sustainable development.

The existence of reliable information and dependable assessment of water resources is certainly a pre-requisite for proper water management, successful development plans and soundly guided decision-making processes. From here stems the importance of the present series of reports on “State of the Water in the Arab Region,” the 3<sup>rd</sup> edition of which (2015) is in hand, as an update of the previously published 1<sup>st</sup> and 2<sup>nd</sup> editions (2004 & 2012 respectively).

The State of the Water reports aim at providing an update of the country-level water resources and management assessment of the Arab region, and these Reports are regularly presented to the Arab Water Council (AWC) General Assembly every three years, pursuant to the AWC Constitution and By-Laws. It is truly considered a valuable piece of work to be consulted while outlining national water policies and projects.

Thanks are due to the inter-disciplinary team of experts, professionals, analysts, designers, IT and communication specialists, apart from the focal points of the 22 Arab countries who provided the inherent information, for their dedicated efforts and hard work to make this publication a successful output, reflecting the joint collaboration and effective partnership between CEDARE and AWC under the umbrella of the League of Arab States. A note of appreciation is importantly attributed to the OPEC Fund for International Development (OFID) for their generous contribution which made this “3<sup>rd</sup> Report on the State of the Water in the Arab Region” possible.

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## Preface



The Centre for Environment and Development for the Arab Region and Europe (CEDARE) has long-standing and deeply-rooted cooperation with the Arab Water Council, at different fronts. High on the agenda is the regular publication of the widely-acclaimed State of the Water Report for the Arab Region, which was initiated in 2004.

CEDARE is proud of the fact that this third series is prepared also under the umbrella of the League of Arab States. Indeed, this would have not been possible without the tireless efforts of the National Focal Points from the Ministries of Water in the Arab Region, who consistently coordinated with several other officials in their countries.

230 indicators and parameters have been used to monitor change, progress and trends in the water sector in the Arab Region. Moreover, modern techniques and transformative technological developments in the world, such as Artificial Intelligence, and others, call upon us to adapt our methodologies and practices for the benefit of our people.

Remote sensing technology and satellite imagery, referred to in this Report, their evolution, accuracy and applications in assessment and management of water resources, provide information and data that are difficult to obtain under traditional methods, especially in remote areas and in sources of transboundary waters outside national and regional borders. Satellite data provide factual information on rainfall and agricultural water consumption as well as the impacts of land use change on water use. This is especially important where rain gauges, climate data and measurement stations are scarce. Technological developments in the field of water treatment, desalination and harvesting water vapor open many promising prospects to make use of every drop of water, whether, it exists in the atmosphere around us, or in the wastewater resulting from different uses, or in the seas, oceans or gulfs around the Arab Region.

This Report is a very useful resource for information required by decision makers, especially in pursuing the Water, Food, Energy Nexus approach, to achieve security in these three fundamentally important sectors.

That said, Climate Change is here, it is clear and it is urgent! It affects the volume and timing of the expected rainfall, as well as the agricultural water requirements. It is thus imperative to continue monitoring the impacts of these changes on water, using credible Reports, such as this.

Providing non-conventional and alternative energy and water resources, including new and renewable energy, particularly solar energy which is abundant in the Arab region, will address, and alleviate, harmful climate change emissions. In addition, non-conventional water resources, such as reusing wastewater and desalination, are areas where the Arab region has made extensive progress in size and technology. The report provides a thorough assessment of the status of non-conventional water resources in the Region.

We at CEDARE are committed to the development and publication of the State of the Water Reports in close cooperation with our leading partners: the Arab Water Council and the League of Arab States, as well as other notable institutions.

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## Executive Summary

The Arab population in 2015 reached almost 400 million inhabitants representing about 5% of the world's population and residing on about 10% of the world's land area. While the global precipitation on land amounts to 110,000 BCM/y, the Arab Region receives only 1,462 BCM/y with a spatial average depth of about 115 mm. AQUASTAT, FAO, 2014 states that Egypt is the country with the lowest spatial average precipitation depth in the Arab region with 18.1 mm/year, followed by Libya with 56 mm/year and Saudi Arabia with 59 mm/year. The extreme aridity prevailing throughout most of the Arab countries indicates that the share of rainfall depth for the Arab Region is 28% of the global average rainfall water depth, while the Arab inhabitant is endowed with (nearly 300 m<sup>3</sup>/cap/y) about 5% of the global per capita average share (nearly 6000 m<sup>3</sup>/cap/y) of the Total Internal Renewable Blue Water Resources (TIRBWR) as shown in Figure 1.

Per Capita Shares of Internal Renewable Water Resources (m<sup>3</sup>/cap/year)

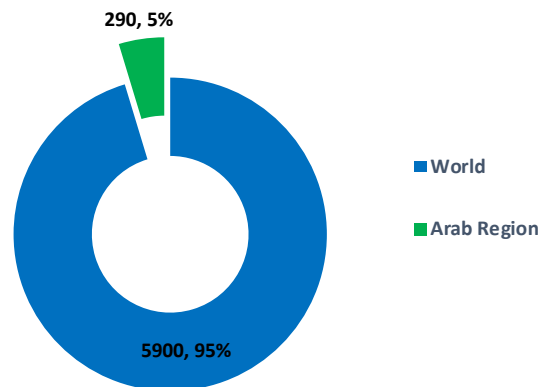


Figure 1. Per Capita TIRBWR Share for the Arab Region versus Global Average

The critical status of water resources in the Arab Region (growing water scarcity, escalating water demands, and limited water resources) necessitates the existence of a reliable dynamic and periodical assessment and evaluation of all relevant water-related aspects. This document represents the third State of the Water Report for the Arab Region, and is hopefully intended to provide beneficial guidance to the water sector decision making process to support better water planning, management and development. The report is prepared by CEDARE and the Arab Water Council along with the focal points from the Ministries responsible for Water in the region, and is supported by The OPEC Fund for International Development (OFID). This report comprises nearly 230 indicators and parameters describing the State of the Water sector in the Arab Region. The indicators are classified into 15 major categories, namely; water & availability, water & uses, water & land use changes, water & services, water & energy, water & population, water & health, water & quality, water & ecosystems, water & climate, water & socio-economics, water & finance, water & trade, water & governance, and water & international relations. Remote sensing techniques have been introduced to estimate many of the unmeasured/unreported parameters and to enhance the accuracy of others.



The available water resources may be distinguished according to five main classifications. The first categorization differentiates resources into conventional and non-conventional water resources. The latter is mainly attributed to three activities, namely; agricultural drainage reuse, municipal and industrial wastewater reuse, produced desalinated water, and also recycled groundwater recharged for surface water uses. Brackish groundwater presents potential addition to non-conventional water resources when economically desalinated. A double counting exists between both categories since agricultural drainage potential reuse for irrigation water, produced municipal and industrial wastewater, and recycled groundwater have already been counted as conventional resources. Figure 2 shows that the total conventional water resources for the Arab Region sums up to 709.97 BCM and the gross produced non-conventional water resources adds up to 73.55 BCM. A double counting of about 60.84 BCM exists, but it provides an amount of water that could be withdrawn again for reuse, some of which after treatment. The full amount could be reused if Zero Liquid Discharge (ZLD) is to be achieved.

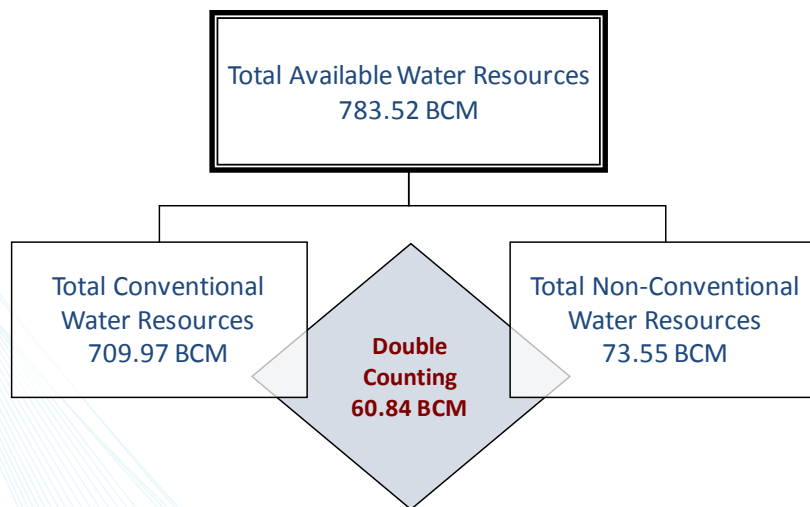


Figure 2. Conventional and Non-Conventional Water Resources in the Arab Region.

The second classification refers to whether renewable water resources for beneficial water abstractions are directly from rainfall atmospheric water (Green Water) or from surface water bodies and groundwater aquifers (Blue Water). Typically, abstractions for rainfed forests, pasture, and rainfed agriculture that are mainly fed from precipitation, are referred to as Green Water. Blue Water is simply the water that could be extracted from surface water bodies and groundwater aquifers. Figure 3 indicates that nearly two thirds (62%) of the annual conventional water resources are attributed to green water (442.88 BCM) while 38% are attributed to blue water (267.09 BCM). This highlights the significance of green water, and accordingly, any national or regional assessment which does not properly account for green water in its budget has to be rendered incomplete. In the Arab Region, natural pasture lands consumes about 48% of the green water (212.07 BCM), while Forests consume nearly 18% (80.29BCM) and rainfed agriculture consumes about 150.52 BCM/y.

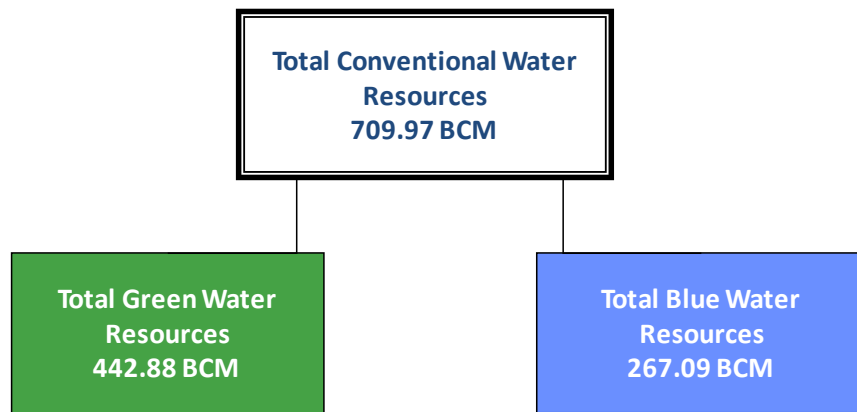


Figure 3. Green and Blue Water Resources in the Arab Region.

The water resources may be further categorized according to its renewability. Renewable resources are those which, when abstracted for beneficial use, are being replenished (renewed) annually through rainfall and/or natural surface and groundwater flows crossing the national boundaries. Consequently, all green waters are considered renewable. Non-renewable water resources, like fossil aquifers, are non-recoverable, and are not replenished upon abstraction. Distinction according to renewability of resources is displayed in Figure 4. The total annual renewable water resources (green and blue) are estimated as 663.29 BCM. 82% of the total blue water (267.09 BCM) is attributed to renewable water resources, while potentially planned annual abstractions from non-renewable fossil groundwater were estimated as contributing to the remaining 18% (46.68 BCM).

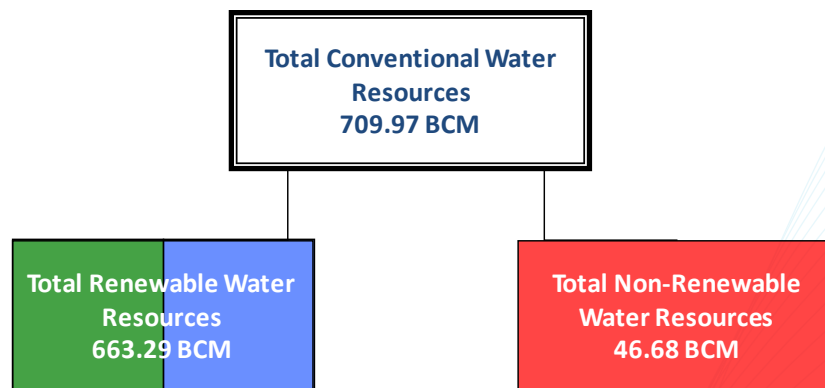


Figure 4. Renewable and Non-Renewable Water Resources in the Arab Region.

Similarly, water resources may also be differentiated according to whether they have been generated inside the national (or regional) territories, or outside of it. Endogenous precipitation, which occurs in the boundaries of each country, is the source of internal renewable water resources, (IRWR). Equivalently, incoming surface and groundwater flows, which cross the boundaries of a country (or region), account for externally generated water resources. Figure 5 shows that 581.20 BCM of water are annually available internally (including green water, renewable and non-renewable groundwater). The net external water resources represent the difference between the inflows and the outflows to the Arab countries including both surface water and groundwater.

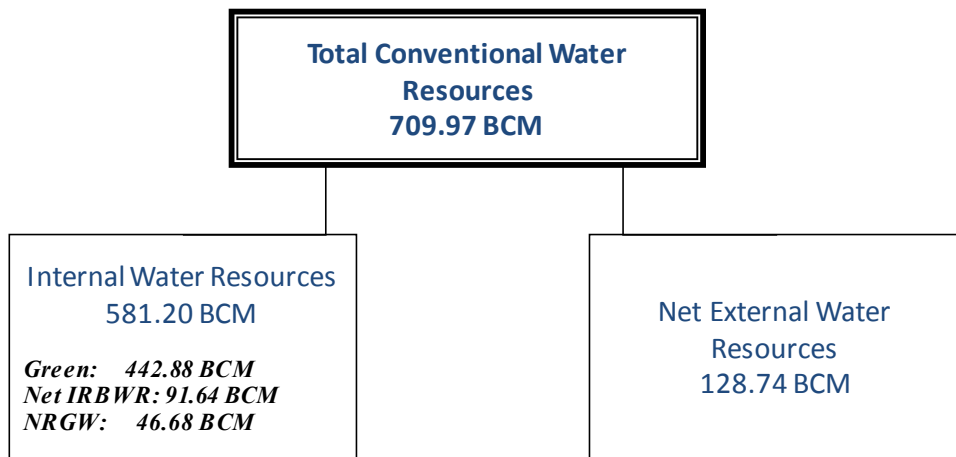


Figure 5. Internally and Externally Generated Water Resources for the Arab Region.

Moreover, the blue water resources may be also categorized as surface water resources and groundwater resources. Surface water constitutes nearly two thirds of the total blue water resources as depicted from Figure 6. The total internal renewable blue water resources equals to 91.68 BCM, which is the sum of the renewable surface blue water (69.11 BCM) and the renewable groundwater (41.27 BCM) excluding the overlap between surface and groundwater (18.7 BCM). Furthermore, 163.16 BCM of renewable blue water are being generated outside the Arab Region and are being transferred, mainly through the shared rivers of the Nile, Tigris, Euphrates, and Senegal, as well as some transboundary groundwater inflows. It represents 64% of the sum of the internal and external (to the region) renewable blue water resources (254.84 BCM). The net external renewable blue water resources equals to 128.74 BCM, which is the sum of the net external surface blue water (118.24 BCM) and the net external groundwater (10.5 BCM). It represents 58% of the sum (220.42 BCM) of the net external renewable blue water resources and internal renewable blue water resources.

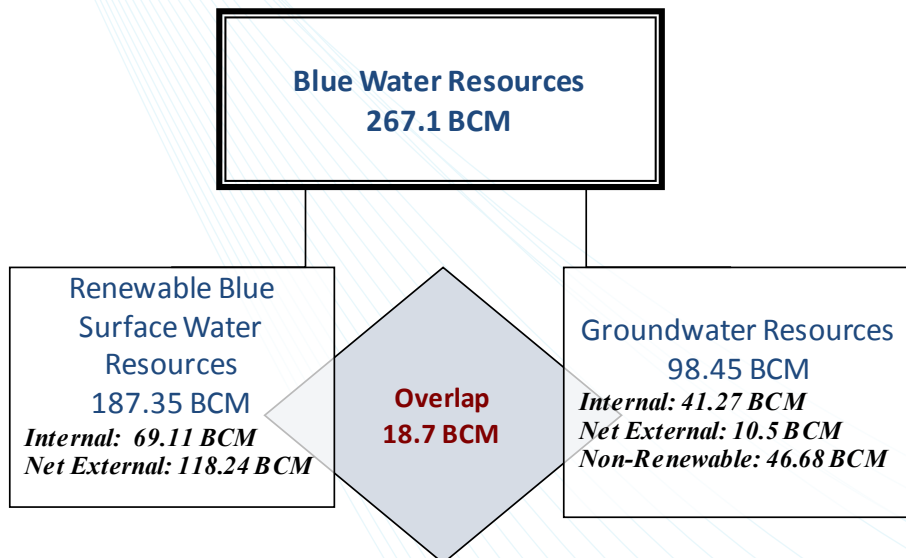


Figure 6. Surface and Ground Water Resources for the Arab Region.

The water sector in almost all Arab countries is under stress with different levels of severity and different stages of vulnerability. Upstream water development projects, for shared rivers, constitute an enormous threat to water security for the whole region. Severe impacts are already encountered by Syrian and Iraq.

The State of Water resources in the Arab Region representing the year 2015 is shown in Chart 1 while the State of Water based on the long term averages is shown in Chart 2.

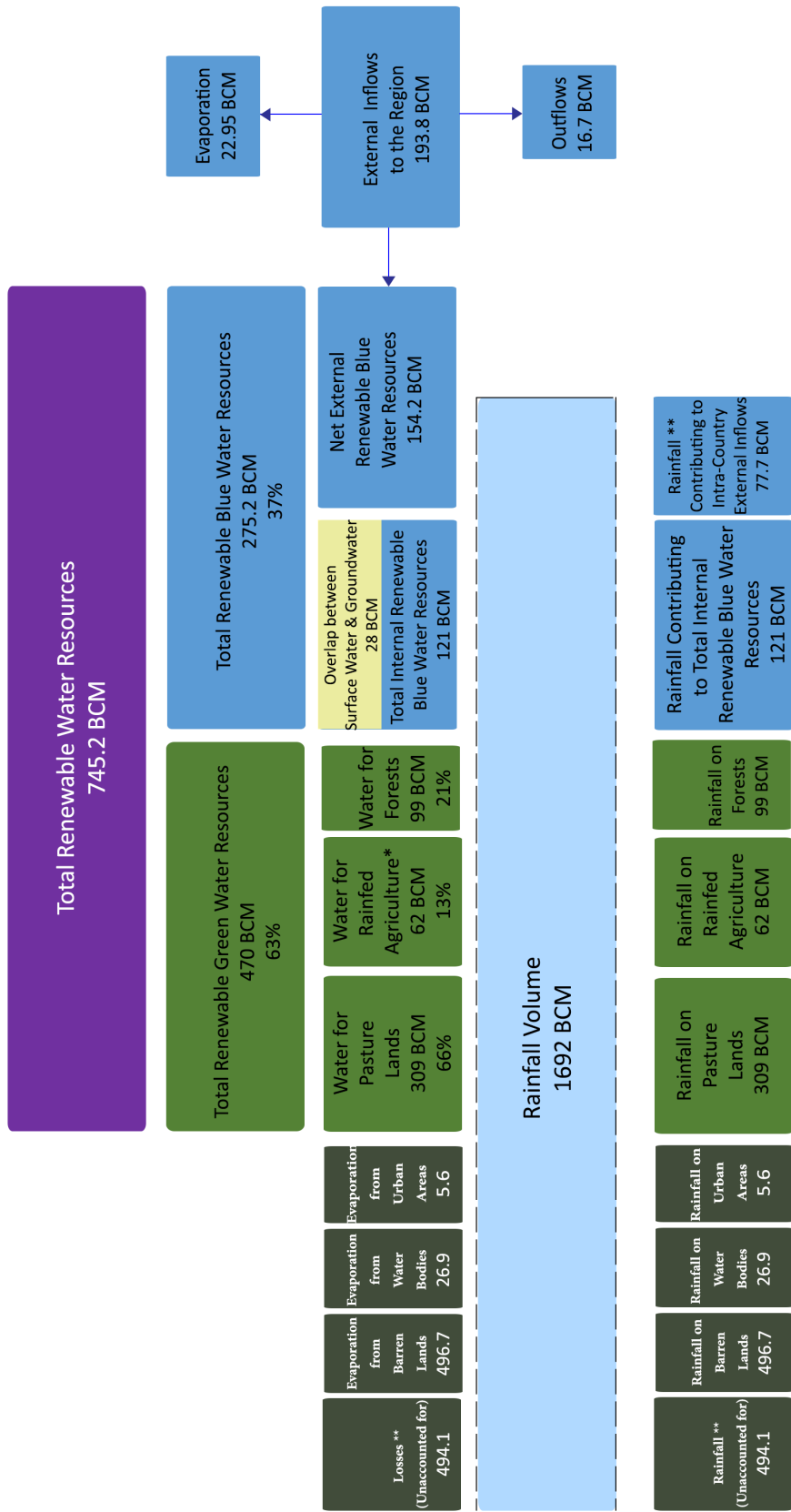
As an example, for the difference between the former two approaches, Figure 7 displays the rainfall depth distribution per country based on: (i) the long-term average (as reported in the FAO Aquastat database), and (ii) the values reported by each country for the precipitation occurring during the year 2015, specifically. Remote sensing derived values are also included. The figure shows 13 countries has remote sensing estimated rainfall depths' values lower than the long term average, while 9 countries has values higher than the long term average.

The total annual water withdrawals from blue water resources sum up to 235.13 BCM. The agricultural sector uses 81% of total withdrawals (190.10 BCM). Domestic withdrawals add up to 32.88 BCM (14% of total) while the industrial sector uses about 5% (11.17 BCM). It has to be clear that the total agricultural uses amount to 293.68 BCM, where more than one third (103.56 BCM) is being satisfied directly from precipitation through green water (rainfed agriculture). The total irrigated agricultural lands in the Arab region amounts to 12.63 million hectares, where nearly half of these areas belong to Egypt and Iraq. Rainfed agricultural covers an area of 46.72 million hectares with more than one third of the areas (38%) pertaining to Sudan.

About 88% of total withdrawals are attributed to conventional water resources while 12% is derived from non-conventional resources, mainly agricultural drainage reuse. Annual withdrawals from blue water resources are equal to 205.76 BCM, which exceeds 77% of the total blue water resources. The average per capita share of withdrawals from total renewable blue water resources is nearly equal to 575 CM/y. The former numbers reflect a remarkably high level of water stress and provide additional pressure on already vulnerable fossil groundwater resources. 17 Arab countries are below the scarcity limit (1000 CM/cap/y) and 13 countries are below the severe water scarcity limit (500 CM/cap/y). The highest per capita share of agricultural water withdrawals occurs in Iraq (880 CM/cap/y), while the highest per capita share of industrial water withdrawals occurs in Egypt (60 CM/cap/y). Kuwait is providing a remarkably high share of domestic water equivalent to 235 CM/cap/y while the average share of domestic supplies in Somalia is less than 2 CM/cap/y.

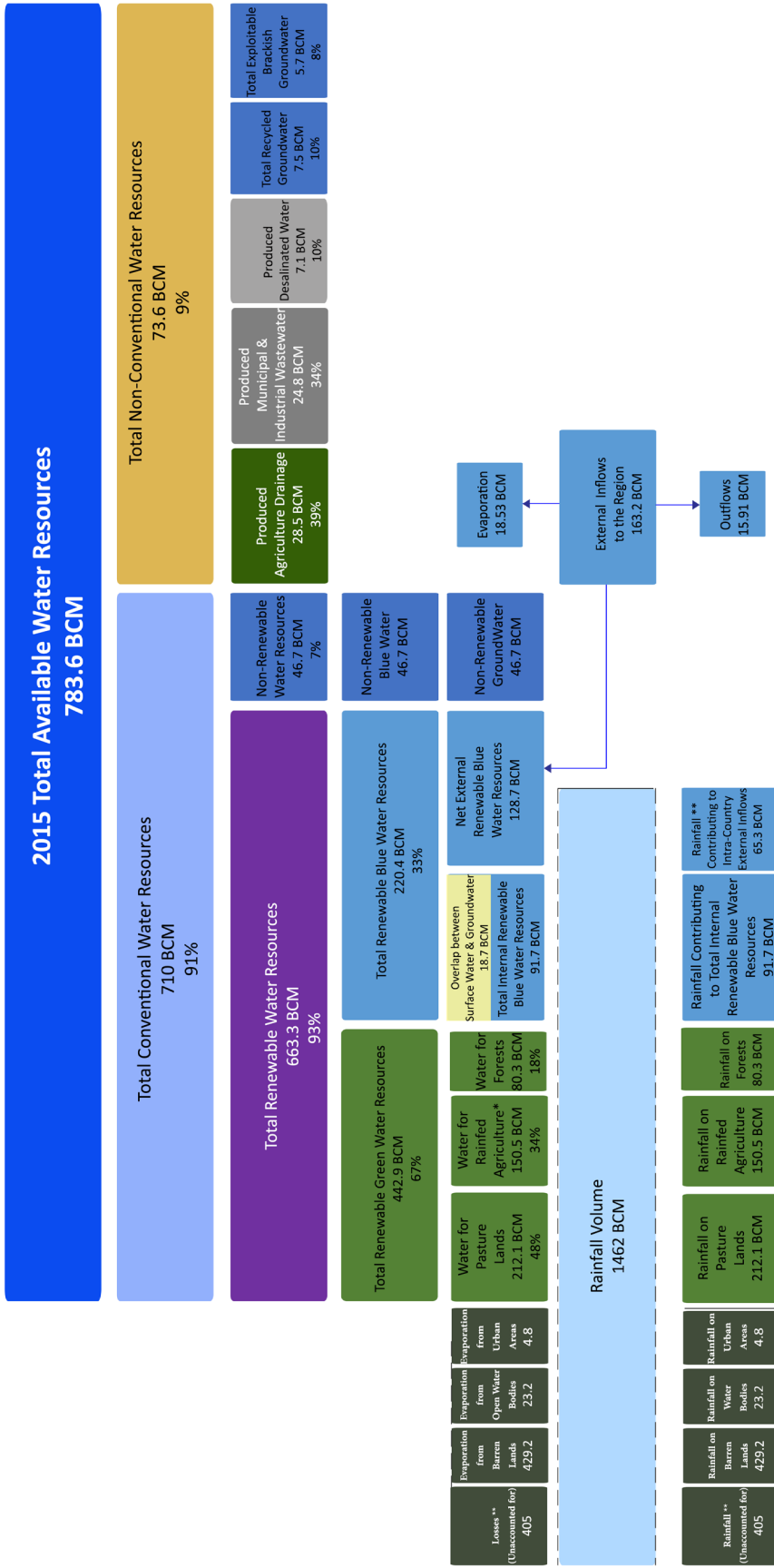
Urban encroachment on green cover has expanded by 188,267 ha between the years 2012 and 2015. New communities and settlements have been built over 43,821 ha of previously classified desert lands. Unfortunately, new urban developments have been replacing other natural and/or beneficial land uses. In a region where 83% of the total area is mere desert, it seems highly inappropriate to expand in developments on the expense of scarcely available green areas.





\* Includes Rainfall Contributing to Irrigated Agriculture Lands  
\*\* Requires Further Assessment

Chart 1. Estimated Long Term Annual Average State of the Arab Water Resources at a Glance



\* Includes Rainfall Contributing to Irrigated Agriculture Lands  
\*\* Requires Further Assessment

Chart 2. 2015 Annual State of the Arab Water Resources at a Glance

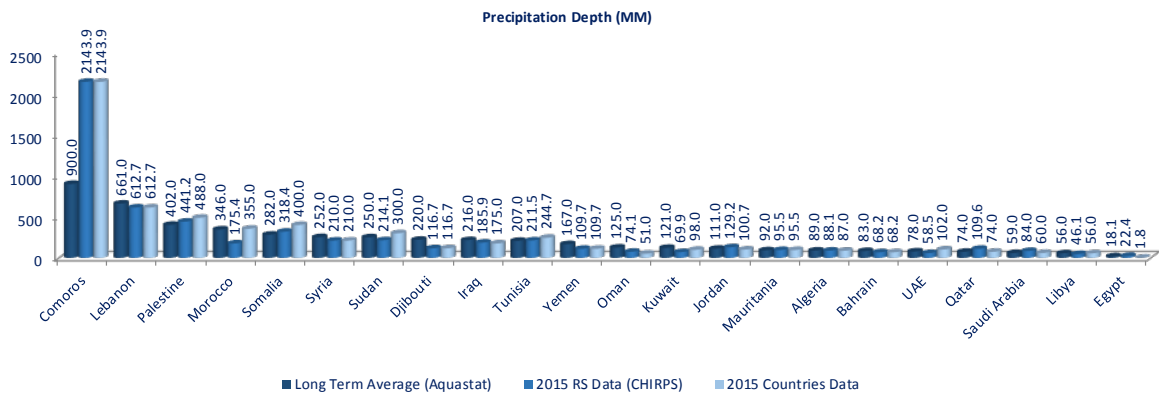


Figure 7. Long Term Average versus 2015 Precipitation (Remote Sensing & Country data).

In regards to water and sanitation services, country reporting shows that 79% of the total Arab population benefits from piped water connections on the premises of their dwellings. 86% of the total Arab population have access to improved drinking water services, while 76% have access to improved sanitation services, 63 million persons are still deprived from improved drinking water services, and 79 million inhabitants are equally deprived from improved sanitation services. A special section is devoted for reporting on the progress in achieving Sustainable Development Goal 6 (SDG6), which is concerned for achieving commitments towards provision of clean water and sanitation for all people. Eight targets along with their various indicators are being processed for all Arab countries.

Nearly one million kilometers of drinking water networks do exist in the Arab Region. Lengths of sewage or wastewater collection networks are significantly less, summing up to 183 thousand kilometers or nearly 20% of the water supply networks. At least 43% deficit in wastewater collection may be revealed. Municipal wastewater treatment capacity is estimated at nearly 71% of wastewater collection capacity.

The Joint Monitoring Program for Water Supply, Sanitation and Hygiene, supported by WHO/UNICEF, (JMP) estimates that 63% of rural Arab population have their drinking water accessible on premises as compared to 87% for urban communities. Population suffering from unimproved drinking water services has shrunk from 12% to 3% between the years 2000 and 2015. JMP further estimates that the percent of rural population receiving at least basic sanitation services reaches 68% in 2015 as compared to 84% for urban communities. Unfortunately, the portion of population subjected to unimproved sanitation services remains constant at 7%. 14% of rural populations in Arab countries still practice open defecation.

Country reports on several water borne diseases have shown a steady decline. While the number of incidents infected by dracunculiasis (Guinea worm) in some Arab countries were in the order of hundred thousand in 1996, it dropped to the order of tens of thousands in 2006. The last reporting show rare cases less than ten. Nevertheless, proper assessment for the situation in countries with political unrest may reveal a different status.

The Arab region generates roughly 35,127 GWh per year of electricity generated using hydropower as of 2015. Nearly 41% of the hydropower is generated in Egypt (15,510 GWh/y). Sudan and Syria generate about 44% of the

total hydropower. Political unrest has affected water infrastructure and the ability for monitoring and evaluation of the water sector in several countries in the region such as Syria, Libya and others, including the repercussion of the war in Iraq.

The wetlands in the Arab Region, which are internationally acknowledged by RAMSAR sums up to 157 site, mostly in African countries. The wetlands cover an area of about nine million hectares, one third of which are in the Algerian territories.

Impacts of climate change are experienced in the day to day realities in the Arab Region, spreading desertification, devastating flash floods and prolonged droughts. Although this report include data on the numbers of drought and flooding events in some countries (including a total of 96 flooding events resulting in 665 human losses and 840 million USD of direct economic losses), yet these are insufficient to depict climate trends. The Arab countries may be lacking basic tools (and plans) to assess and monitor changes in the climate. There is an urgent need to adopt a regional program for comprehensive assessment and basic periodic monitoring for climate parameters.

Agricultural water productivity for the main food producing countries (Egypt, Sudan and Syria) report values in the range of 0.34 to 0.6 \$/CM. The job per drop indicator (or the sectorial employment level) indicates 110, 54 and 20 jobs per million cubic meters of irrigation water in Egypt, Sudan and Syria respectively. Industrial water productivity is expected to be higher. Countries report a very wide range for industrial water productivity, especially in Gulf countries, which raises the average industrial water productivity to 753 USD/CM. Furthermore, the average employment in the agricultural sector amounts to 900 job per million m<sup>3</sup> of water while employment in industry reaches 17,000 job per million m<sup>3</sup> of water.

In Kuwait, 18.4 % of the national budget is directed towards water and sanitation programs as compared to 1.9% in Tunisia and 1.3% in Egypt. The percentage of GDP directed to sanitation & hygiene is as high as 10.9% in Jordan and as low as 0.06% in Sudan. The cost recovery for operation and maintenance for water and sanitation services reaches 83% in Jordan and 80% in Tunisia, 75% for Egypt and UAE, and 9% for Iraq.

In 2015, The Arab countries have imported 128.4 million Metric Ton of agricultural food and livestock products which a value of 70.7 Billion USD and exported about 18.3 million Metric Tons of agricultural food and livestock valuing around 15.96 billion USD. The Arab countries imported 288 BCM of virtual water embedded in these food products, while the virtual water exported was about 33.4 BCM. About half of the imported virtual water for food serves three products; wheat, dairy products, and cooking oils. Wheat consumes nearly 20% of the total imports (55.3 BCM/y). The water used for local food production has increased from 282 BCM/y in 2012 to 324 BCM/y in 2015.



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