2nd Arab State of the Water Report 2012

CEDARE
سيدارى

المجلس العربي للمياه
Arab Water Council

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ISBN: 978 - 977 - 90 - 3806 - 3
Deposit Number: 5092 / 2016

ISSN: 2357 - 0318
Deposit Number: 24008 / 2016

For reference purposes, this publication should be referred to as:
AbuZeid, K., Elrawady, M., CEDARE, Arab Water Council (2014). "2nd Arab State of the Water Report - 2012", Water Resources Management Program - CEDARE & Arab Water Council, ISBN: 978 977 90 3806 3, ISSN: 2357 0318.

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Executive Summary

Considering the increasing water scarcity in the Arab region with growing water demands and limited resources, the existence of reliable and dependable assessment of water resources related indicators in the Arab Region is a prerequisite for guiding the decision-making processes to support proper water planning and management for successful future development plans.

This Arab State of the Water report is the second report to follow up on the region's water status. It was prepared by CEDARE and the Arab Water Council along with the countries in the region to present the country level water resources assessment in the 22 Arab countries, and to shed the light on their water needs and water utilization. A set of well-defined indicators is covered to consider issues such as **water availability, water withdrawals and consumption, land-use change, demographics, energy, accessibility, health, climate, economics and Political Affairs, among others.** The State of the Water Report proves to be an invaluable tool for performance assessment, gap analysis and planning for each country, as well as the region as a whole.

The "Total Renewable Water Resources" and the "Total Renewable Blue Water Resources" are reported for all Arab Countries, as well as the region. The difference between the two values is due to the consideration of Green Water. It is recommended to change the definition of the traditionally used term "Total Renewable Water Resources" to include Renewable Green Water as it has been used in this report. This report also presents the term "Total Available Water Resources" which includes the generated Non-Conventional Water Resources that would be made available through reuse and desalination (Chart 1).

63% of the 1,384 BCM/year of precipitation volume is evaporated, while 28% is used beneficially by rain-fed agriculture, pasture areas, and forests. Only 9% of precipitation volume is transformed to Blue Water, 6% of which is Surface Water and 3% is Ground Water.

Water Availability in the Arab Region has been assessed with the consideration of Blue and Green Renewable Water Resources, in addition to Non-Renewable Water Resources and Non-Conventional Water Resources. With the consideration of the Green Water as a water resource, the Total Renewable Water Resources in the Arab Region is distributed as 59% Green Water (385 BCM) and 41% Blue Water (274 BCM), while the annual Non-Renewable Water Resources currently used is estimated at 24 BCM, which is 4% of all Conventional Water Resources in the Region.

The Total Annual Green Water Resources are divided into pasture land consumption, rain-fed agriculture consumption, and forest consumption, where 253 BCM is consumed by pasture land, 81 BCM consumed by forests, and 51 BCM consumed by rainfed agriculture. Overall, about 44% (121 BCM) of the Total Renewable Blue Water Resources is generated within the Arab Region and

the remaining 56% (153 BCM) is generated outside the Arab Region.

In addition to almost 4 BCM of annual desalinated water, produced agricultural drainage is the most available Non-Conventional Water Resource in the Arab Region with a total potential of 34 BCM/year followed by produced municipal and industrial wastewater with a potential of 24 BCM/year.

One of the most important aspects of water is the economics, and in this respect there are great variances between the regions with respect to water availability. Most notable, the Arab Region as of 2012 imports 274 BCM/year of virtual water embedded in about 87 million metric tons of agricultural food products, and exports 55 BCM/year of virtual water embedded in about 19 million metric tons of agricultural food products. In 2012 the agricultural food production in the region utilized 282 BCM/year.

To a great extent, the relationship between water and its strategic issues, such as availability, consumption, accessibility and economy, are tackled in this report to support further developments in the water sector.

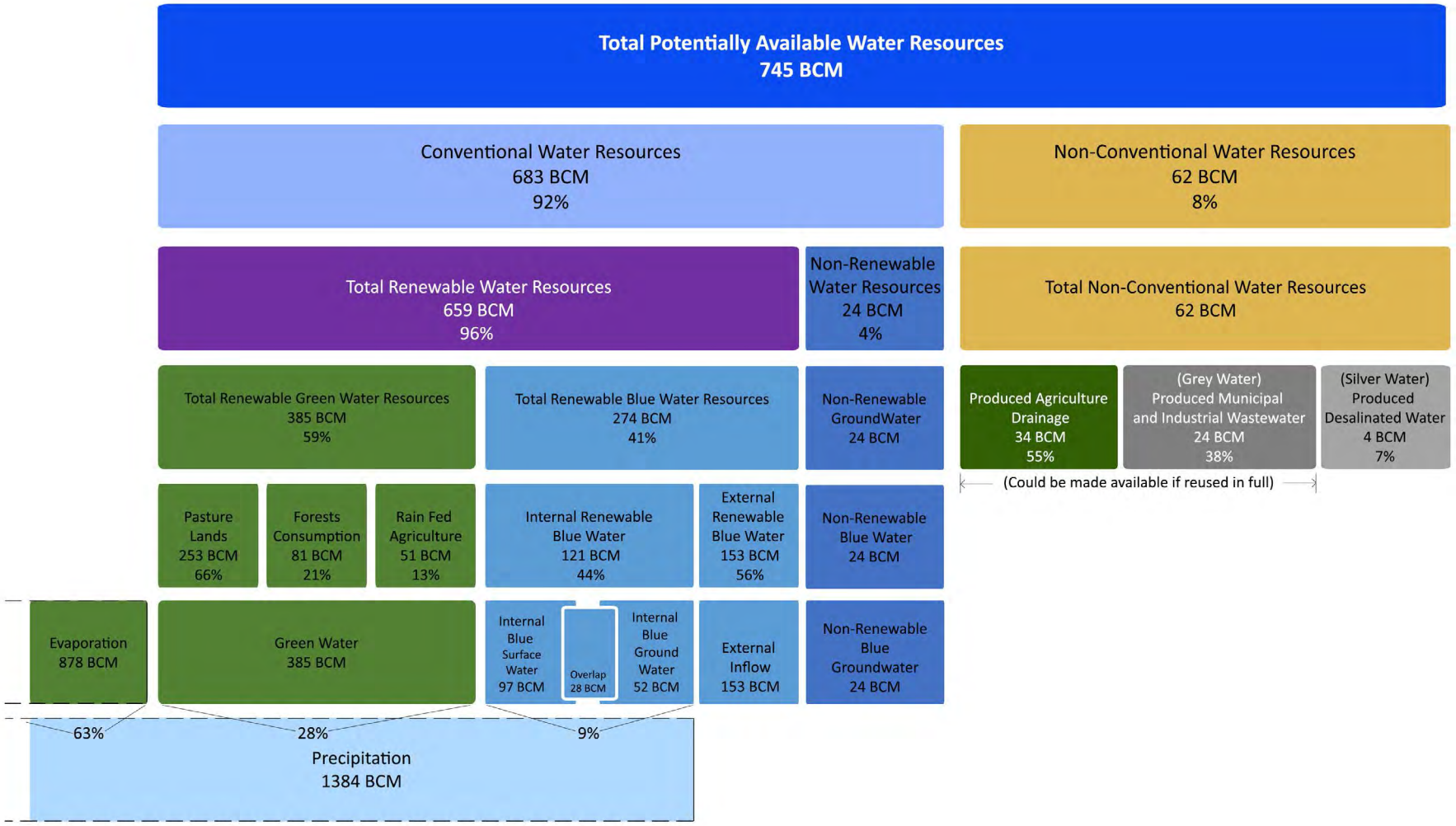

Chart 1. Average Annual Arab State of the Water Resources at a Glance - 2012

State of the Water in the Arab Region

a. Water & Availability

Conventional Water Resources

Precipitation is the source of life; it is the beginning and the end of the ever renewable water cycle. Waters of all colors originate from rainfall; the secret of life carried within the drops is then transferred to different locations above and underneath the ground allowing different methods of abstraction so that the activities that keep the world spinning could be continuously performed. In some cases, rainfall drops are consumed or evaporated even before landing on earth or directly at the very moment they make landfall.

For any given country, precipitation can be expressed by two indicators, the Average Annual Precipitation Depth (Figure (1)) and the Average Annual Precipitation Volume (Figure (2)). Any description of precipitation in any given country is definitely incomplete if one of the two indicators is missing. The effective rainfall area is the parameter that transforms rainfall depth to rainfall volume. Identifying the rainfall depth is the first step in the process of estimating the rainfall volume, while the second step is determining the effective rainfall area. The precipitation volumes shown in Figure(2) were estimated following the precipitation pattern developed by CEDARE and the Arab Water Council as shown in the first Arab State of the Water report that was published in December 2004 (CEDARE and AWC, 2004).

From figures (1) and (2), it is clear that the annual precipitation depth ranking of Arab countries is different from that of the average annual precipitation volume which depends on the effective area. While Comoros has the highest annual precipitation depth, its relatively small area in comparison to the rest of the Arab countries has ranked it 19th in the Total Annual Average Precipitation Volume chart shown in Figure (2). Similarly, Sudan ranks first in regard to the total average annual precipitation volume, although it ranks 11th on the annual precipitation depth chart.

It is worth mentioning that the split of Sudan in 2010 was one of the most recent significant political developments that directly affected the overall Water Resources in the Arab Region, as South Sudan was separated from the Arab Region The total average annual Precipitation Volume in the formerly unified Sudan used to be 1,092 BCM, therefore the Arab region has lost around 772 BCM due to the separation of South Sudan from Sudan. Figures (3a) & (3b) show the precipitation contours in the Arab Region and South Sudan. The Average rainfall depth in the Arab Region is estimated to be 229 mm while the overall Precipitation Volume is 1,384 BCM.

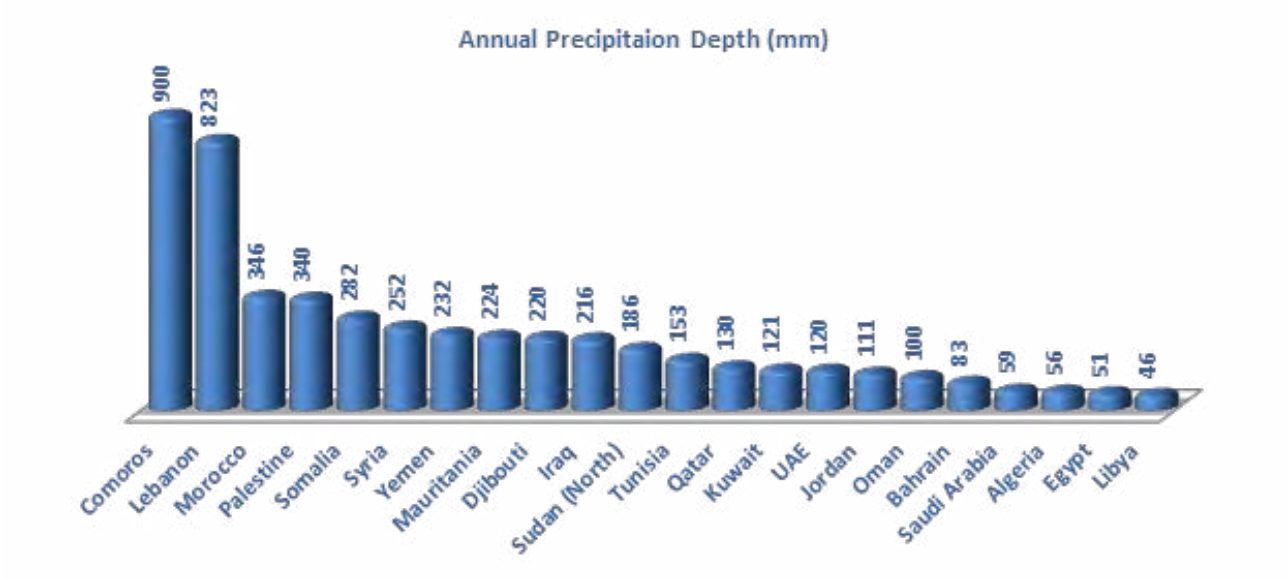

Figure 1. Annual Precipitation Depth in the Arab Region (FAO, 2012)

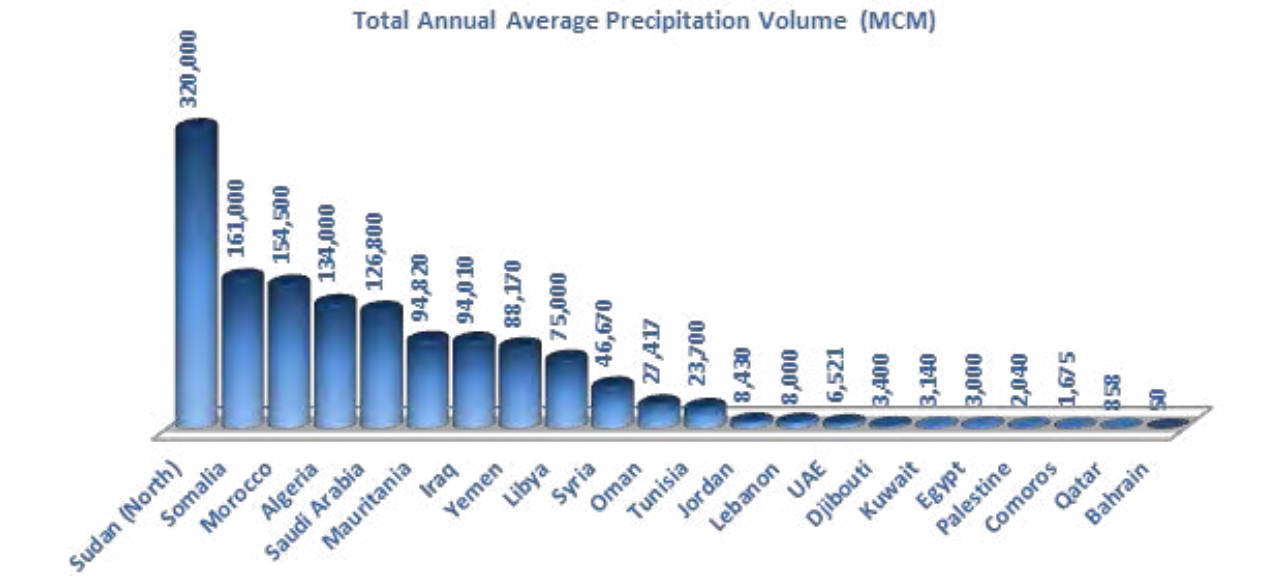

Figure 2. Average Annual Precipitation Volume in the Arab Region (CEDARE, AWC, and FAO, 2012)

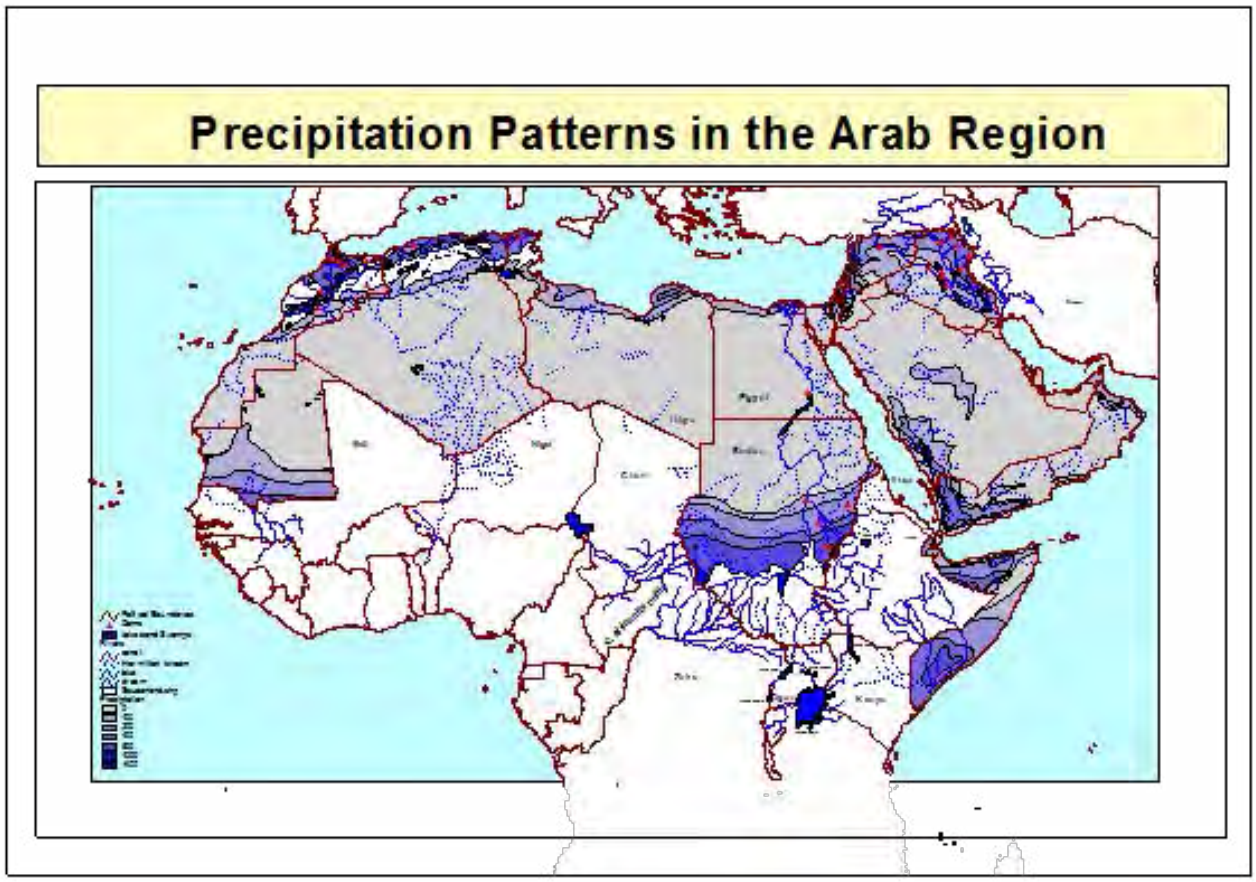

Figure 3a. Precipitation Patterns in Arab Region (CEDARE, 2011)

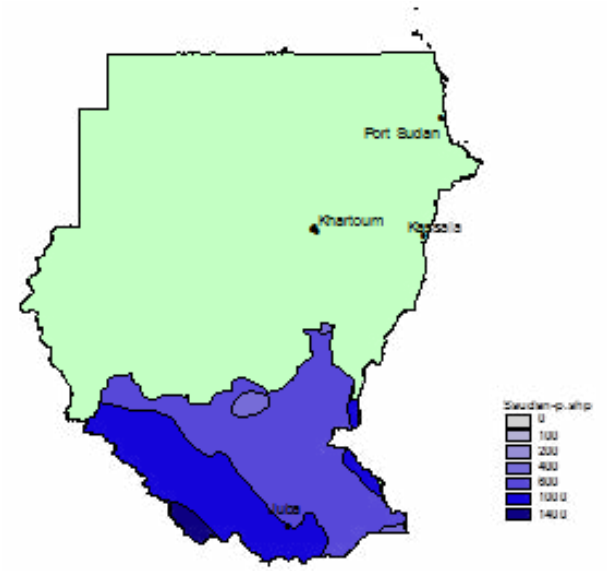

Figure 3b. South Sudan Precipitation Patterns (after 2010 Separation) (CEDARE, 2011)

Blue Water

Simply put, Blue Water is the water abstracted from surface water bodies and groundwater aquifers. The surface Blue Water is formed as a direct result of surface runoff and routing into river bodies, canals, and lakes. The blue groundwater is simply all types of water extracted from groundwater aquifers, regardless of its renewability and spatial or temporal variation.

Blue Water could be either renewable or non-renewable. The only form of Non-renewable Blue Water Resources is the Non-renewable Groundwater which is available in underground water bearing formations that ceased to receive any significant recharge.

As for Renewable Blue Water Resources, it is divided into Internal Blue Water Resources and External Blue Water Resources. The Internal Renewable Blue Water Resources are formulated as a direct result of the natural hydrological processes occurring in a given country, which transforms the local precipitation into surface runoff or as a recharge to groundwater. Figure (4) shows the Internal Renewable Blue surface and groundwater, while it is clear that while Iraq has the largest Internal Renewable Blue Water Resources, some countries such as Kuwait and Bahrain have very limited Renewable Blue Water within their borders, and apparently, depend almost entirely on External Water Resources and Non-conventional Water. The majority of Arab countries have negligible Internal Water Resources. The Total Internal Renewable Blue Water Resources that include groundwater in addition to surface water are shown in Figure (5). The values of Internal Renewable Blue Water Resources shown in Figures (4) and (5) include the overlap between surface and ground water resources which is most evident in the case of Egypt. The Total Internal Ground Water Resources that is generated as a recharge from precipitation amounts to 1.3 BCM, whereas 8.5 BCM are recharged annually by means of seepage from the Nile River which results in a total of 9.8 BCM. The additional 8.5 BCM are already considered among the External Renewable Water Resources.

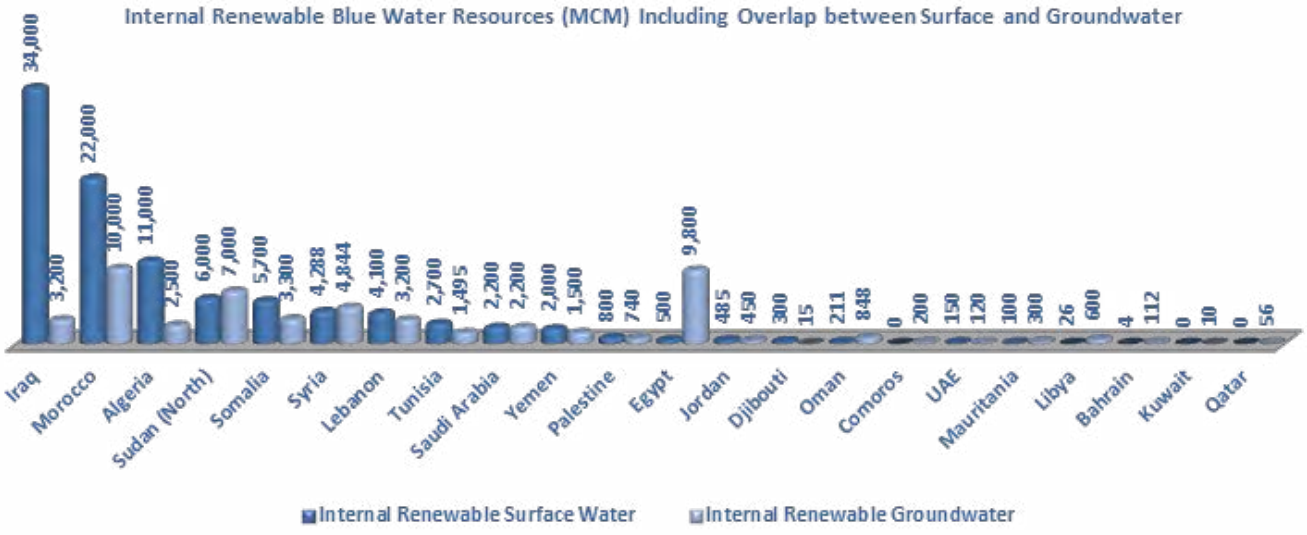

Figure 4. Internal Renewable Blue Surface & Groundwater (FAO 2009, CEDARE & AWC 2004)

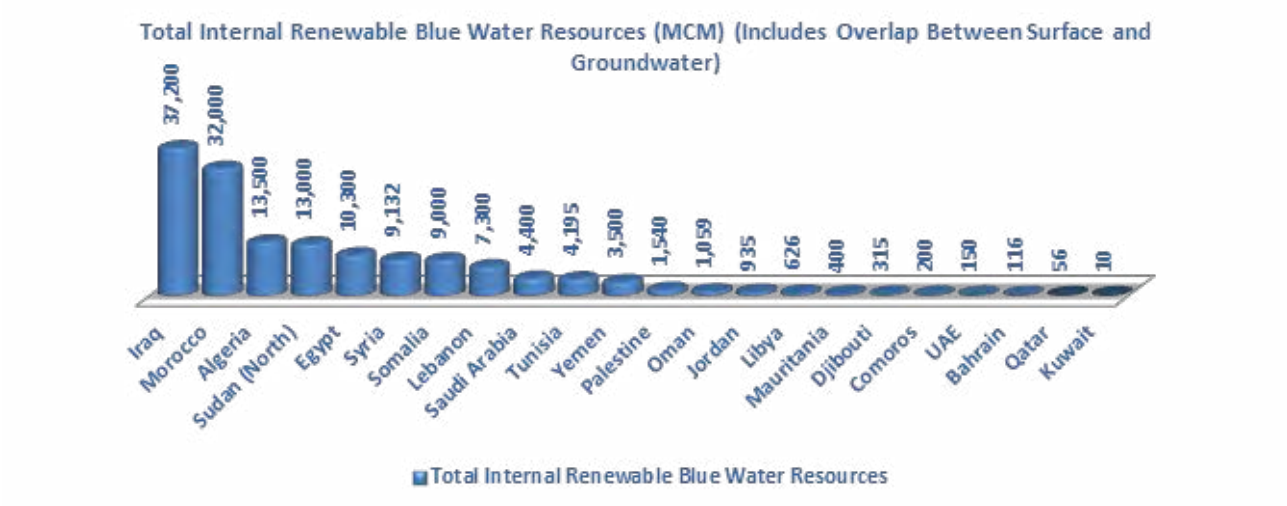

Figure 5. Total Internal Renewable Blue Water Resources (FAO 2009 and CEDARE & AWC 2004)

The External Renewable Blue Surface Water is also divided into Surface and Ground Water. The transboundary movement of surface and groundwater is expressed by an inflow as well as an outflow. Figures (6) and (7) show the annual average inflow and outflow of blue surface water, respectively, while figures (8) and (9) show the annual average Transboundary Groundwater Inflow and Outflow, respectively. Figure (10) shows the Total External Renewable Blue Water Resources which corresponds to the total inflows of Transboundary Surface and Ground Water into the borders of the different Arab countries for which data were available.

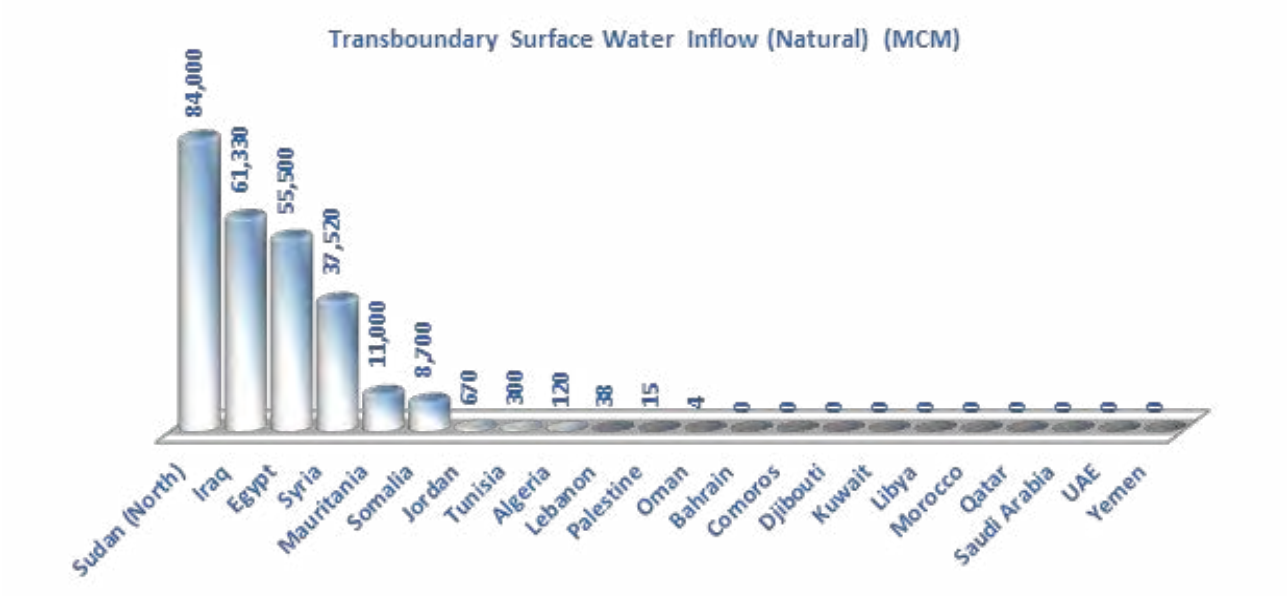

Figure 6. Transboundary Surface Water Inflow (FAO, CEDARE, and AWC)

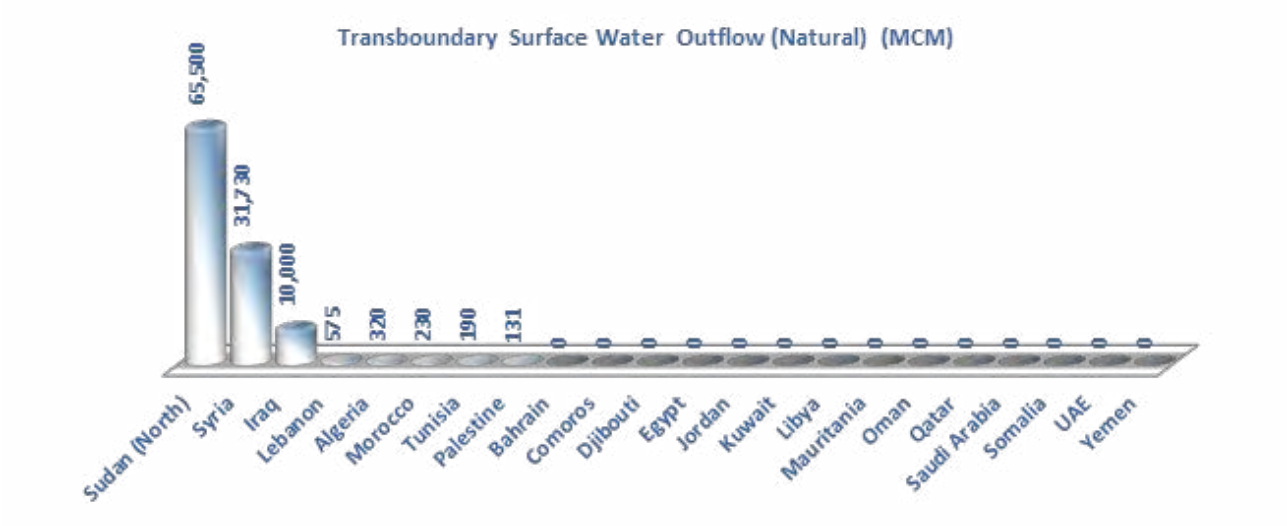

Figure 7. Transboundary Surface Water Outflow (FAO, CEDARE, and AWC)

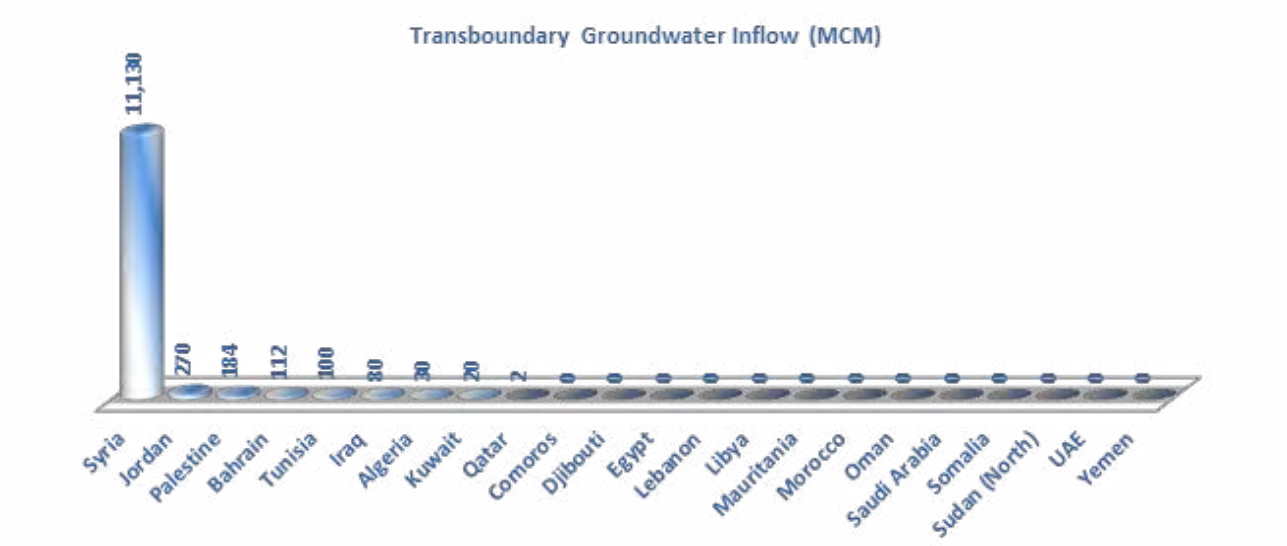

Figure 8. Transboundary Groundwater Inflow (FAO, CEDARE, and AWC)

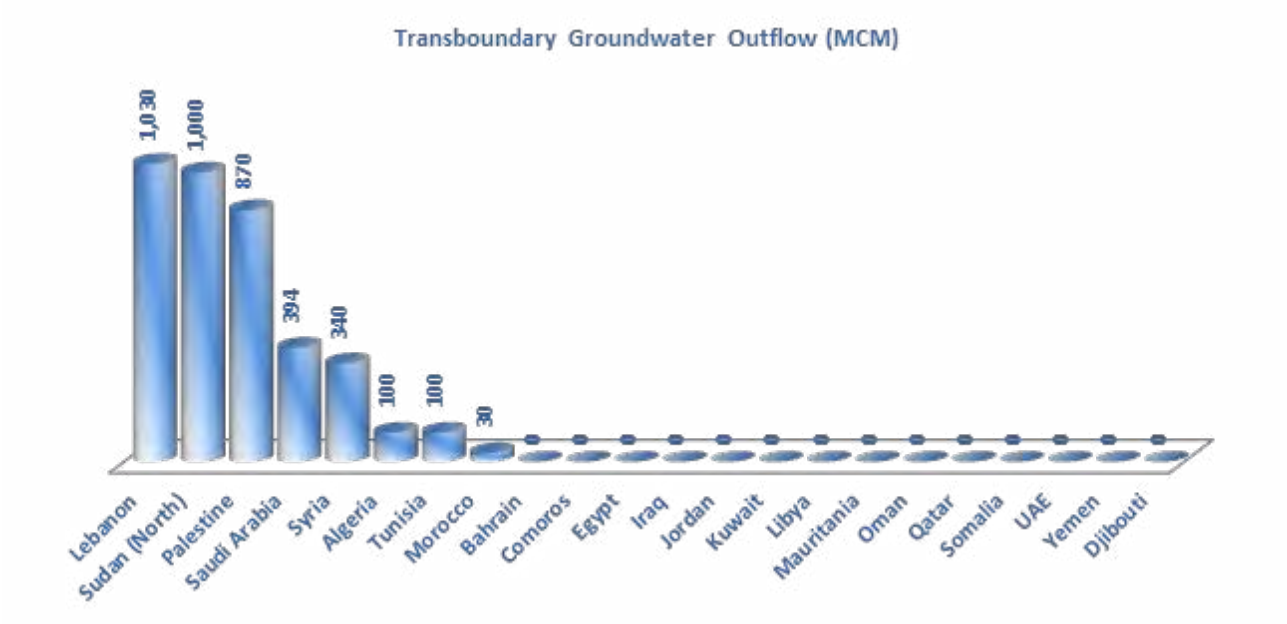

Figure 9. Transboundary Groundwater Outflow (FAO, CEDARE, and AWC)

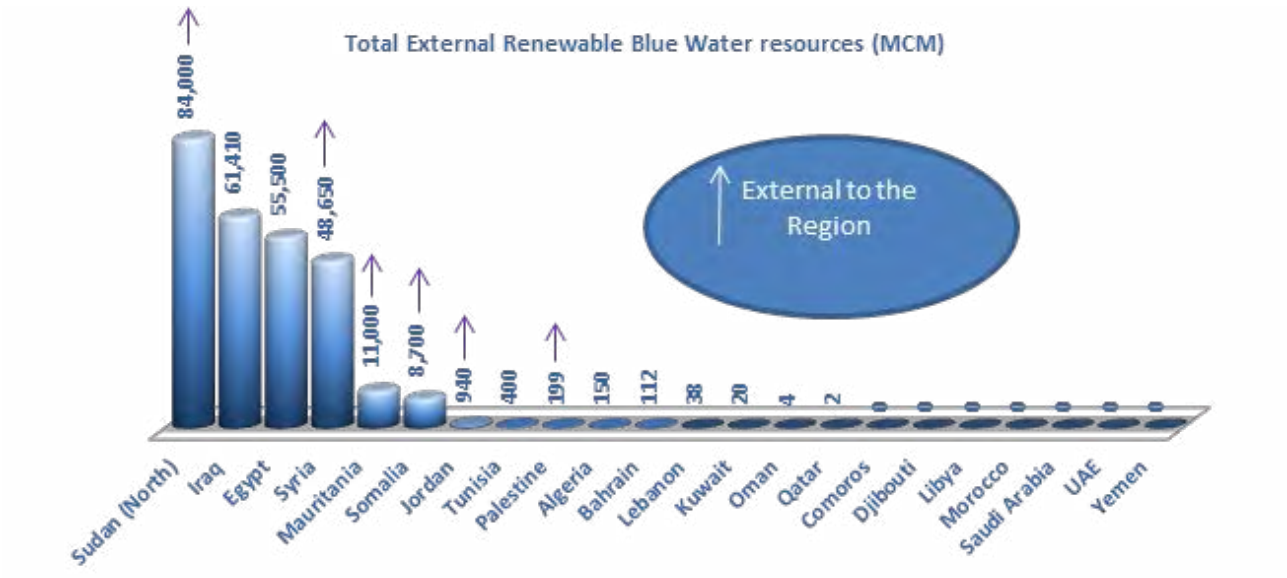

Figure 10. Total External Renewable Blue Water Resources (FAO, CEDARE, and AWC)

Figure (11) shows the Total Renewable Blue Water Resources presented as Total Renewable Surface Water and Total Renewable Groundwater. Figure (11) takes into consideration the net external blue surface and ground water resources by subtracting the outflows in Figures(7 & 9)from the inflows in Figures (6 & 8). The Total Renewable Blue Water Resources which is shown later in Figure (24b)could be expressed as the sum of the Total Renewable Blue Surface Water and the Total Renewable Blue Groundwater shown in Figure (11) excluding the overlap between them shown in Figure (12a).

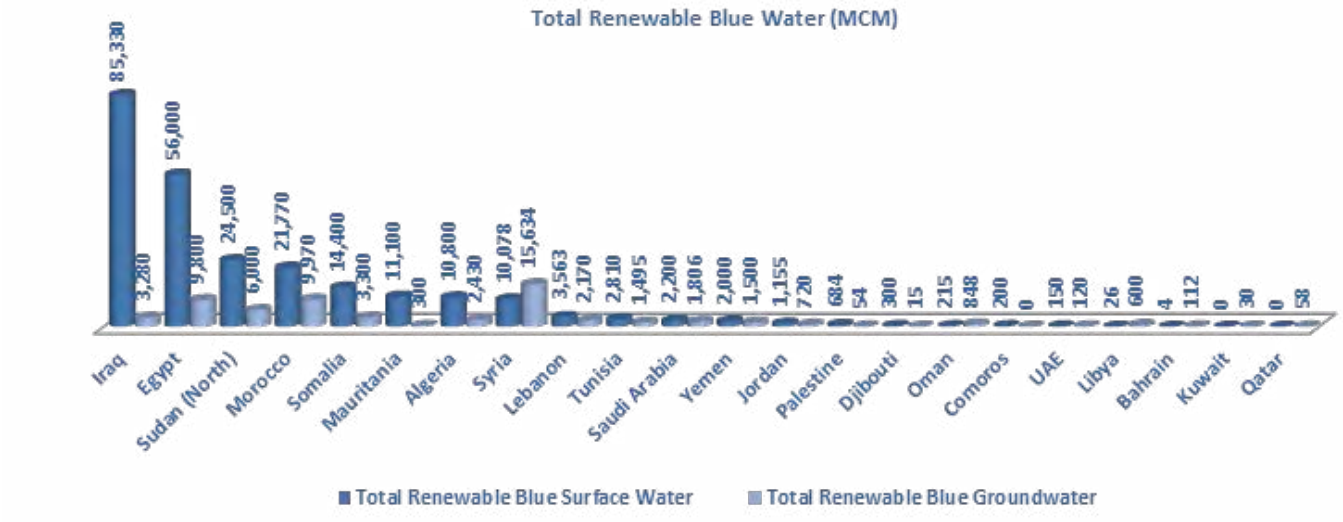

Figure 11. Total Renewable Blue Surface & Ground Water Resources (FAO, CEDARE, and AWC)

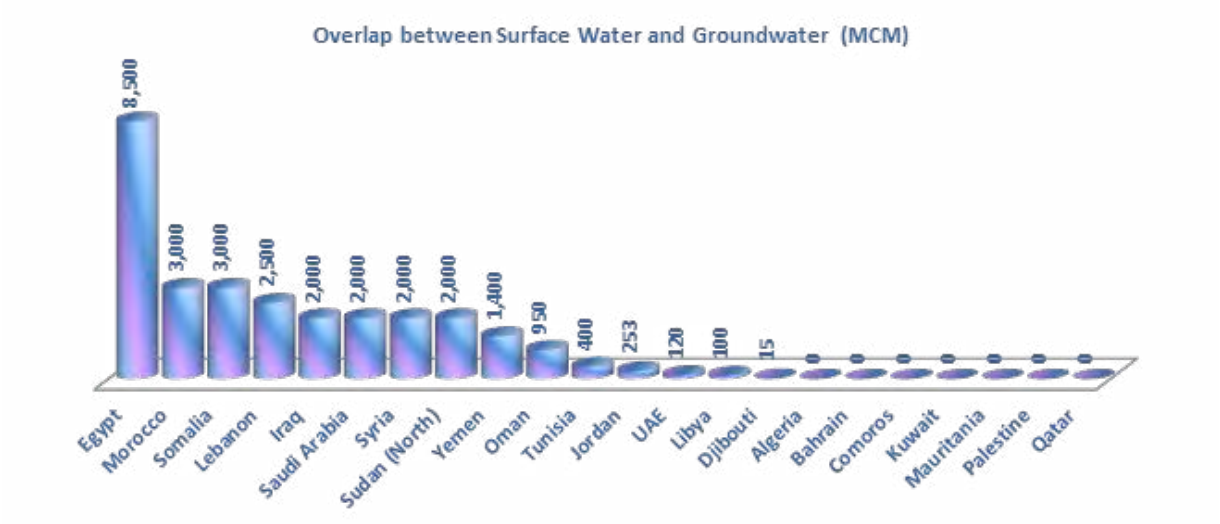

Figure 12a. Overlap between Blue Surface and Groundwater (FAO, CEDARE, and AWC)

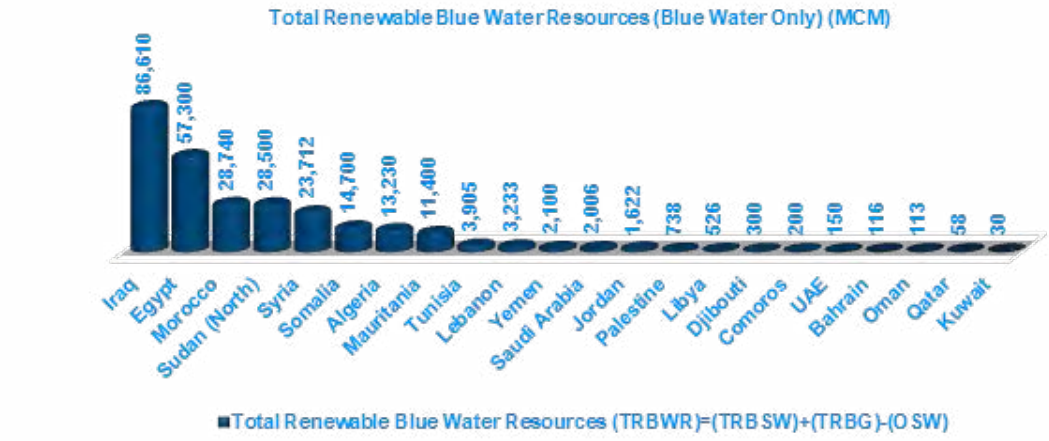

Figure 12.b Total Renewable Blue Water Resources in the Arab Region

Non-Renewable Groundwater is a vital source of water in many Arab Countries. Sustainable use of a source that will surely be depleted has always been a big dilemma which is beyond the purpose of this report. However, for reporting purposes, another dilemma exists, contrary to renewable water resources; there is a huge difficulty in expressing Non-renewable Water Resources as annual volumes. The approach adopted in this report honors the utilization period that countries have planned for different non-renewable groundwater aquifers. These planned annual exploitation of non-renewable groundwater has to be associated with a lifetime and an expected drawdown in groundwater levels. Figure (13) shows the Non-renewable Groundwater Resources available for utilization on annual basis by selected Arab countries.

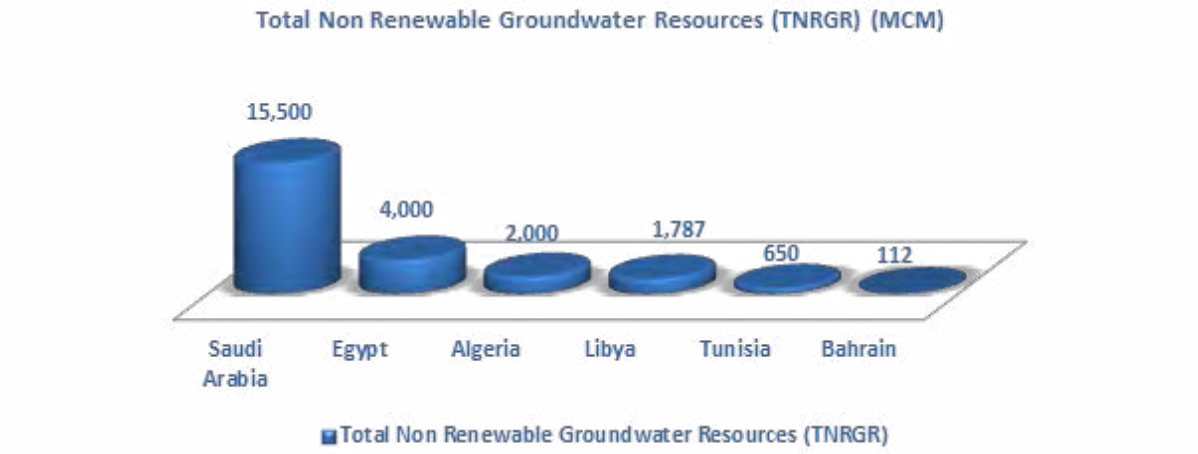

Figure 13. Total Non-Renewable Groundwater Resources (CEDARE & AWC)

Green Water

Green Water is the portion of beneficial abstractions of Renewable Water Resources from green cover which comes from atmospheric water directly and is consumed by rain-fed agriculture, natural pasture, and forests (AbuZeid, K., 2008). It has been shown that sustainable, water-dependent, socio-economic development will simply not be possible without taking an integrated perspective on all water-dependent and water impacting activities in a river basin and their relative upstream/downstream relations (Falkenmark, 1999).

Green Water is the main key factor in any basin-wide water resources assessment approach, therefore its precise assessment is a necessity in any water resources assessment, monitoring, and evaluation.

The Total Renewable Green Water Resources typically consist of rain-fed agriculture abstractions, natural pasture abstractions, and forest abstractions which are shown for all Arab countries in figures (14), (15), and (16), respectively. Assessment method is elaborated in Annex B, Table B-1.

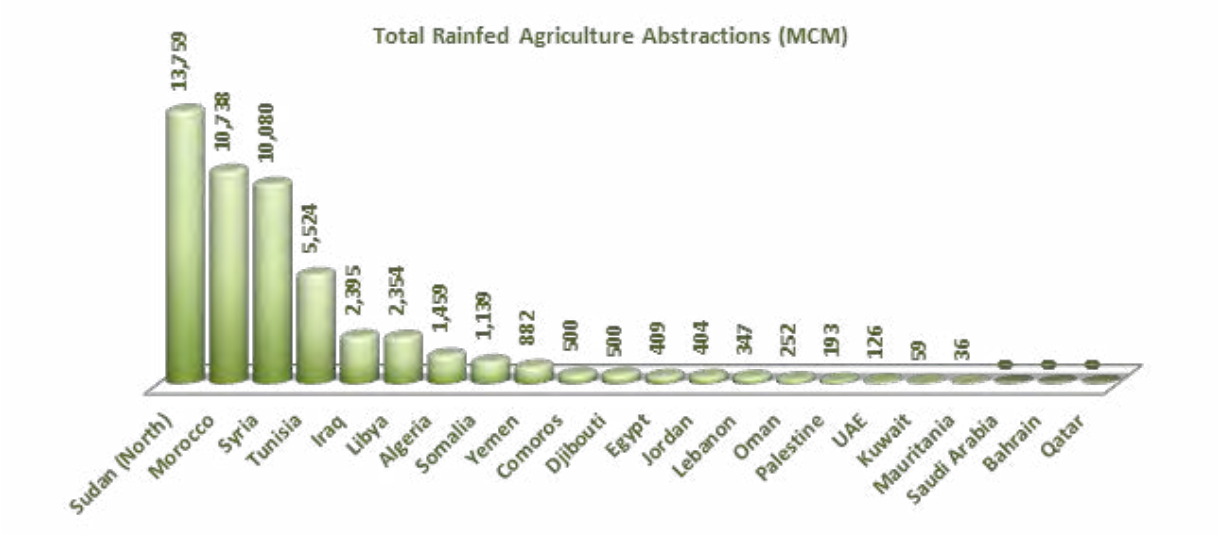

Figure 14. Total Rainfed Agriculture Abstractions (CEDARE and AWC, 2012)

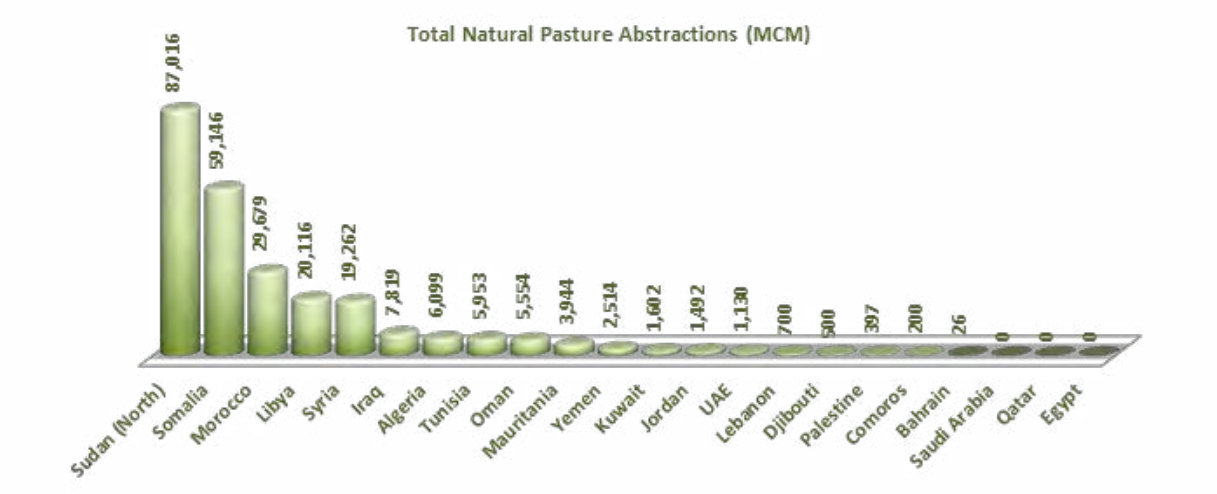

Figure 15. Total Natural Pasture Abstractions (CEDARE and AWC, 2012)

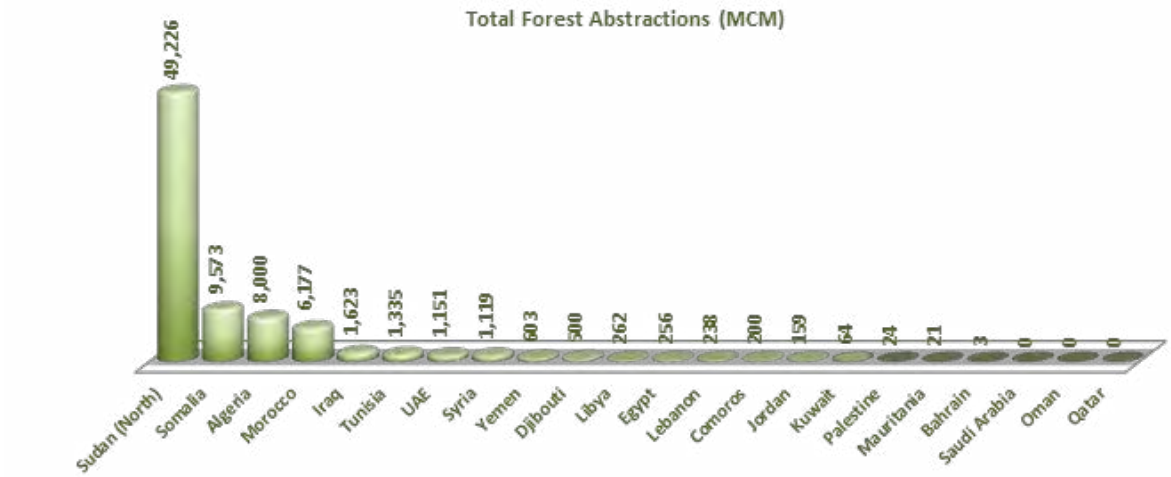

Figure 16. Total Forest Abstractions (CEDARE and AWC, 2012)

The Total Annual Renewable Water Resources takes into account the Total Renewable Green Water Resources shown in figure (17a) which is the summation of figures (14) through (16) and the Total Annual Renewable Blue Water Resources. Figure (17b) shows the Total Renewable Water Resources in all Arab Countries, while figure (18) points out the significance of the most precise approach for estimating the Total Annual Renewable Water Resources by comparing it with the traditionally used approaches which only consider Blue Water.

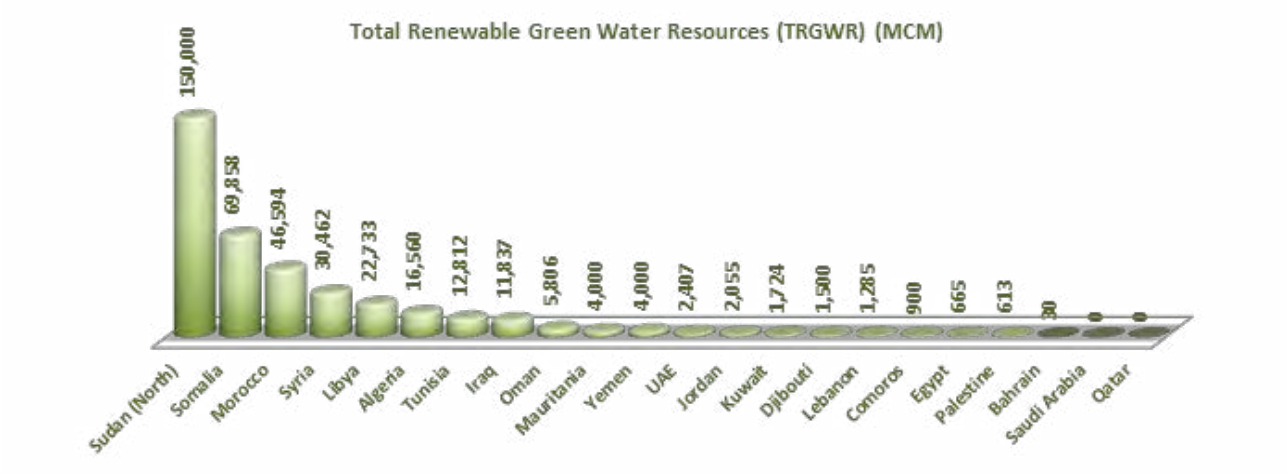

Figure 17a. Total Renewable Green Water Resources (CEDARE and AWC, 2012)

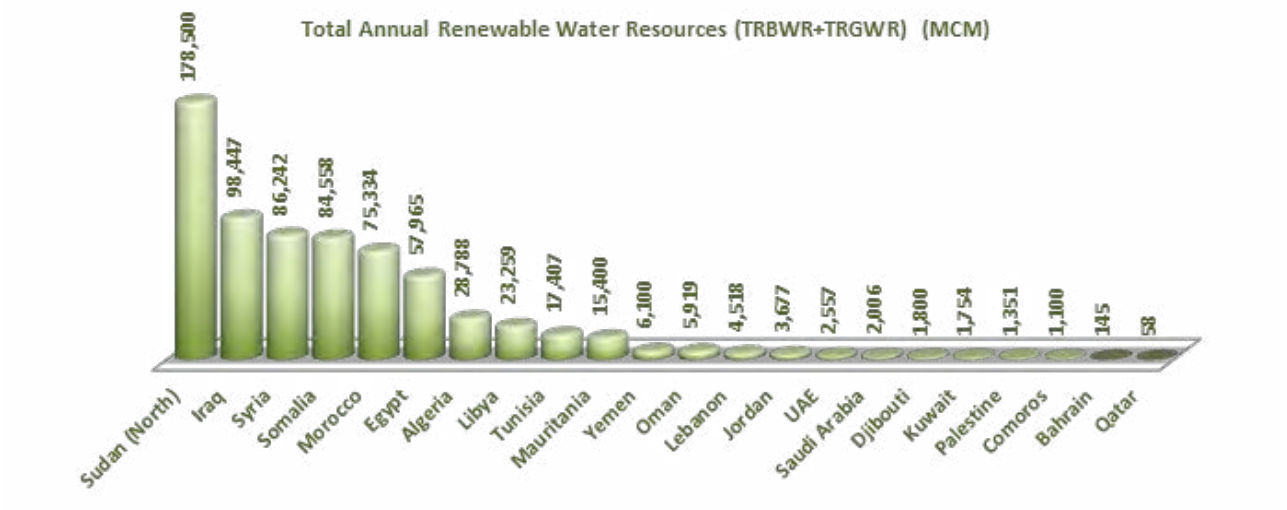

Figure 17b. Total Annual Renewable Water Resources (CEDARE and AWC)

Looking at the Arab Region holistically, the Total Annual Green Water Resources are divided as shown in Figure (18) where the majority (253 BCM) is consumed by pasture land. Whereas, Figure (19a) shows that Green Water Constitutes 49% of the total water resources of the Arab region which amounts to 385 BCM, with the remaining 51% divided between Internal Renewable Blue Water (16%) and External Renewable Blue Water (35%). The latter distribution considers the sum of all Renewable Blue Water Resources that flows from outside each Arab Country, which includes the inter-Arab flows as in the cases of Sudan and Egypt as well as Iraq and Syria. Figure (19b) which is a better representation of the Region as a whole, shows the same indicators shown in Figure (19a) with the

consideration of the Total External Blue Water Resources that flows from outside the whole Arab Region which will be the basis of total Blue Water calculation from this point onwards. It shows that Green Water represents 59% of all Renewable Water Resources while Blue Water is divided between Internal and External Blue Water resources in the ratio of 18% and 23%, respectively. Figure (20) shows that the Total Renewable Water Resources in the Arab Region is distributed as 59% Green Water (385 BCM) and 41% Blue Water (274 BCM). Figure (21a) shows that the Annual exploitable Non-Renewable Ground Water accounts for 4% of all Conventional Water resources in the Region. Figure (21b) shows that this Non-renewable Blue Ground Water accounts for 8% of Blue Water Resources, while Renewable Blue Water Resources account for 92%. 121 BCM (44%) of the Total Renewable Blue Water Resources is generated inside the countries' borders, and 153 BCM (56%) is generated outside the countries borders' as depicted in Figure (22). Figure (23) looks deeper into the Total Internal Renewable Water Resources as a percentage of precipitation and the evaporation associated with such precipitation. It is clear that 63% of precipitation volumes are evaporated, while 28% are used beneficially by rainfed agriculture, pasture areas, and forests. Only 9% of precipitation volumes are transformed to Blue Water, 6% of which are Blue Surface Water and 3% are Blue Ground Water.

Figure (24) shows the Total Renewable Water Resources and the Total Renewable Blue Water Resources in all Arab Countries. The Difference between the two values is due to the consideration of Green water. This Report recommends a change in the definition of the traditionally used term "Total Renewable Water Resources" to include Renewable Green Water as it has been used in this report.

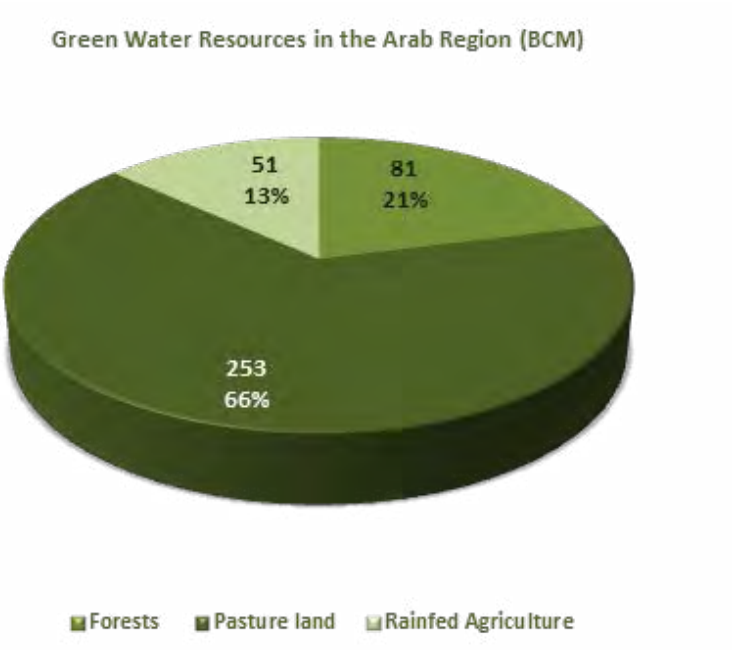

Figure 18. Green Water Distribution in the Arab Region

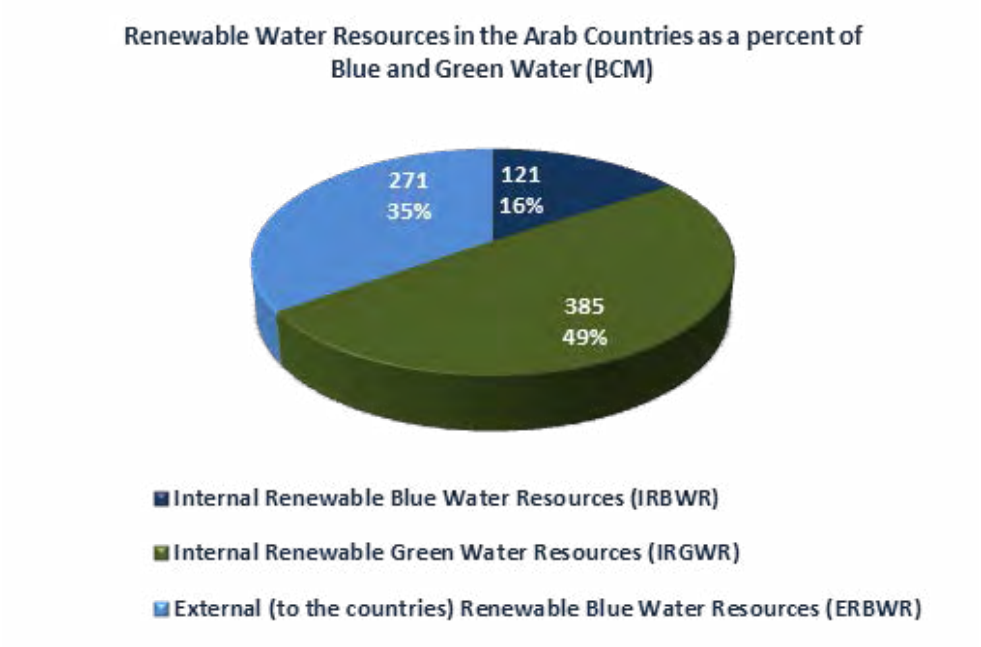

Figure 19a. Total Water Resources Distribution in the Arab Countries

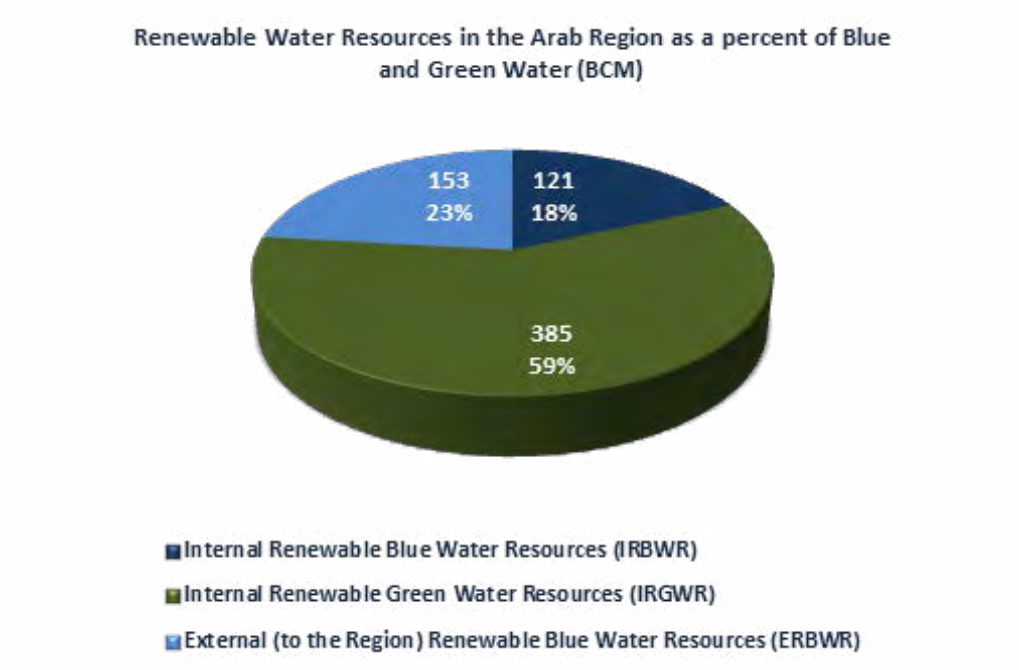

Figure 19b. Water Resources Distribution in the whole Arab Region

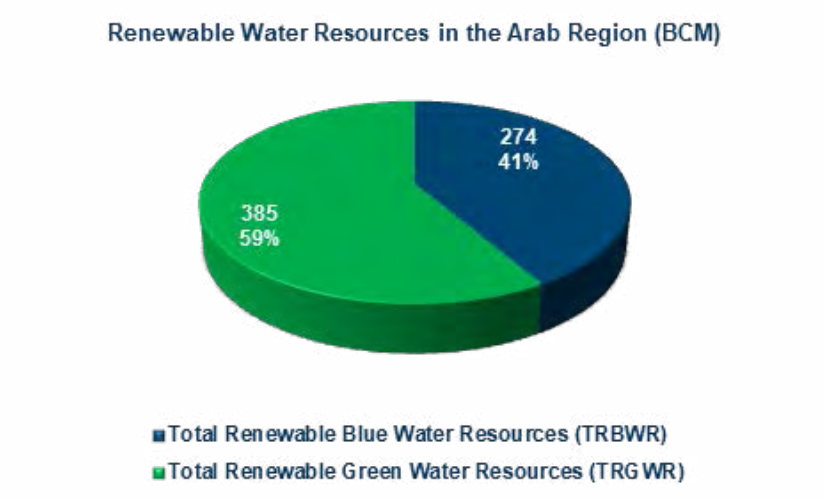

Figure 20. Blue and Green Water Resources Distribution in the Arab Region

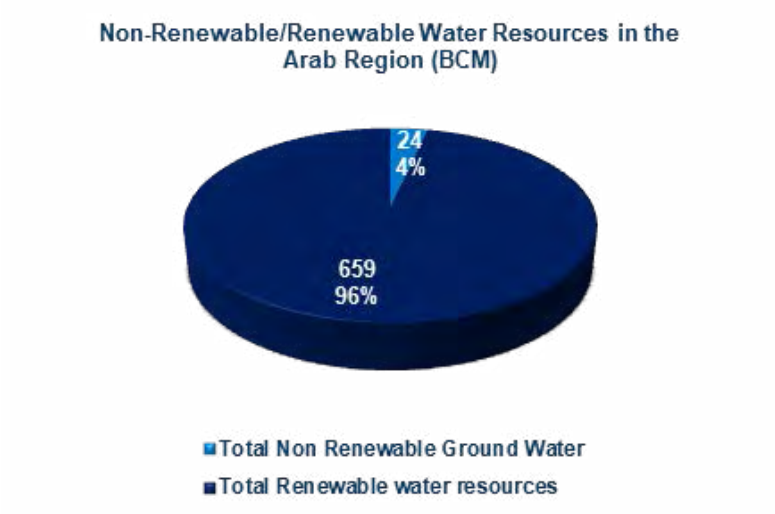

Figure 21a. Renewable and Non-Renewable Water Resources Distribution in the Arab Region

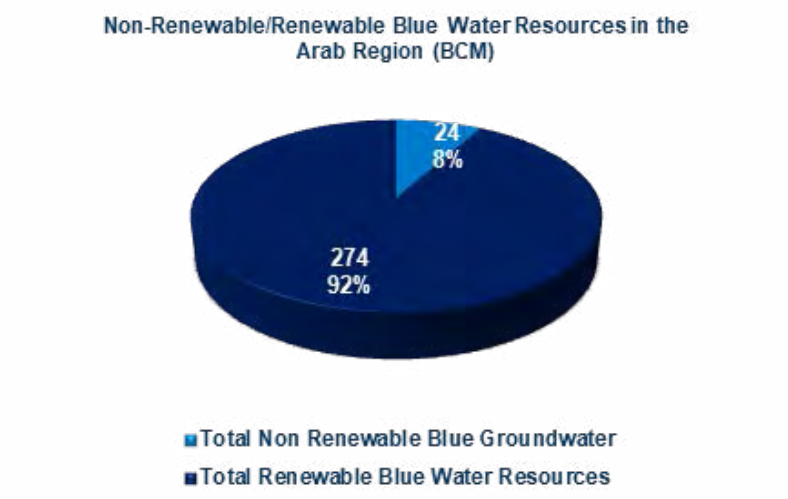

Figure 21b. Non-Renewable and Renewable Blue Water Resources in the Arab Region

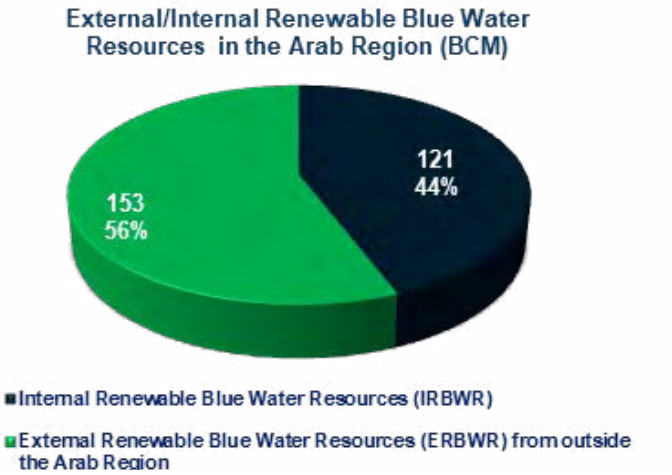

Figure 22. Renewable Blue Water Resources Distribution in the Arab Region

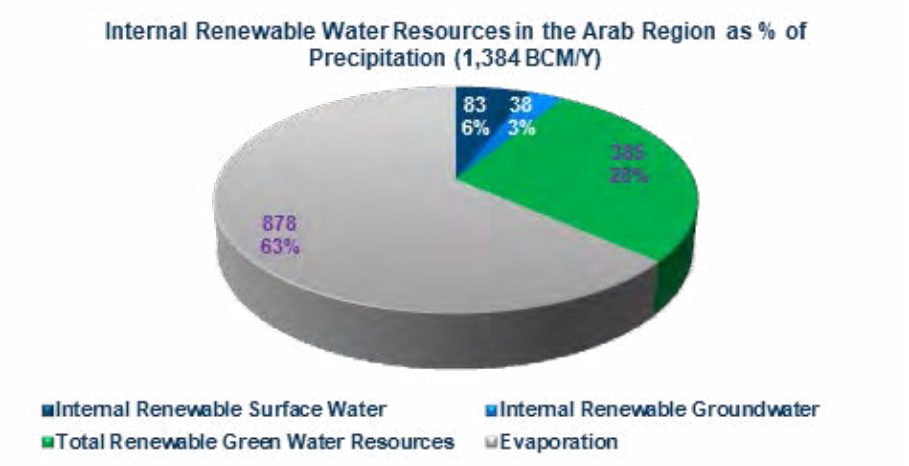

Figure 23. Internal Renewable Water Resources as % of Precipitation in the Arab Region

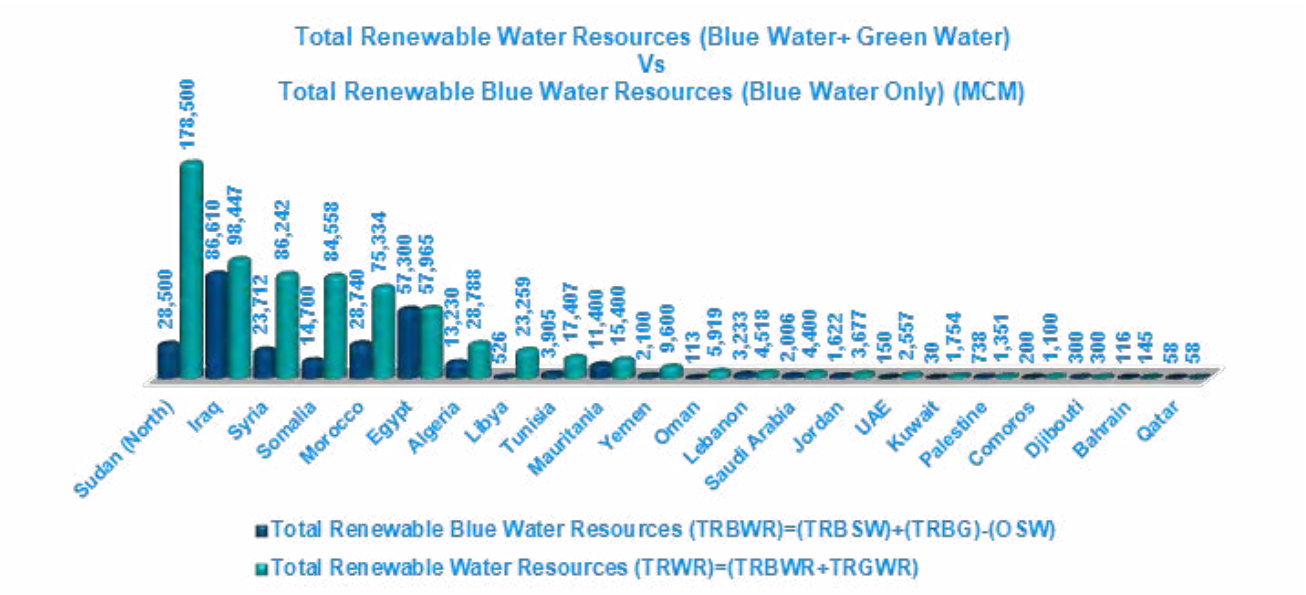

Figure 24. Total Renewable Water Resources & Total Renewable Blue Water Resources in the Arab Region

Non-Conventional Water Resources

Grey Water

Non-Conventional Water Resources account for all volumes of water that are made available for use by different water-use sectors through a treatment process due to the fact that those volumes are not usable in their original from. The most important non-conventional water source is treated wastewater; its importance has been continuously increasing to the extent that it has been labeled, by AbuZeid, K. as the "Renewable Water Resource of the Future". For the purpose of this report, Wastewater as a whole will be referred to as Grey Water. Figure (25) shows the annual amounts of produced and treated wastewater in most Arab Countries; it is clear from the figure that although Egypt is ranked first in wastewater treatment volumes among Arab countries, the current annual treatment is less than half of the produced amount of wastewater. In many Arab countries, there is a good match between the produced and treated wastewater, yet the treated amount is relatively small to contribute significantly to the national water balance. A country like Jordan treats 82 MCM out of 320 MCM of produced Wastewater, which is a low percentage (about 25%) given the current water scarcity situation in the Hashemite Kingdom. It is worth noting that the produced wastewater usually includes industrial wastewater as it is difficult to assess both quantities separately in many Arab countries at the moment. It is also to be noted that the level of treatment may vary and not all the treated amounts of wastewater are treated to the same degree of treatment (primary, secondary, tertiary, or advanced treatment). Of the 23.45 BCM/year of produced wastewater, only 6.34 BCM/year 27.4% is treated.

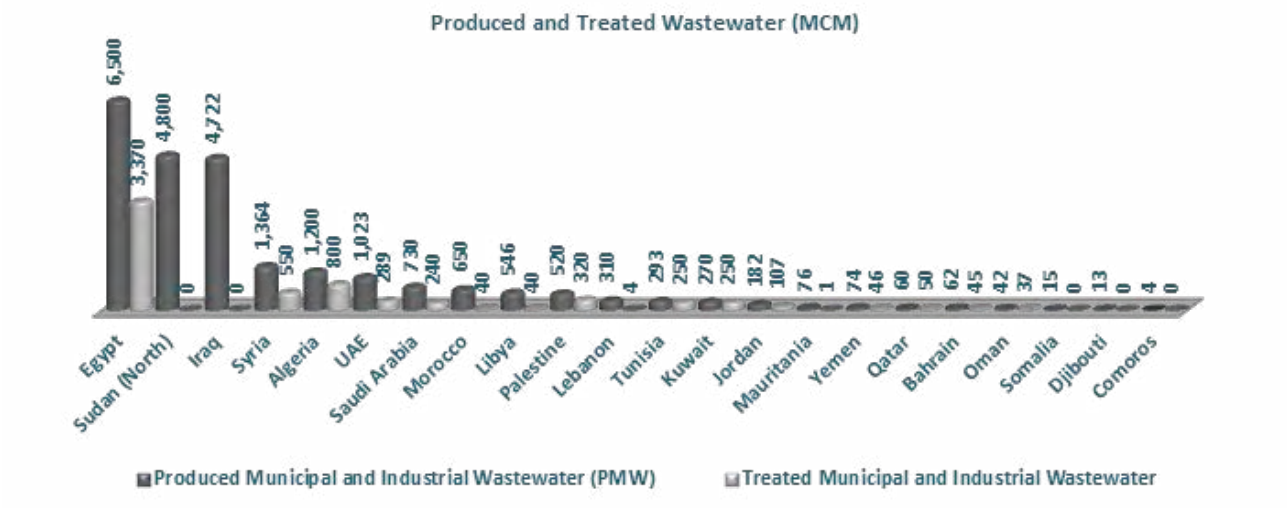

Figure 25. Produced and Treated Wastewater in the Arab Region

Figure (26) shows the actual Reused Treated Municipal and Industrial Wastewater in different Arab countries. It is clear that huge volumes of treated wastewater are being reused in Syria which is ranked first among all Arab countries in terms of volume of Wastewater Reuse. The United Arab Emirates also reuses all its treated wastewater volume which amounts to 290 MCM / Year, while Saudi Arabia reuses 166 MCM of the 240 MCM treated annually.

Although Egypt comes second in volumes of directly reused wastewater in the Arab Region, yet this represents only 10% of the produced wastewater. However, there may be additional untreated wastewater that may be indirectly reused through mixing with freshwater in canals, or agricultural drainage. The total reused amount of wastewater in the Arab Region in 2012 reached about 1.63 BCM/year.

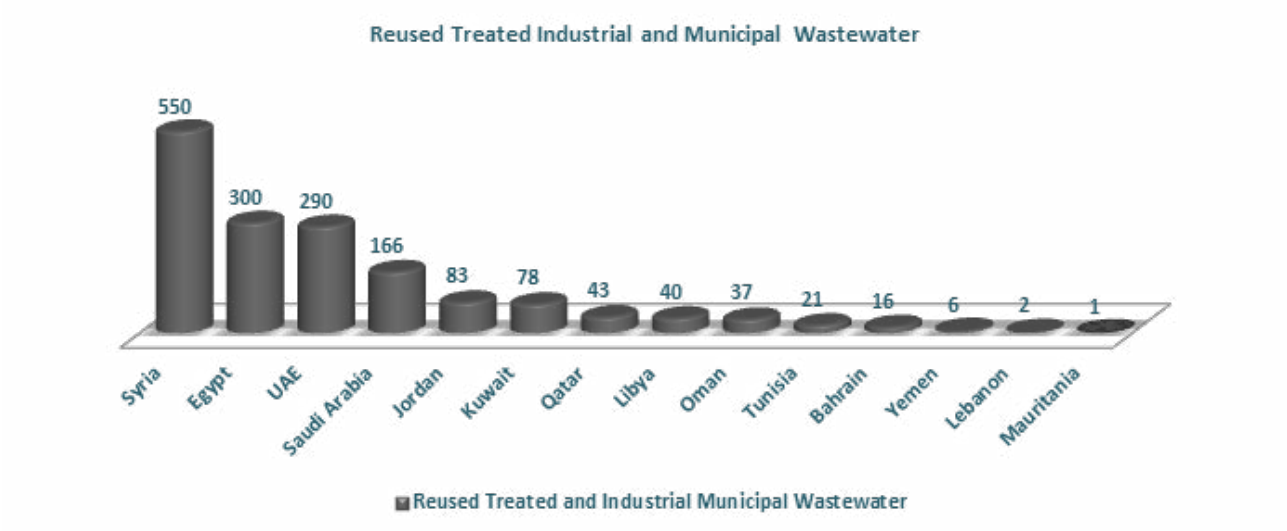

Figure 26. Reused Treated Industrial and Municipal Wastewater

Another important non-conventional resource is the Agricultural Drainage as it is often reused in many Arab Countries; therefore it can be included in the overall Agricultural water balance. The estimates in Figure (27) show that such resource is of extreme importance in Iraq and Egypt and of significant importance in Sudan, Syria and Morocco.

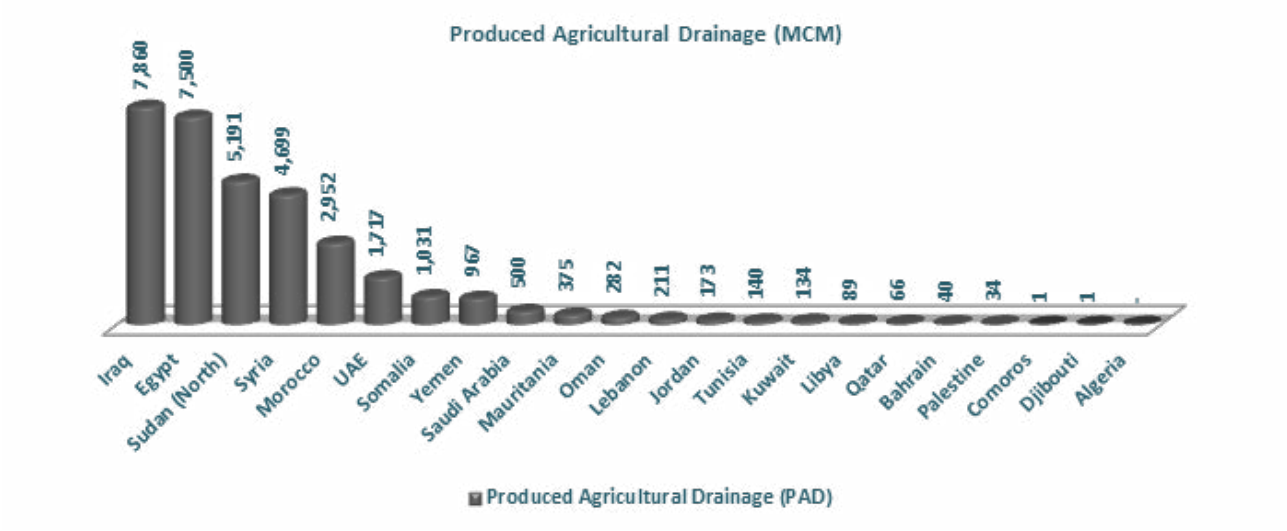

Figure 27. Produced Agricultural Drainage in different Arab Countries

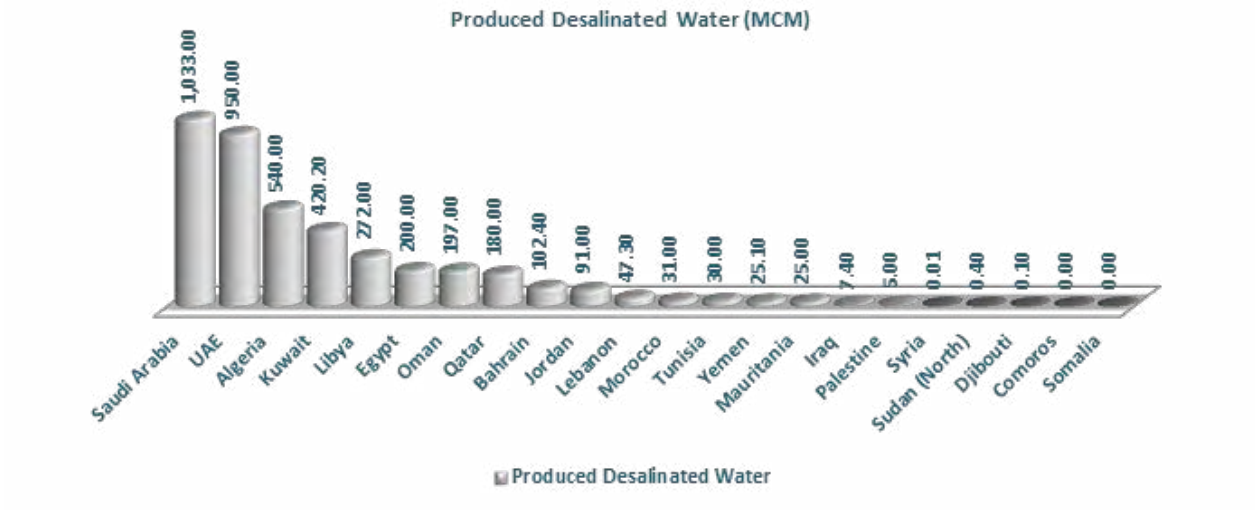

Figure 28. Produced Desalinated Water in different Arab Countries

Silver Water

The most expensive of all Non-conventional Water Resources is Seawater Desalination (also known as Silver Water); however, it is becoming one of the essential water resources in many Arab countries, particularly, Gulf countries as shown in Figure (28). It is interesting to note that other Arab countries in North Africa have started to exceed Gulf countries in their desalinated water volumes per year, with Algeria, and Egypt becoming 3rd and 6th respectively exceeding Kuwait, Oman, Qatar, and Bahrain. Figure (29a) shows the Total Non-Conventional Water Resources for every country in the Arab Region. Seawater Desalination constitutes only 7% of the total non-conventional water resources in the Arab Region amounting to a total of 4.16 BCM as shown in Figure (29b), which also shows that the produced agricultural drainage is the most available non-conventional resource with a total potential of 34 BCM followed by produced municipal and industrial wastewater which amounts to 23.43 BCM. Figure (30) shows that Non-Conventional Water Resources comprise 8% of all Water Resources in the Arab Region.

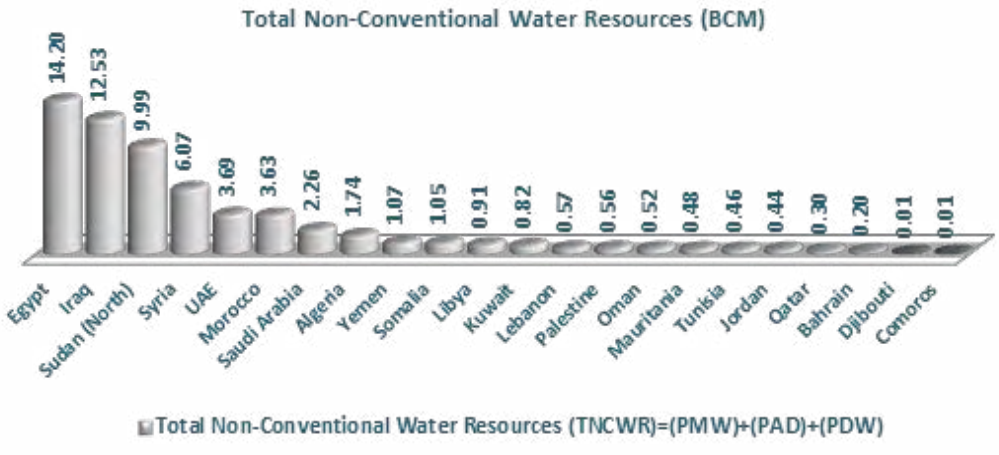

Figure 29a. Total Non-Conventional Water Resources for every country in the Arab Countries

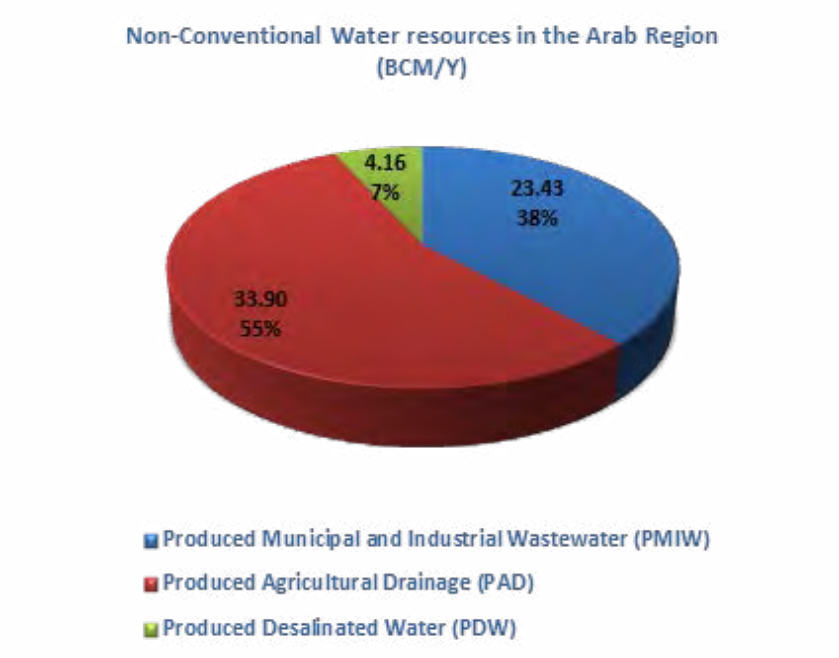

Figure 29b. Non-Conventional Water Resources in the Arab Region

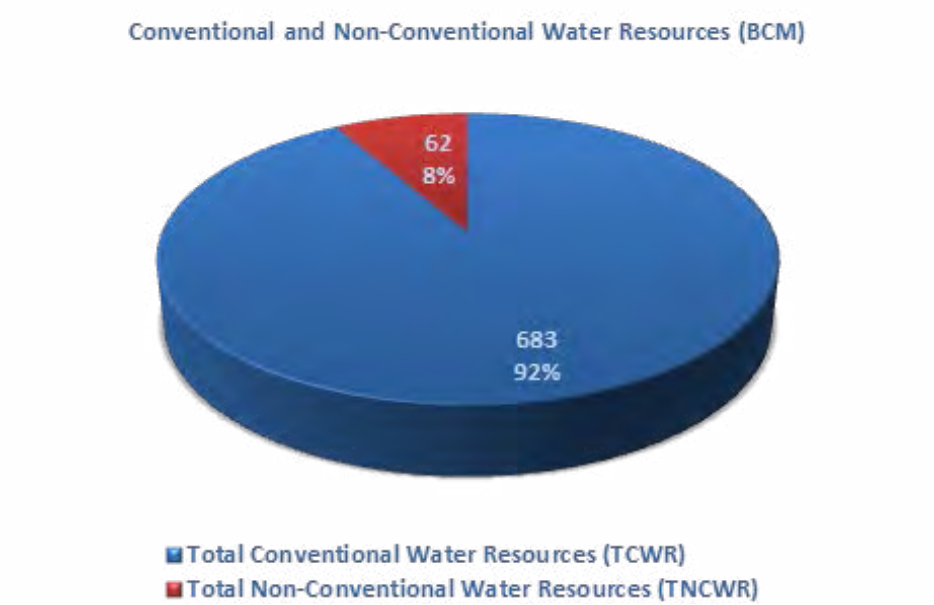

Figure 30. Conventional and Non-Conventional Water Resources in the Arab Region

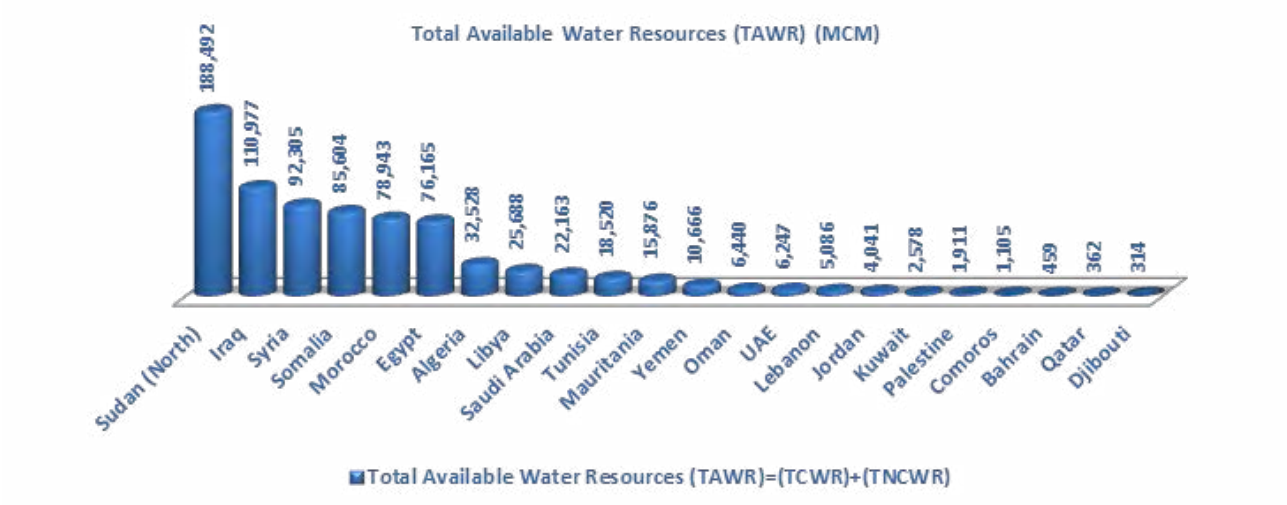

Figure 31a. Total Available Water Resources in the Arab Region

Figure (31a) shows the Total Available Water Resources which consists of the Total Conventional Water Resources (Renewable and Non-Renewable) and the Non-conventional Water Resources. It is clear that the produced Wastewater and Agricultural Drainage in Iraq and Egypt have significantly enhanced the overall available water resources in both countries. Figure (31b) shows the Total Available Water Resources and the Total Renewable Water Resources, as well as the Total Renewable Blue Water Resources community used as indicated in Figure (24).

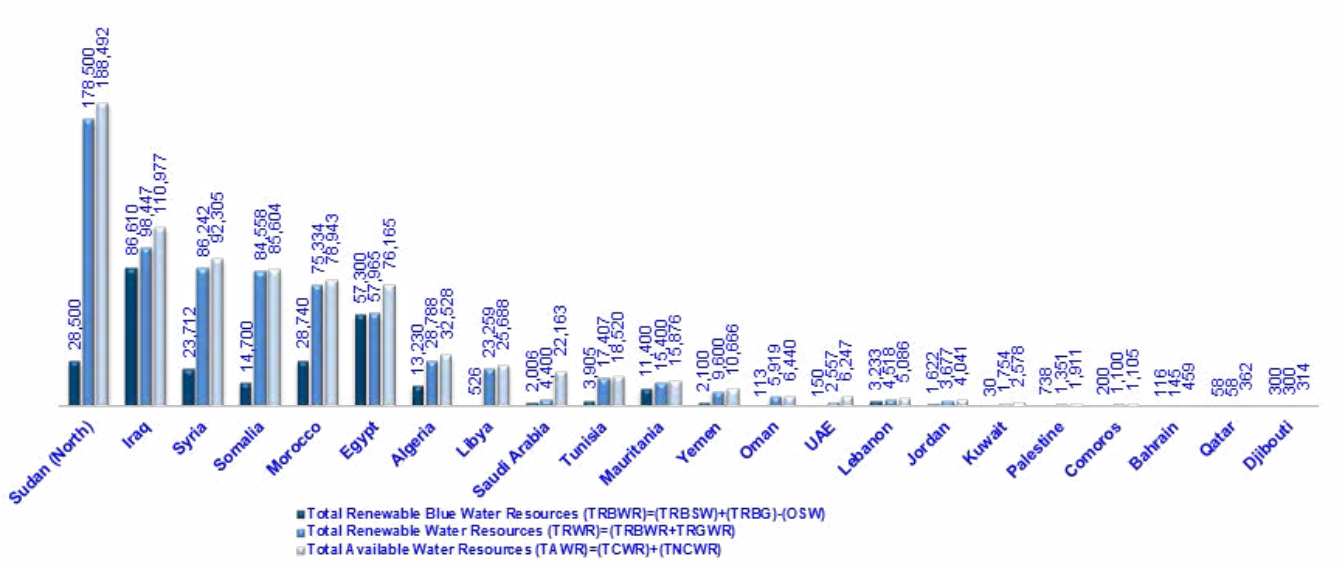

Figure 31b. Available vs. Renewable Water Resources

b. Water Withdrawals & Consumption

Withdrawals and consumption are two different terms that describe water usage by different water-use sectors. While the term "withdrawals" describes the usage from the supplier's point of view, the term "Consumption" describes the actual usage by the consumer, with the difference between the two quantities that numerically represent both terms being the physical and commercial losses as well as the return drainage or wastewater flows. The three major water use sectors are considered here to be the agricultural, industrial, and domestic sectors. Figures (32 a) through (32c) show the different Blue Water withdrawals for the three sectors for the years 2000 and 2012 of for all Arab countries. It is clear from the figures that in almost all Arab countries, the Agricultural sector is by far the biggest consumer, with the exception of Djibouti and Comoros. Both countries reportedly do not withdraw Blue Water for irrigation purposes as the agricultural areas in both countries are rain-fed and rely on Green Water. Figure (32d) presents the total withdrawals for each sector at the regional level. Figure (33) shows the percentages of withdrawals by different sectors in all Arab countries and showcases the change of allocation and consumption patterns in countries such as Djibouti, Iraq, Sudan, Jordan, Morocco and Qatar where significant percentage of the water allocations have been directed towards the domestic and industrial sectors between the period of 2000 and 2012. Figure (34) clearly differentiates between Blue and Green Water Use for different types of Green Cover in the Arab region where it is evident that Egypt and Iraq have the highest dependence on Blue Water for green cover, while Sudan is shown to have the largest Green water consumption.

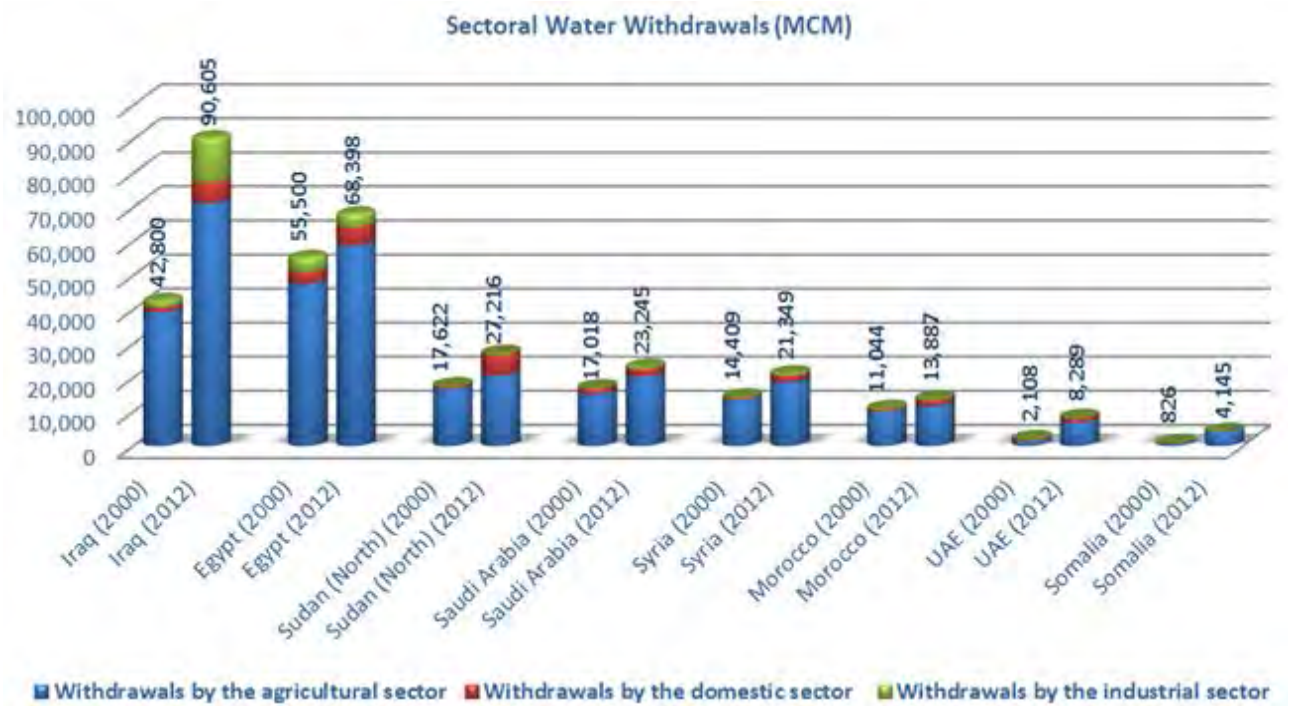

Figure 32a. Water Withdrawals from Blue Water for different sectors in the Arab Region

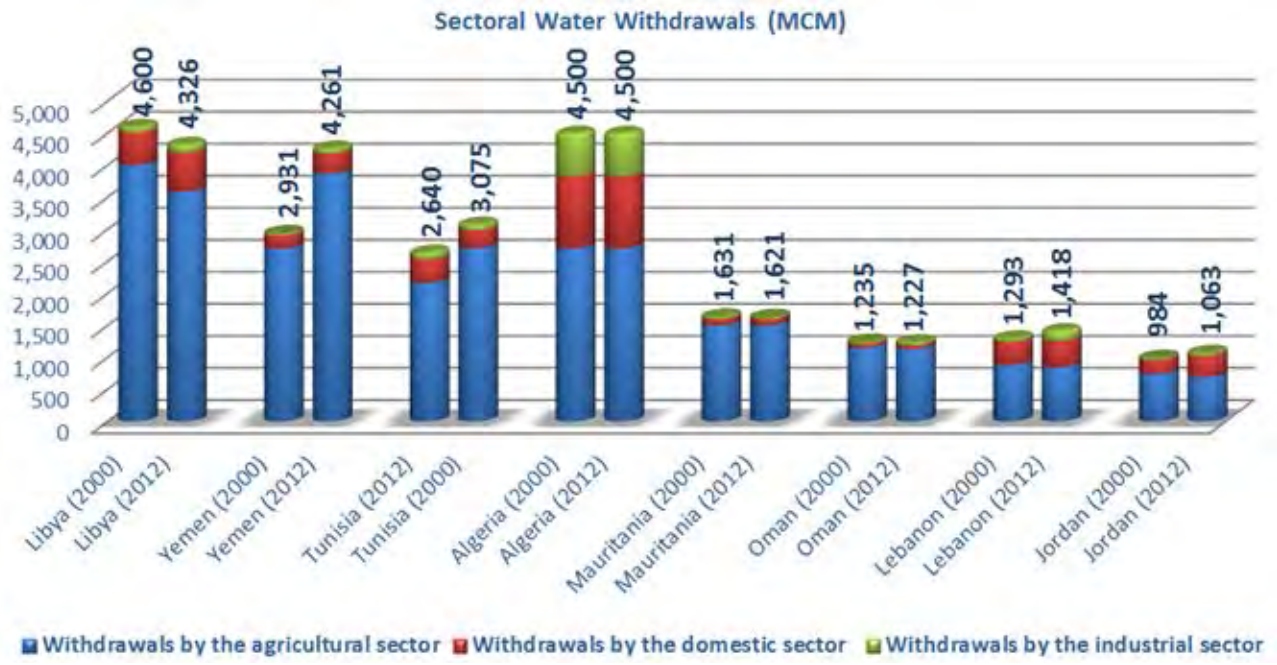

Figure 32b. Water Withdrawals from Blue Water for different sectors in the Arab Region

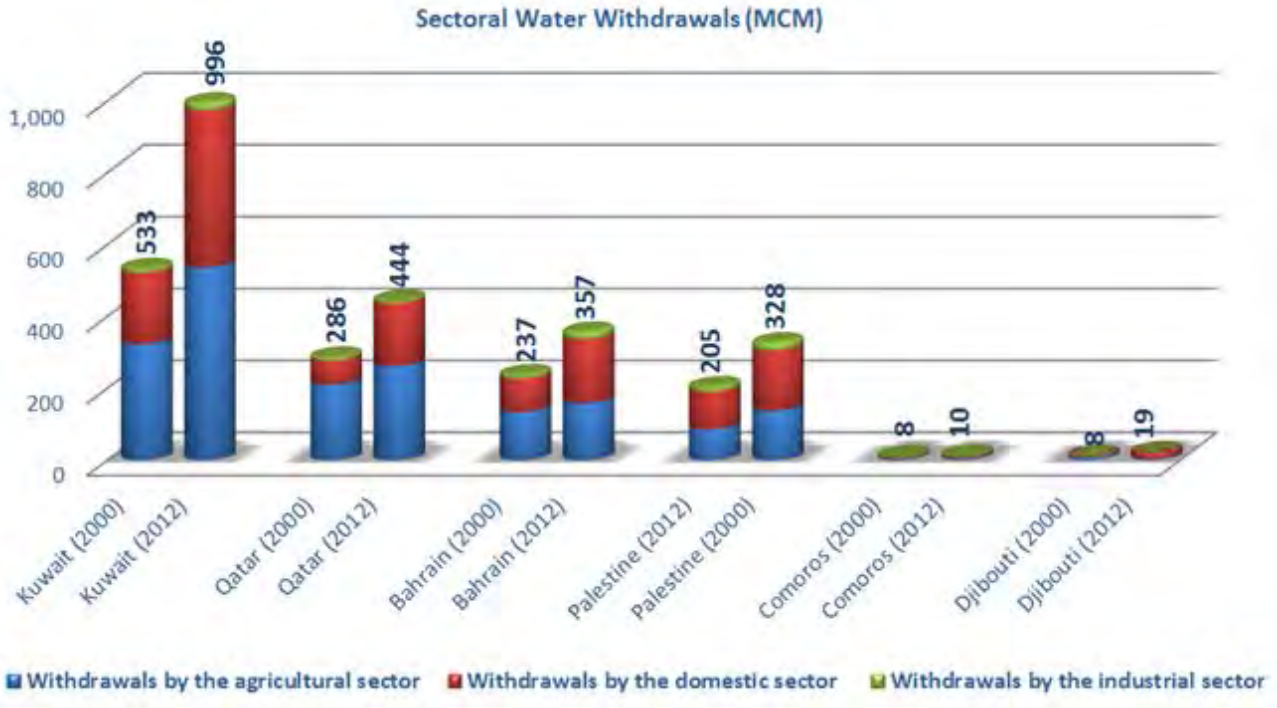

Figure 32c. Water Withdrawals from Blue Water for different sectors in the Arab Region

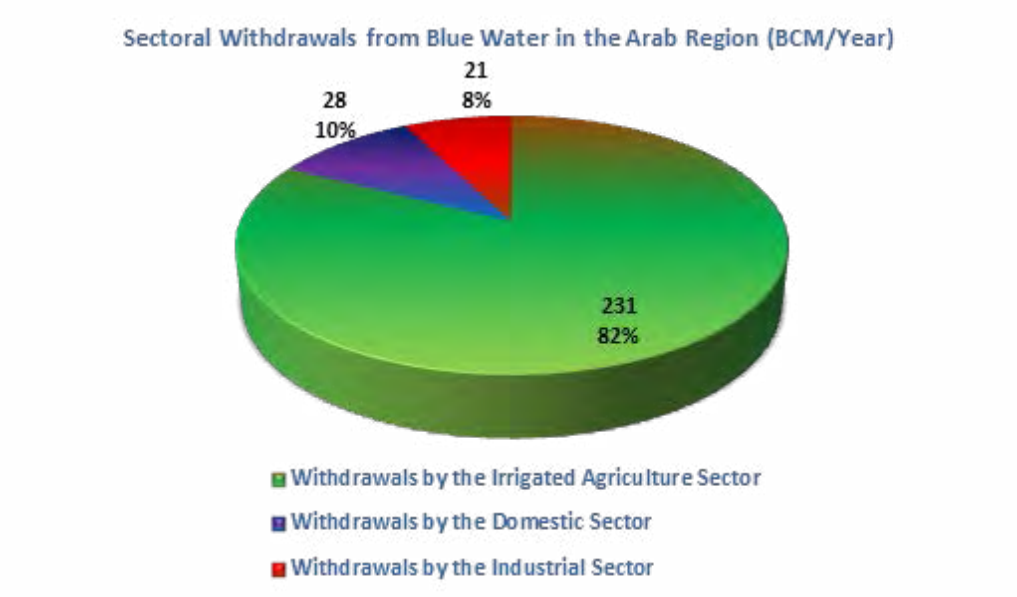

Figure 32d. Sectoral Withdrawals from Blue Water in the Arab Region

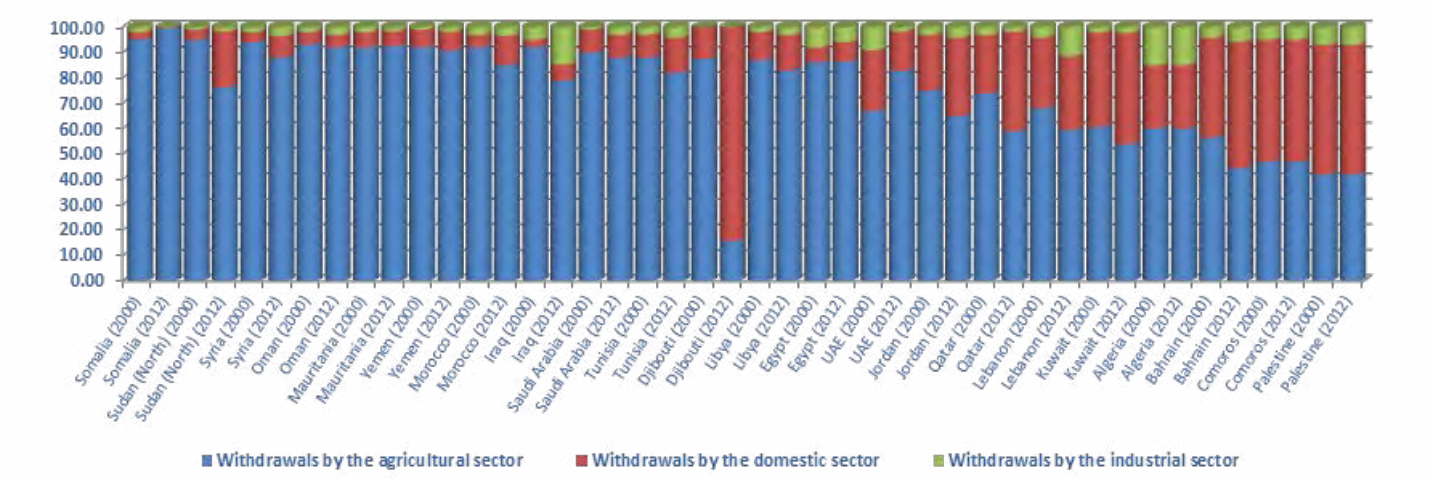

Figure 33. Percentages of Sectoral Withdrawals from Blue Water in the Arab Region

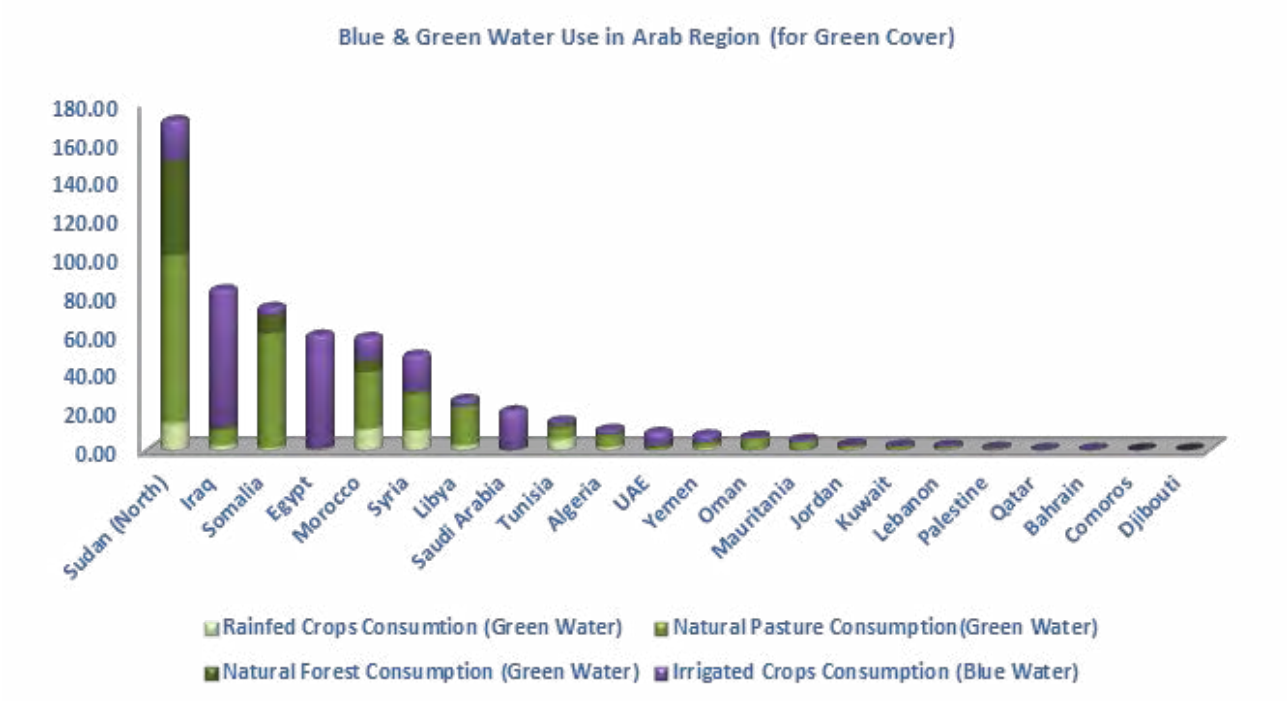

Figure 34. Blue and Green Water Use for Green Cover

It is of great importance to assess the source of withdrawals that each country depends on; Figure (35a) shows the total withdrawals from Blue Surface water for selected Arab countries, while Figure (35b) shows the total withdrawals from Blue Groundwater. On the other hand, Figure (36) shows the withdrawals from Non-conventional Water Resources which include reused treated municipal and industrial wastewater in addition to the used desalinated water.

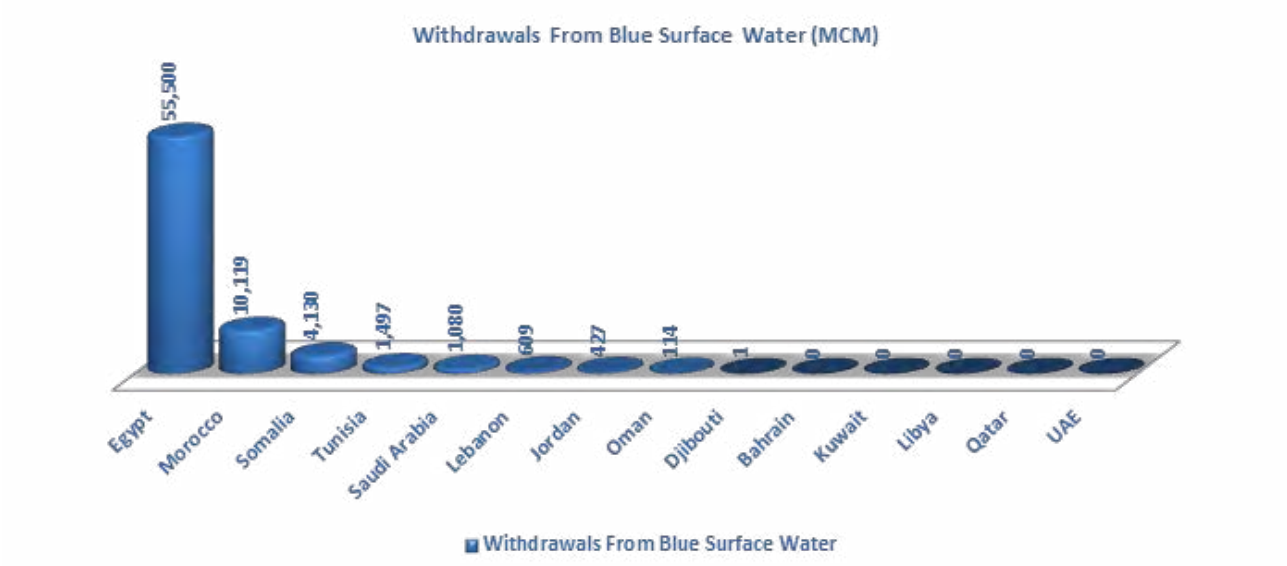

Figure 35a. Sectoral Water Withdrawals from Blue Water in the Arab Region

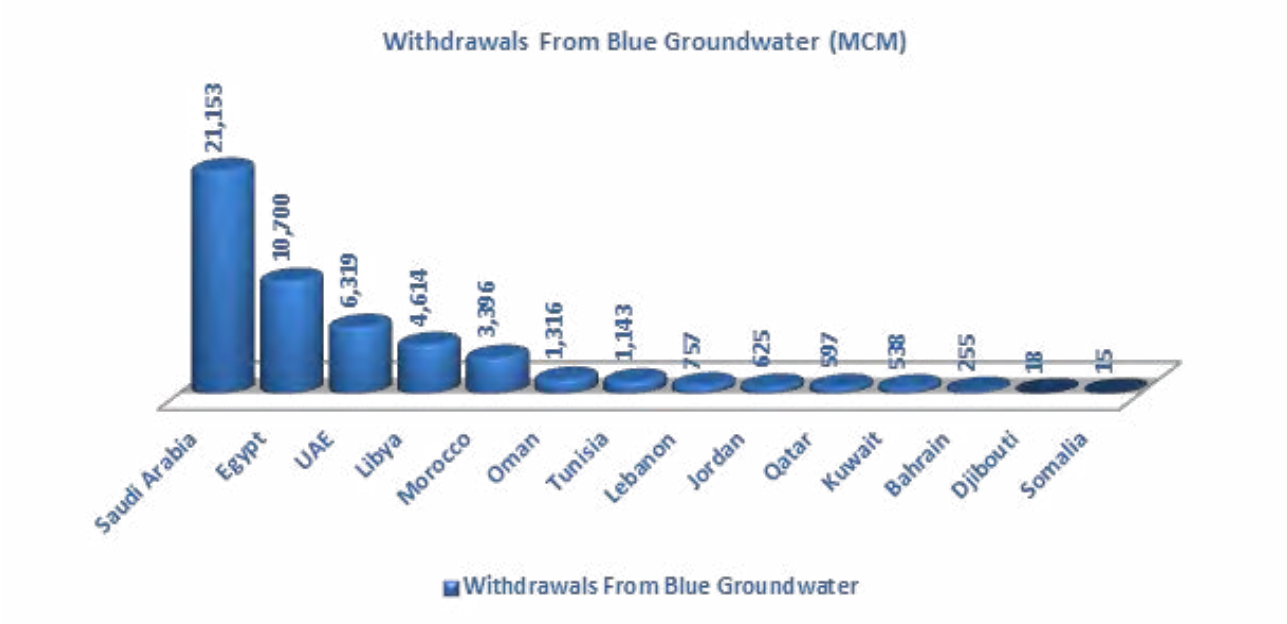

Figure 35b. Sectoral Water Withdrawals from Blue Water in the Arab Region

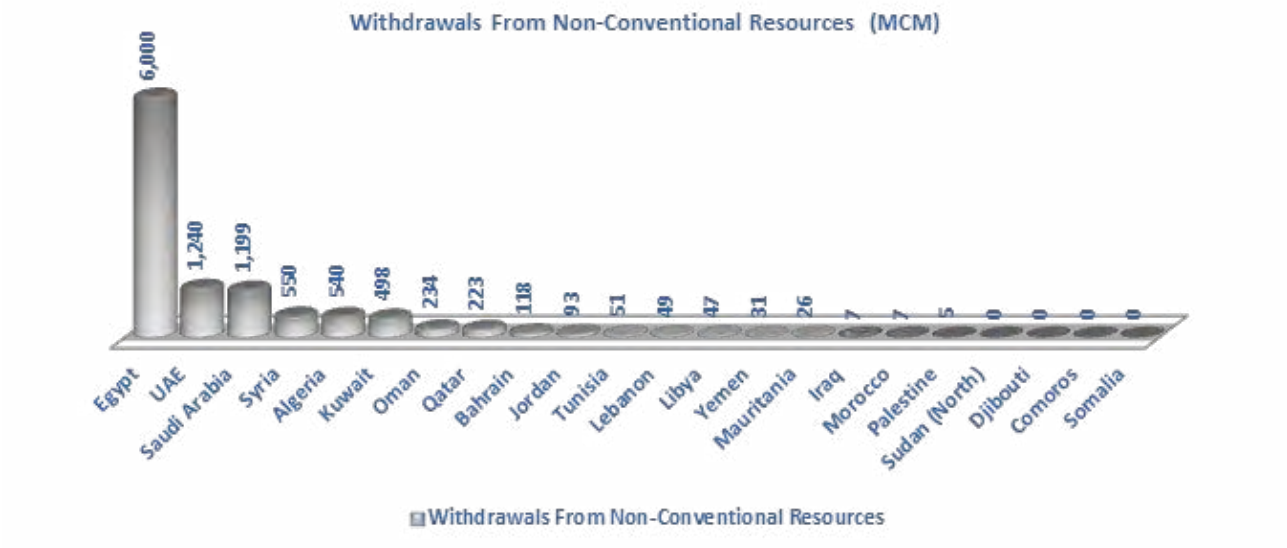

Figure 36. Water Withdrawals from Non-Conventional Water Resources in the Arab Region

When withdrawals and consumption are discussed, the issues of physical conveyance efficiency and on-farm irrigation efficiency become of great importance; however, the overall efficiency is a more wholistic indicator in terms of how a particular country utilizes and reuses all its water from different sources and for different uses efficiently. The Overall Water Use Efficiency is defined as the ratio of the "difference between the total withdrawals from original sources (surface water, renewable and non-renewable groundwater, and Desalinated Water)" and the "wastewater and Drainage flows" to the "Withdrawals from Original Sources" expressed as a percentage. The overall Water Use Efficiency indicator considers recycling water as a factor for improving efficiency.

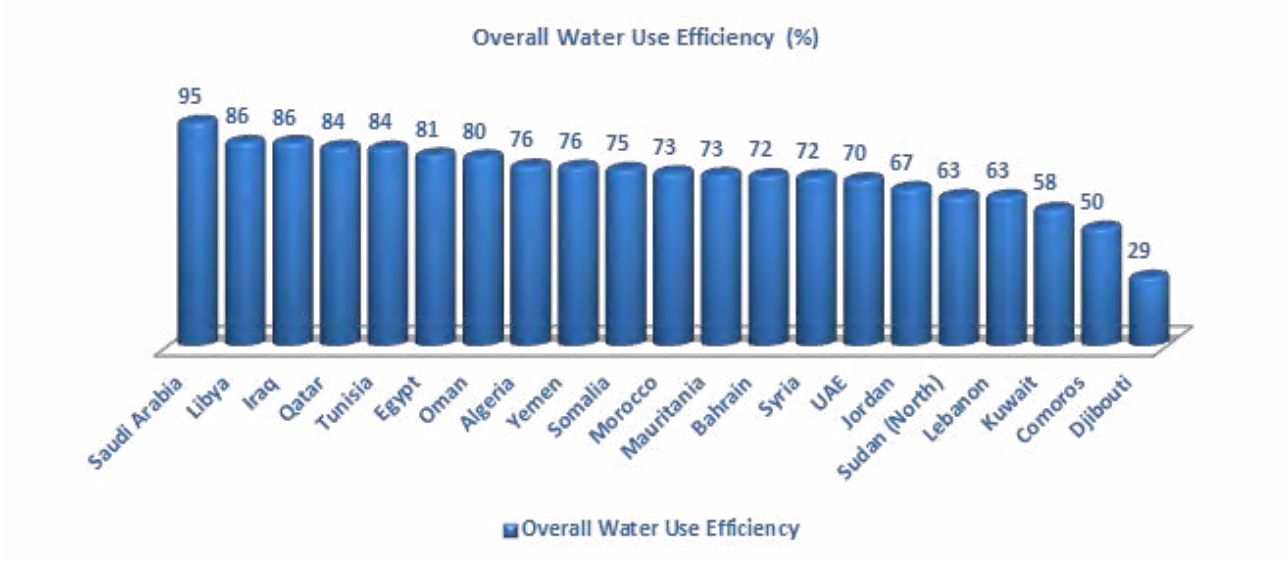

Figure 37. Overall Water Use Efficiency in the Arab Region

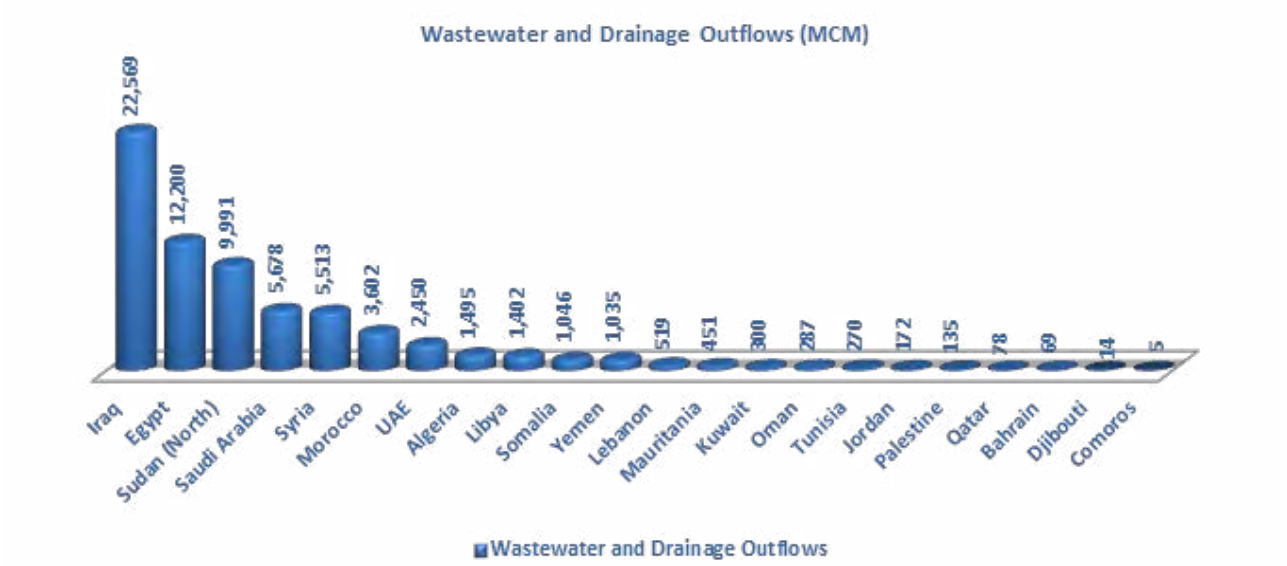

Figure 38. Wastewater and Drainage Outflows in the Arab Region

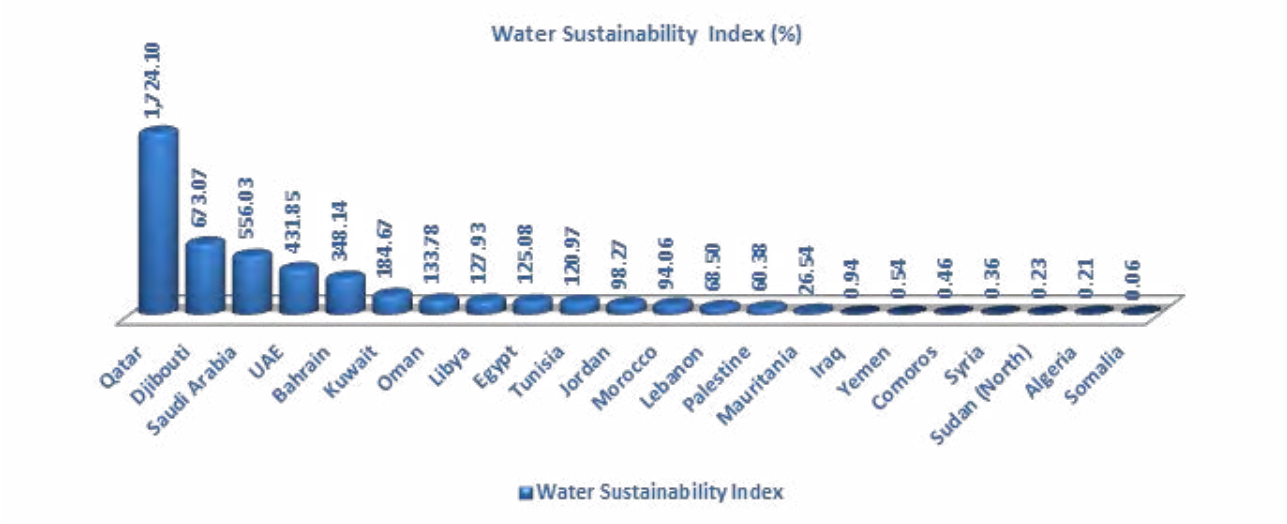

Figure 39. Water Sustainability Index in the Arab Region

Figure (39) showcases a very important and significant indicator with a huge relevance to the Arab Region. The Water sustainability index is the ratio of the total water withdrawals from original sources to the renewable water resources. A water sustainability index of more than 100% indicates that a country depends on non-renewable sources of water such as desalination and non-renewable groundwater, which is quite the case in many Arab Countries especially the Gulf countries.

c. Water & Land Use Change

One of the main important factors affecting water use in any given country is the change in land use. For instance, any increase in irrigated agricultural areas will increase the overall Blue Water withdrawals for the agricultural sector. Also, activities such as deforestation could affect the beneficial Green-Water abstractions by forest areas, which is also the case with rainfed agriculture land and pasture areas. Figure (40a) shows the Land Use Pattern in the Arab Region.

Land Use Pattern in the Arab Region

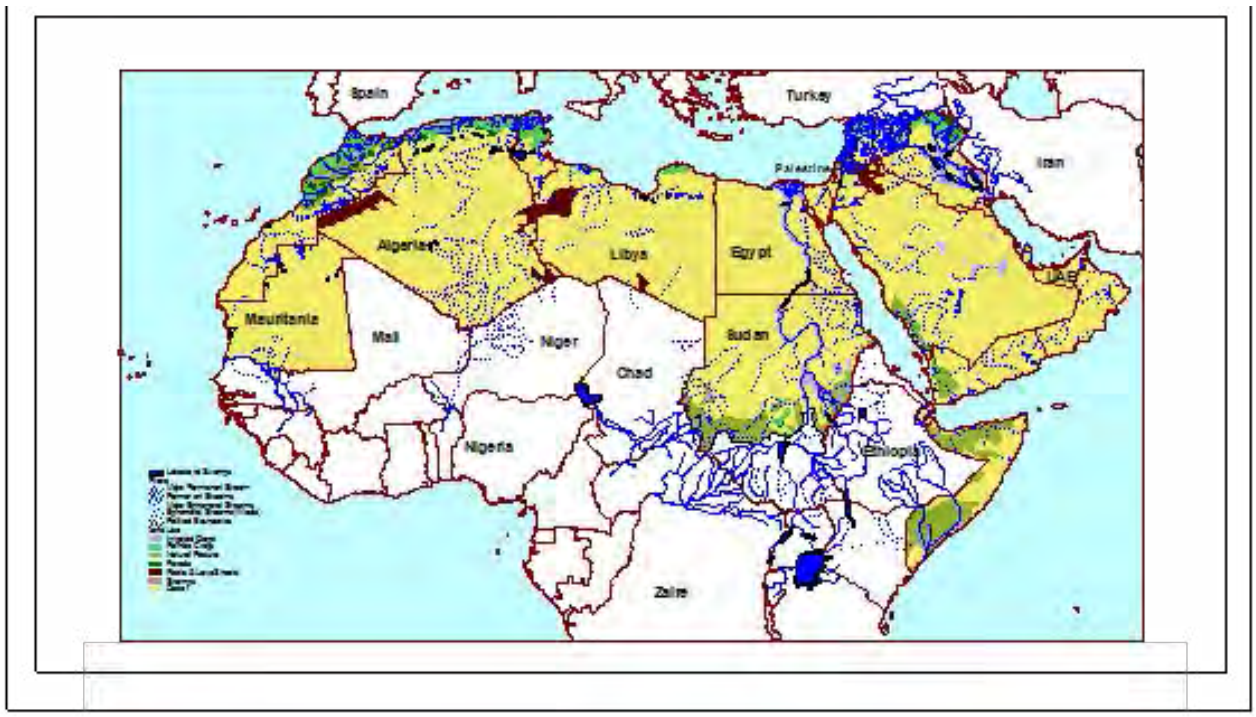

Figure 40a. Land Use Change in the Arab Region

Urban encroachment on Agricultural lands Figure (40b) is a continuously increasing negative phenomenon that affects the overall area of fertile agricultural land along with national food production, and accordingly changes the overall water uses as some areas and communities may undergo the switch from being agricultural consumers to domestic consumers. Urban Encroachment on Agricultural lands also affects the different components of Internal Renewable Blue Water Resources in the sense that changing the land use from green cover to urban use increase may decrease the recharge to groundwater aquifers and increase the surface runoff, where Urbanization may increase flooding risks as it decreases the available infiltration areas. It was found that the total loss of agricultural productive land in the Nile Delta in Egypt was 434.9 km^2, at a rate of 54.4 km^2 per year between 1984 and 1992, and 1525 km^2, at a rate of 108.9 km^2 per year between 1992 and 2006 (Shalaby, 2012). Urban expansion during the 1984 – 2006 period was on the expense of the most fertile as the high productive soils (Class I) lost 797.9 km^2

and the moderate productive soils lost 310.93 Km^2, while the low productive soils lost 672.3 km^2 during the same period (Shalaby, 2012).

Figure 40b. Agriculture Area Decrease (Urban Encroachment on Agricultural Land in Egypt, 2010) (AbuZeid, K., 2010)

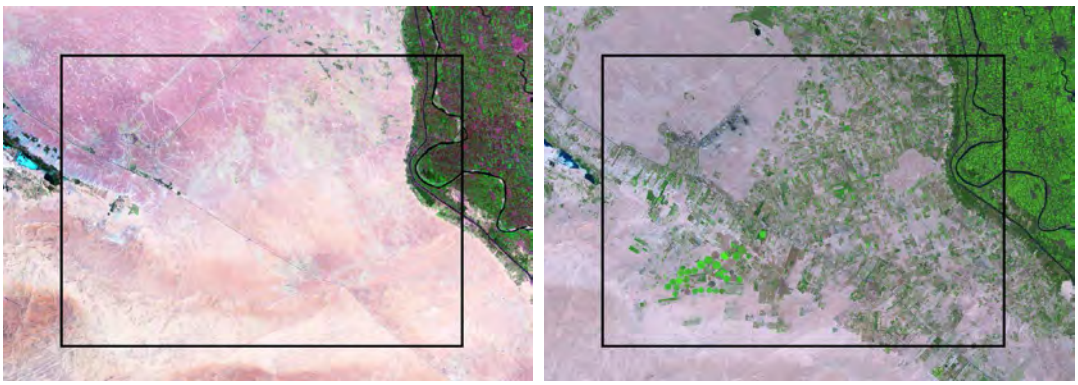

Figure 40c. Agriculture Area Increase (Agricultural Expansion in West Delta, Egypt 1990-2001)

On the other hand, agricultural expansion in desert areas as shown in Figers (40c) & (41) is often associated with non-renewable groundwater use, and depending on the number of utilization years, it could be an indicator of the amount of depletion of non-renewable groundwater. In the absence of ground data, the assessment of this important indicator could depend on high resolution Landsat Satellite images for different years for the area or country of interest, where Land Use Change detection would be evaluated. Figure (40c) shows the agriculture expansion in the West Delta between 1990 and 2001.

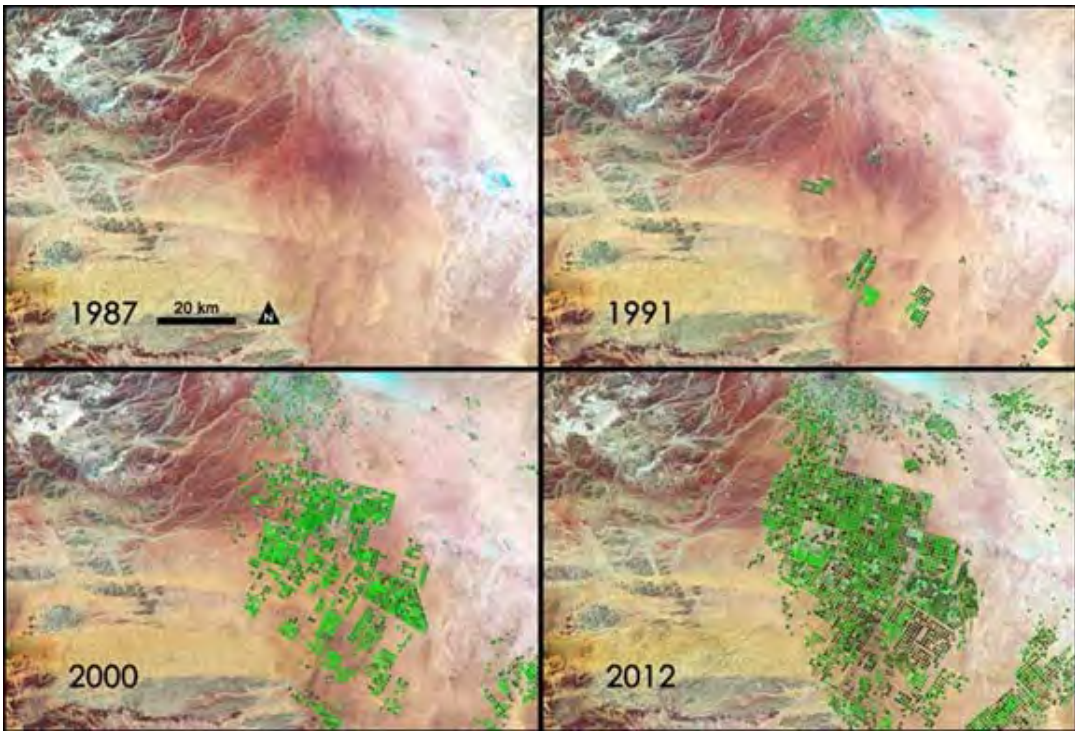

Figure 41. Green Cover in Saudi Arabia (NASA, 2012)

Saudi Arabia experienced an overall increase in green cover as shown in Figure (41). The Significant increase in Green cover between 1987 and 2012 is attributed to agricultural expansion through the development of non-renewable groundwater in the cultivation of strategic crops such as wheat.

d. Water & Demographics

This category of indicators relates different indicators to population by calculating the per Capita share for these indicators. Figures (42a) through (46a) show the per Capita share for Internal Renewable Blue Water, Total Renewable Blue Water, Total Renewable Water Resources, Total Available Water Resources, Total Blue Water Withdrawals, and Total Green Water Consumption. When comparing the per Capita share of Renewable Blue Water in 2000 and 2012 as shown in Figure (43) Lebanon, Morocco dropped below the water scarcity limit. The number of countries below the water scarcity limit in the Arab Region increased from 15 to 17 countries out of 22, between 2000 & 2012.

The number of the population in the Arab region in 2012 reached 363 million, which increased by 80 million since the year 2000 when the population was 283 million. This is an increase of 28%.

2012 data reflects that the average internal renewable blue water resources per capita among the Arab countries reached 406 m^3/capita. The average total renewable blue water resources per capita in 2012 among the Arab countries reached 691 m^3/ capita, which decreased from 888 m^3/capita in 2000, by 197 m^3/capita. The average total renewable water resources per capita among the Arab countries, which also includes green water, reached 2,033 m^3/capita in 2012. The average total available water resources per capita among the Arab countries, which includes also potential non-conventional water resources, reached 2,225 m^3/capita. The average blue water withdrawals per capita among the Arab countries reached 567 m^3/capita, and the average green water consumption per capita among the Arab countries reached 1,354 m^3/capita.

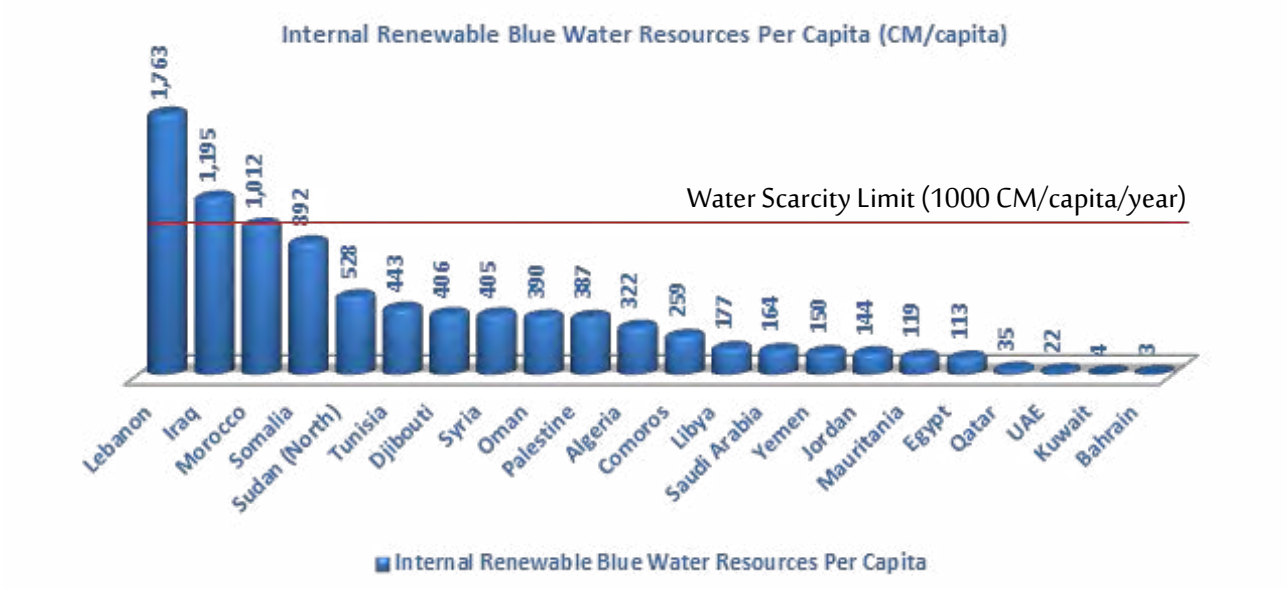

Figure 42a. Internal Renewable Blue Water per Capita in the Arab Region

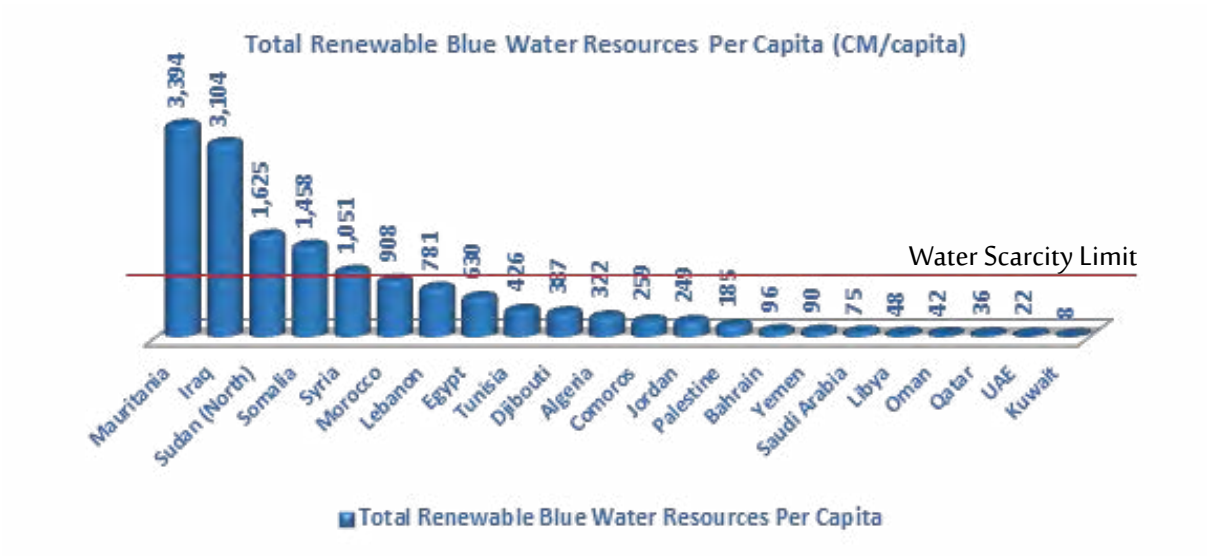

Figure 42b. 2012 Total Renewable Blue Water Resources Per capita in the Arab Region

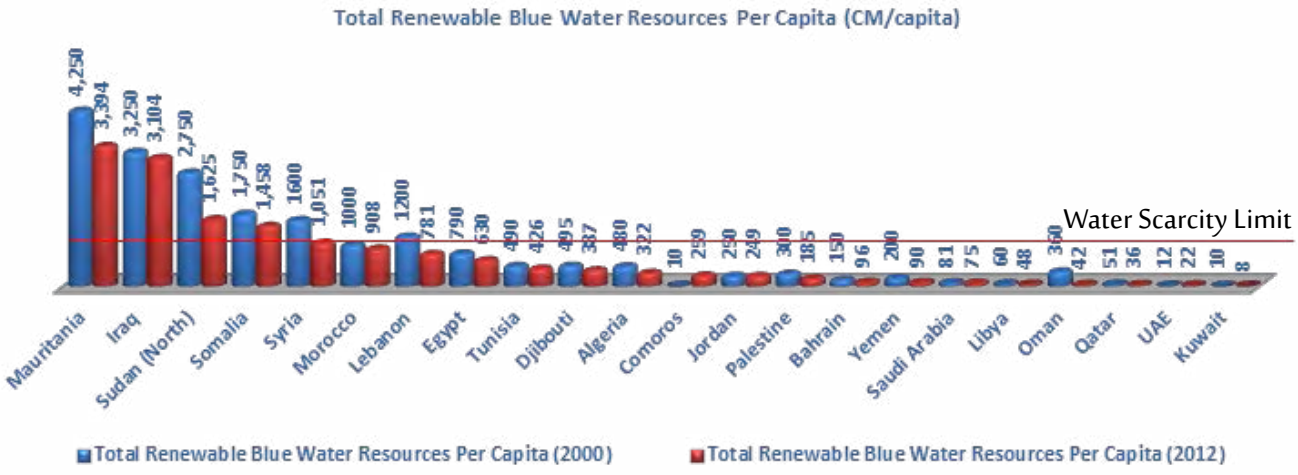

Figure 43. Total Renewable Blue Water Resources per Capita in the Arab Region in 2000 and 2012

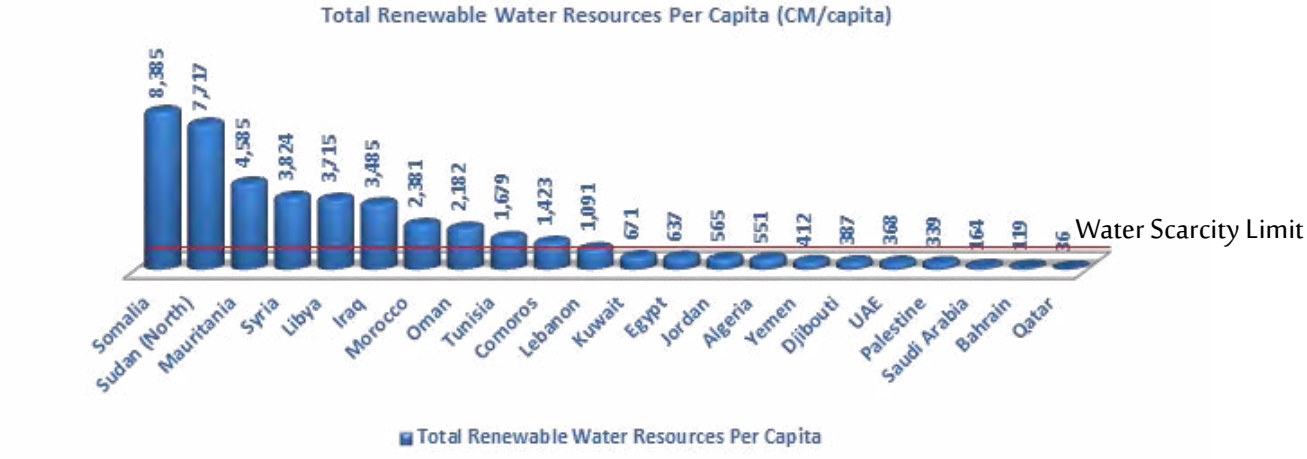

Figure 44a. Total Renewable Water Resources per Capita in the Arab Region

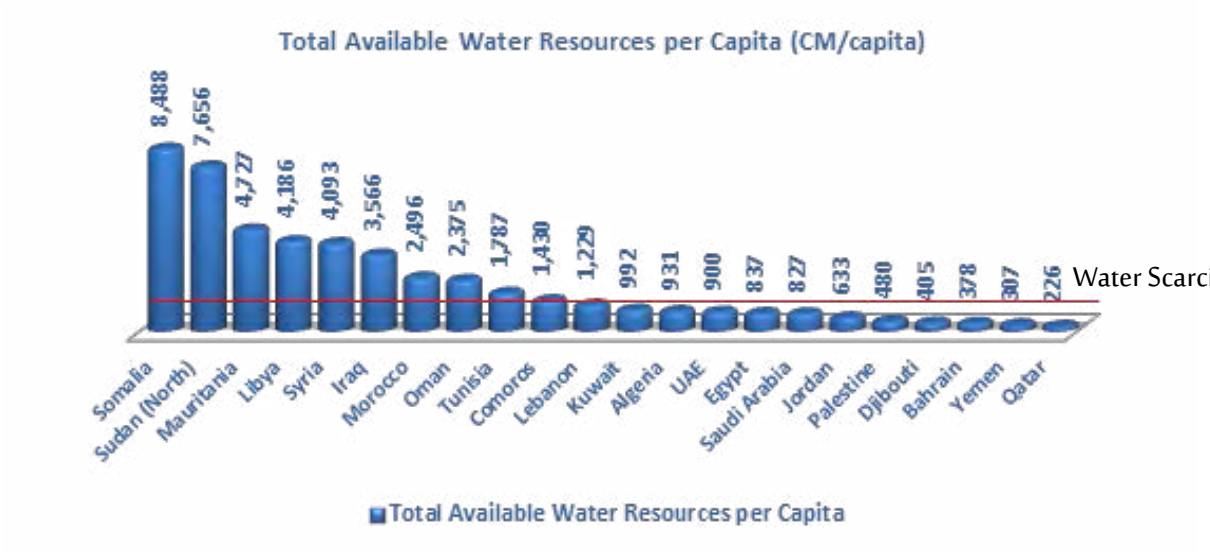

Figure 44b. Total Available Water Resources per Capita in the Arab Region

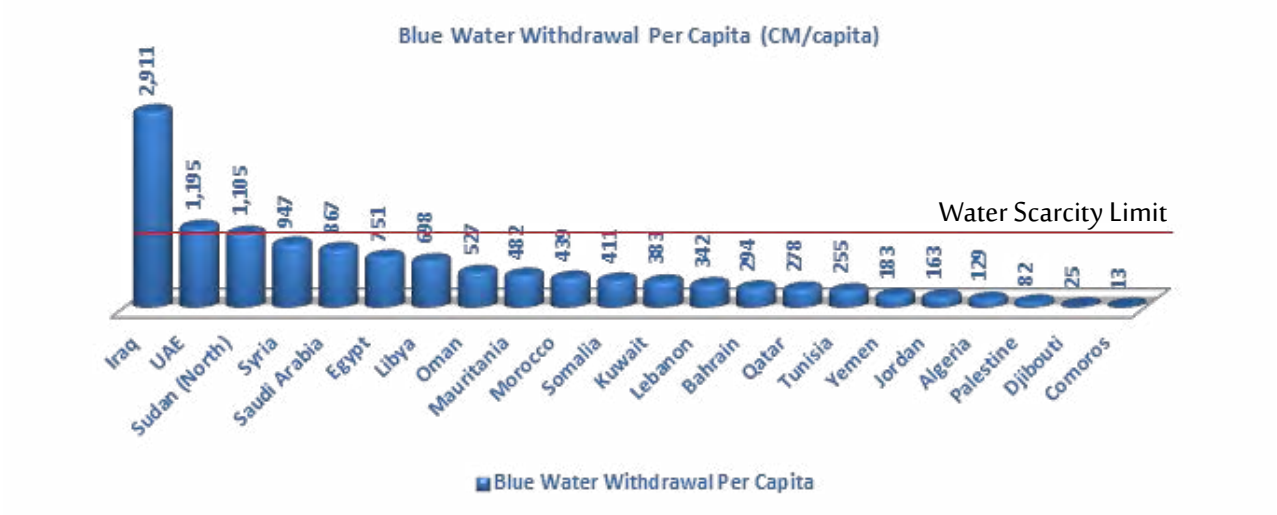

Figure 45. Blue Water Withdrawal per Capita in the Arab Region

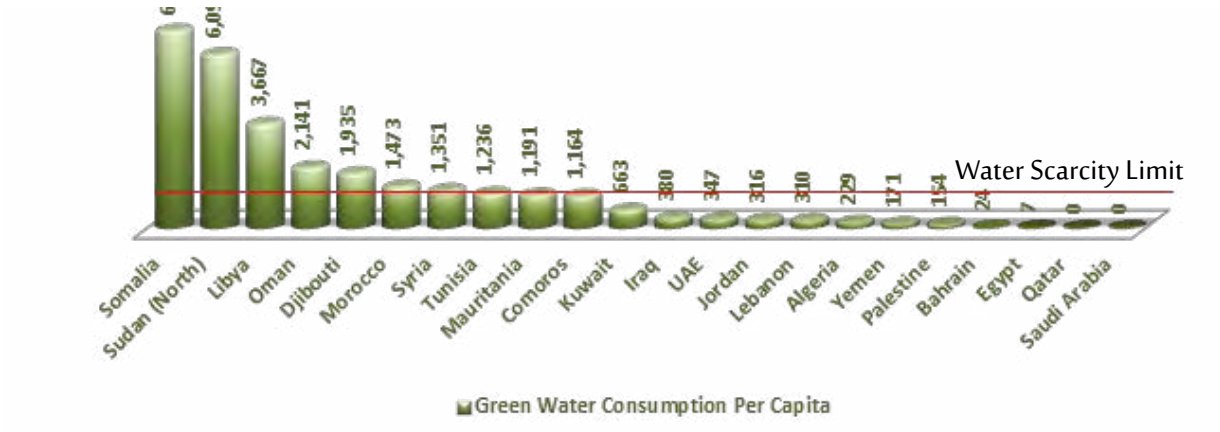

Figure 46a. Green Water Consumption per Capita in the Arab Region

e. Water & Energy

A country's capability to generate hydropower depends mostly on the installed hydropower facilities attached to dams. Not all Arab countries enjoy such privilege, and not all Arab Countries utilize their hydropower potential to the maximum, therefore it is of great importance to report on different indicators related to hydropower potential and utilization in different Arab Countries. Table.1 shows the values for different hydropower related indicators in the Arab Region according to the International Hydropower Association in 2009.

Country	Gross theoretical hydropower potential (GigaWatt hour/year)	Technically feasible hydropower potential (GigaWatt hour/year)	Economically feasible hydropower potential (GigaWatt hour/year)	Installed hydrocapacity (MegaWatt)	Hydro generation in 2008 or/ most recent (GigaWatt hour/year) (average)	% production by hydro in 2008 or most recent (average)	Hydro capacity under construction (MegaWatt)	Planned hydro capacity (MegaWatt)
Algeria	12,000	4,000		278	560	2.7	0	N/A
Comoros				1	2			
Egypt		>50,000	~50,000	2,842	15,510	12.6	0	48
Iraq		90,000	67,000	2,273	N/A	13	~30	800-5,000
Jordan				12	62	0.45	0	N/A
Lebanon				280	750	7	76	N/A
Mauritania				30	120	N/A	0	N/A
Morocco		5,203	4,000	~1,265	1,318	6.6	~40	84-384
Somalia		600						
Sudan		N/A	19,000	575	4,333	55	>1,200	2,000-3,600
Syria				1,505	~8000	15	N/A	N/A
Tunisia	1,000	250	160	~70	160	3	N/A	>20

Table 1. Hydropower Potential and Utilization in the Arab Region

In many cases, hydropower generation is not ultimately a national concern, as it is often associated with shared river basins, and that is where potential conflicts of interest could appear. When one of the riparian states of a shared River Basin fully utilizes its hydropower potential, it could possibly be on the expense of the chances of other riparians to utilize theirs. Therefore, it is of great importance to assess the hydropower related indicators, not just for all Arab countries, but for all countries that share a River Basin with them. Tables 2, 3, and 4 show the values of the different hydropower indicators for the Nile, Euphrates, and Senegal River Basins respectively.

Country	Gross theoretical hydropower potential (GigaWatt hour/year)	Technically feasible hydropower potential (GigaWatt hour/year)	Economically feasible hydropower potential (GigaWatt hour/year)	Installed hydrocapacity (MegaWatt)	Hydro generation in 2008 or/ most recent (GigaWatt hour/year) (average)	% production by hydro in 2008 or most recent (average)	Hydro capacity under construction (MegaWatt)	Planned hydro capacity (MegaWatt)
Burundi	6,000	1,500	600	50	208	100	1	177
D.R. Congo	1,397,000		145,000	2,410	7,303	100	>162	3,690-43,000

Country	Gross theoretical hydropower potential (GigaWatt hour/year)	Technically feasible hydropower potential (GigaWatt hour/year)	Economically feasible hydropower potential (GigaWatt hour/year)	Installed hydrocapacity (MegaWatt)	Hydro generation in 2008 or/ most recent (GigaWatt hour/year) (average)	% production by hydro in 2008 or most recent (average)	Hydro capacity under construction (MegaWatt)	Planned hydro capacity (MegaWatt)
Egypt		>50,000	~50,000	2,842	15,510	12.6	0	48
Eritrea				0	0	0	0	0
Ethiopia	~650,000	>260,000	162,000	669	2,700	>95	1,277	4,170-10,000
Kenya	>24,300			747	3,000	63	41	>160
Rwanda				55	130	59	0	120-209
Sudan (North & South		N/A	19,000	575	4,333	55	>1,200	2,000-3,600
Tanzania	39,450	20,000		561	2,098	61	0	1,868
Uganda		N/A	>12500	~395.5	1,391	67.9	337	~1,000

Table 2. Nile River Basin Hydropower Potential

Country	Gross theoretical hydropower potential (GigaWatt hour/year)	Technically feasible hydropower potential (GigaWatt hour/year)	Economically feasible hydropower potential (GigaWatt hour/year)	Installed hydrocapacity (MegaWatt)	Hydro generation in 2008 or/ most recent (GigaWatt hour/year) (average)	% production by hydro in 2008 or most recent (average)	Hydro capacity under construction (MegaWatt)	Planned hydro capacity (MegaWatt)
Iraq		90,000	67,000	2,273	N/A	13	~30	800-5,000
Syria				1,505	~8000	15	N/A	N/A
Turkey	433,000	216,000	140,000	13,700	48,000	25.4	8,600	22,700

Table 3. Euphrates River Basin Hydropower Potential

Country	Gross theoretical hydropower potential (GigaWatt hour/year)	Technically feasible hydropower potential (GigaWatt hour/year)	Economically feasible hydropower potential (GigaWatt hour/year)	Installed hydrocapacity (MegaWatt)	Hydro generation in 2008 or/ most recent (GigaWatt hour/year) (average)	% production by hydro in 2008 or most recent (average)	Hydro capacity under construction (MegaWatt)	Planned hydro capacity (MegaWatt)
Guinea	26,000	19,300	18,200	123	519	37.8	N/A	>240
Mali		**~5,000**		155	>500	60	140	>100
Mauritania				30	120	N/A	0	N/A
Senegal		4,250	2,050	66	293	16	0	123

Table 4. Senegal River Basin Hydropower Potential

f. Water & Accessibility

Universal Access to Water has always been one of the noblest global goal that many International Organizations and Institutions have been striving to achieve. Access to water and sanitation was recently declared a human right by the United Nations. Moreover, the Millennium Development Goals focused on Water Supply and Sanitation Coverage. Therefore it is of great importance to accurately assess existing coverage by globally, or at least regionally agreed methodologies.

The Joint Monitoring Programme (JMP) was established as a collaboration between UNICEF and WHO with a mission to assess the water supply and sanitation coverage in each and every country of the world, and hence evaluate the progress achieved in all those countries towards achieving the water Millennium Development Goals.

The JMP has certain criteria as to what could be considered improved and non-improved water supply and sanitation. For Water Supply, the most improved option is piping water directly into premises. Other improved drinking water sources include public taps or standpipes, tube wells or boreholes, protected dug wells, protected springs, and rainwater collection. The unimproved drinking-water sources are the unprotected dug wells, unprotected springs, carts with small tank/drum, surface water, and bottled water. The Surface Drinking Water sources like rivers, lakes, ponds and irrigation canals are by far the most unimproved.

According to the above mentioned criteria, JMP has assessed the Water Supply Coverage in all countries including the Arab countries using household surveys. Figures (47a), (47b), (47c) and (47d) show the overall water supply coverage in the Arab Region according to JMP in 2012, while figures (48a), (48b), (48c) and (48d) show the urban water supply coverage, and (49a), (49b) and (49c) show the rural water supply coverage. Data used for these graphs are provided in Annex B, Table B-2.

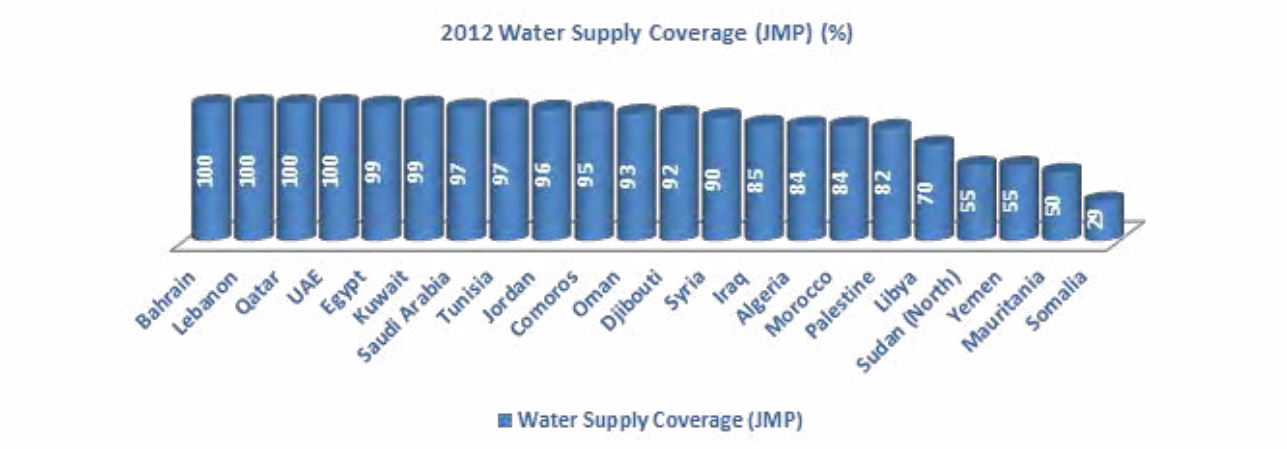

Figure 47a. Water Supply Coverage in the Arab Region

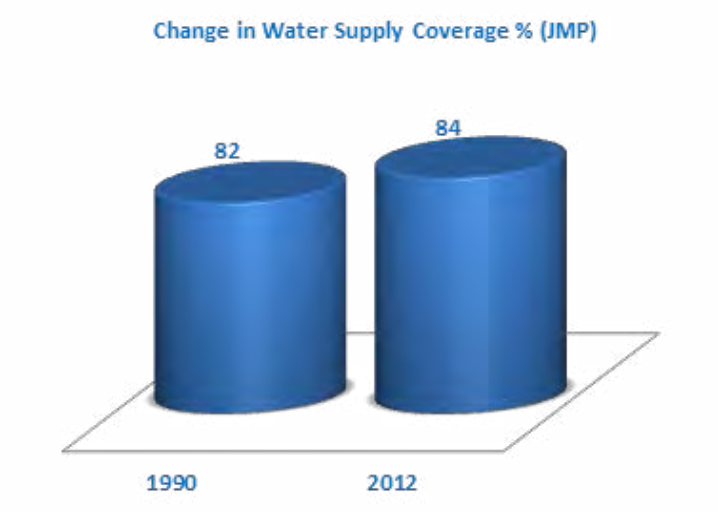

Figure 47b. Change in Water Supply Coverage in the Arab Region

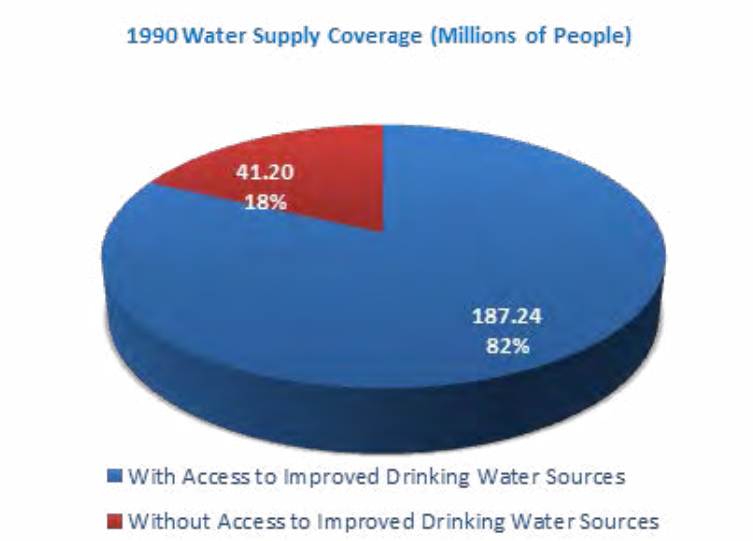

Figure 47c. 1990 Water Supply Coverage in the Arab Region

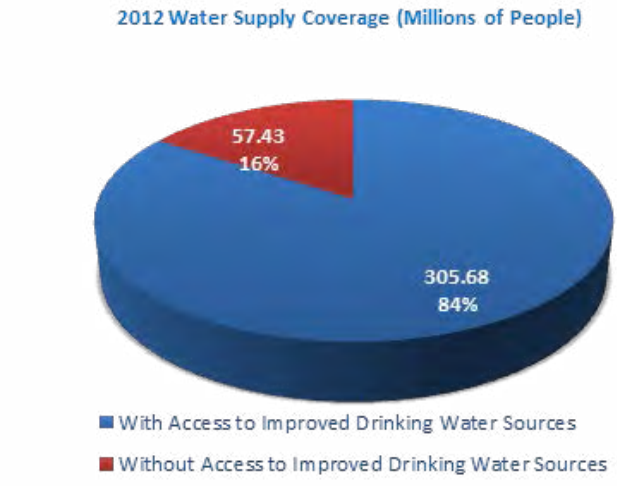

Figure 47d. 2012 Water Supply Coverage in the Arab Region

The percentage of population with improved water supply coverage has increased from 82% in 1990 (the baseline year) to 84% in 2012, and an extra 118 million people have gained access to an improved water supply source in that period, with 57 million people still without improved water supply coverage. The percentage of population without improved water supply coverage has dropped from 18% in 1990 to 16% in 2012, but the number of those people without improved sanitation has actually increased by about 16 million.

The Arab Region as a whole is not on track to reach the MDG water supply target, with the percentage of population without improved water supply services decreasing by 11.1% since 1990 as opposed to the MDG target of 50%.

Only 11 countries are on track to meet the MDG water supply target, namely Bahrain, Comoros, Djibouti, Egypt, Lebanon, Morocco, Oman, Qatar, Saudi Arabia, Tunisia and UAE.

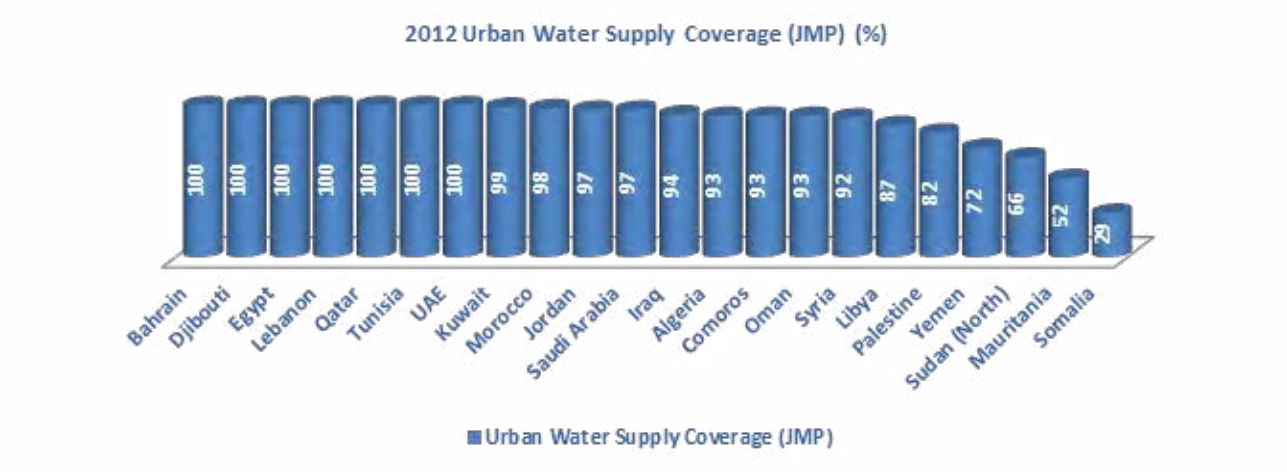

Figure 48a. 2012 Urban Water Supply Coverage in the Arab Region

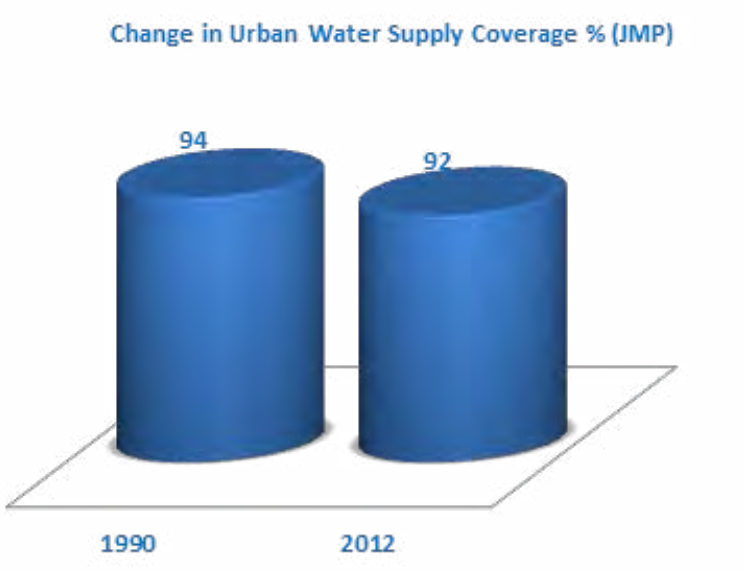

Figure 48b. Change in Urban Water Supply Coverage in the Arab Region

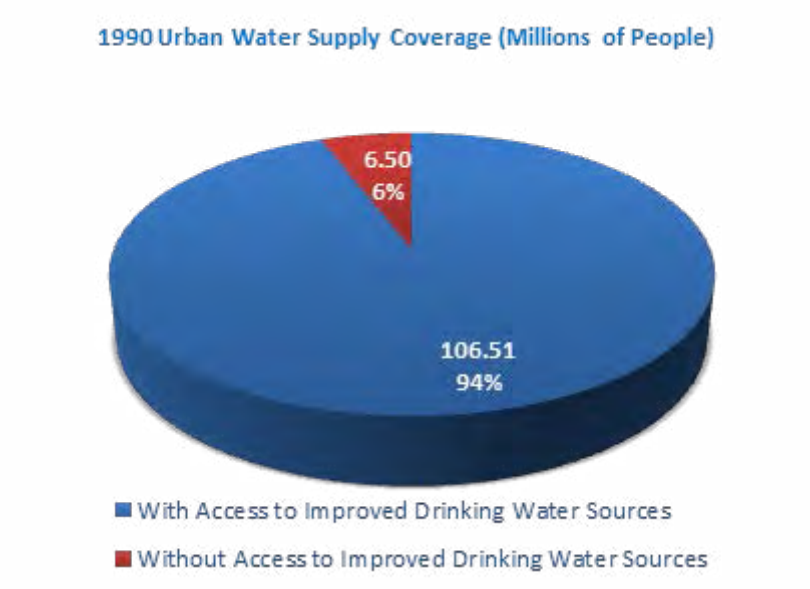

Figure 48c. 1990 Urban Water Supply Coverage in the Arab Region

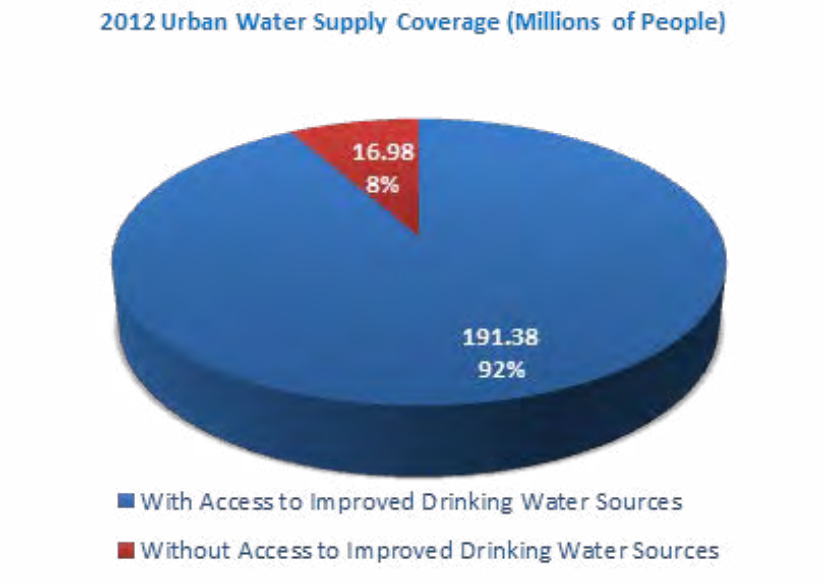

Figure 48d. 2012 Urban Water Supply Coverage in the Arab Region

The percentage of urban population with improved water supply coverage has actually decreased from 94% in 1990 (the baseline year) to 92% in 2012, but an extra 85 million people living in urban areas have gained access to an improved water supply source in that period, with 17 million still without improved water supply coverage. The percentage of urban population without improved water supply coverage has risen from 6% in 1990 to 8% in 2012, and the number of those without improved water supply has increased by more than 10 million people in urban area.

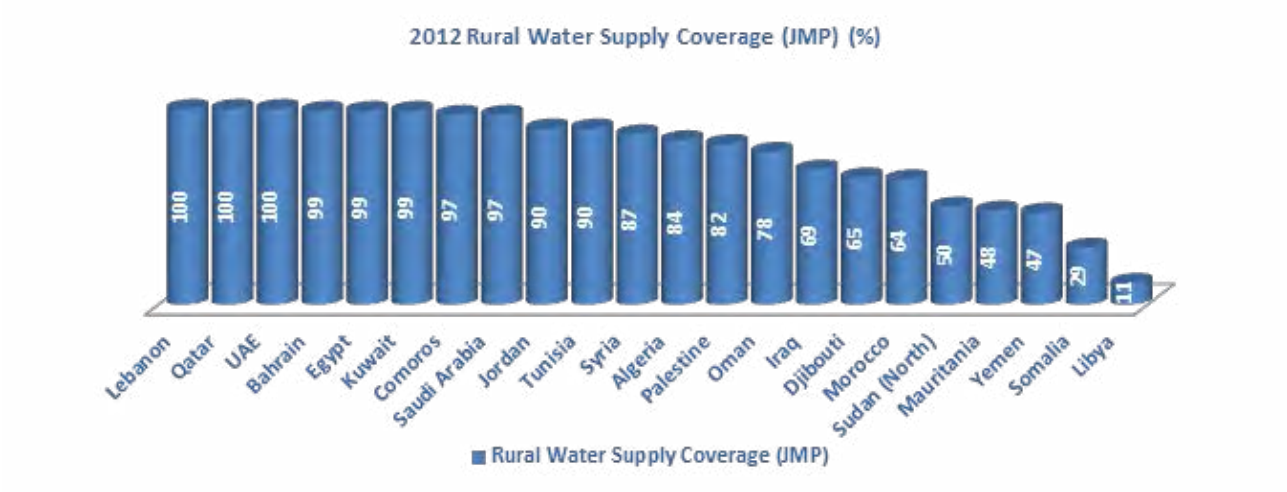

Figure 49a. 2012 Rural Water Supply Coverage in the Arab Region

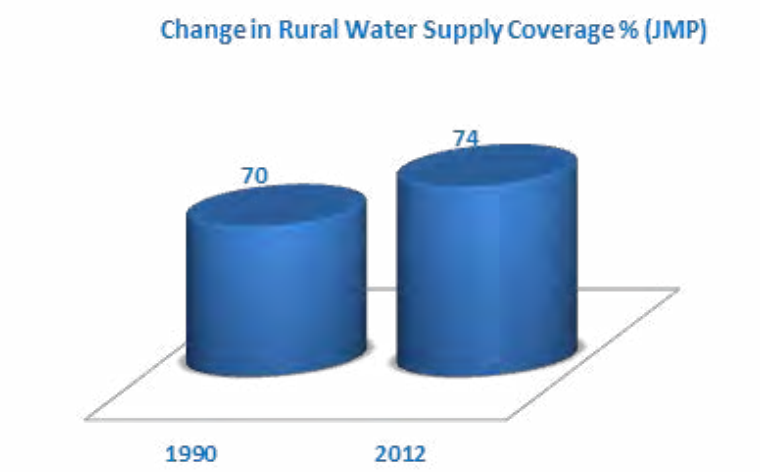

Figure 49b. Change in Rural Water Supply Coverage in the Arab Region

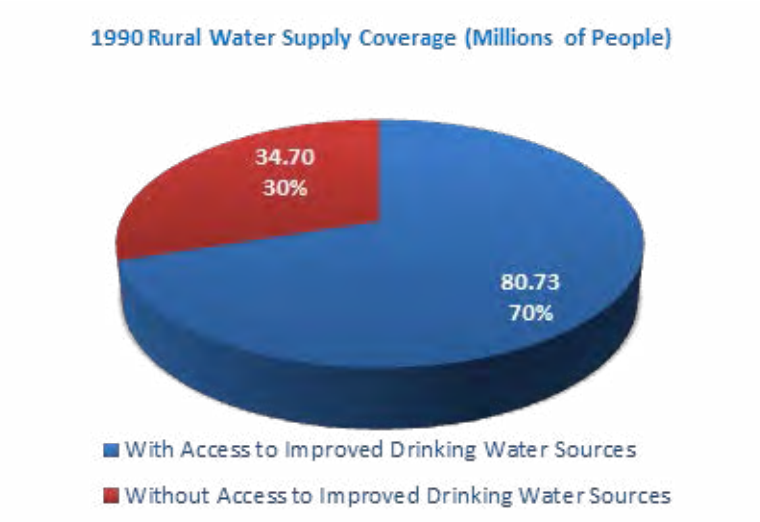

Figure 49c. 1990 Rural Water Supply Coverage in the Arab Region

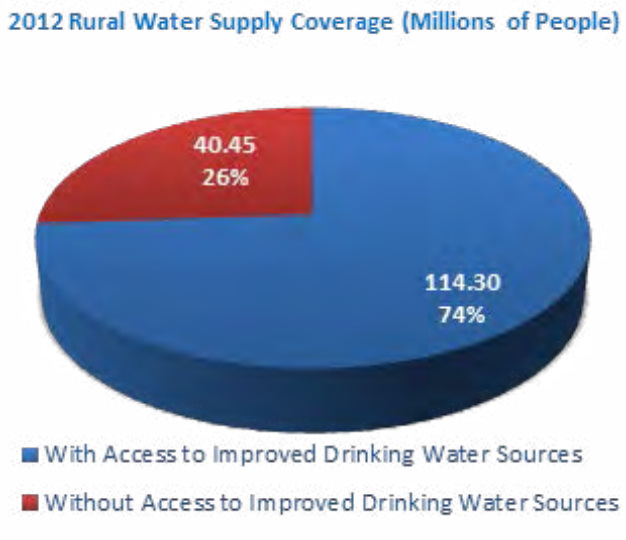

Figure 49d. 2012 Rural Water Supply Coverage in the Arab Region

The percentage of rural population with improved water supply coverage has increased from 70% in 1990 (the baseline year) to 74% in 2012, and an extra 34 million people in rural areas have gained access to an improved water supply source in that period, with more than 40 million still without improved water supply coverage. The percentage of rural population without improved water supply coverage has dropped from 30% in 1990 to 26% in 2012, but the number of those without improved water supply has actually increased by about 6 million people in rural area.

For sanitation, the improved options are piped sewer systems, septic tank, pit latrines, Ventilated Improved Pit (VIP) latrine, and pit latrine with slab. Sanitation facilities of an otherwise acceptable type shared between two or more households are considered unimproved. Only facilities that are not shared or not public are considered improved.

Unimproved sanitation facilities are those that do not ensure hygienic separation of human excreta from human contact. Such as pit latrines without a slab or platform, hanging latrines, and bucket latrines. Open defecation is the lowest level of unimproved sanitation.

According to the above mentioned criteria, JMP has assessed the Sanitation Coverage in the world including the Arab countries using household surveys. Figures (50a), (50b), (50c) and (50d) show the overall sanitation coverage in the Arab Region according to JMP in 2012, while figures (51a), (51b), (51c) and (51d) show the urban sanitation coverage, and (52a), (52b), (52c) and (52d) show the rural sanitation coverage. Data used for these graphs are provided in Annex B, Table B-2.

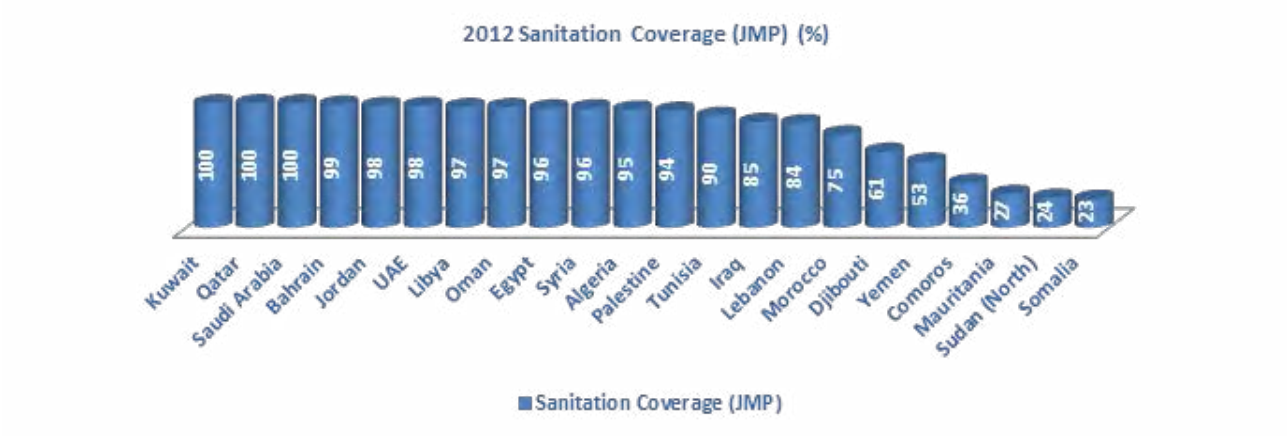

Figure 50a. 2012 Sanitation Coverage in the Arab Region

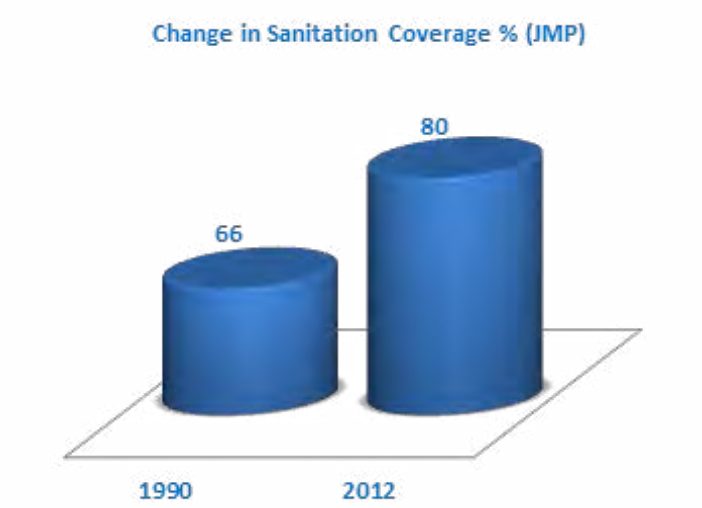

Figure 50b. Change in Sanitation Coverage in the Arab Region

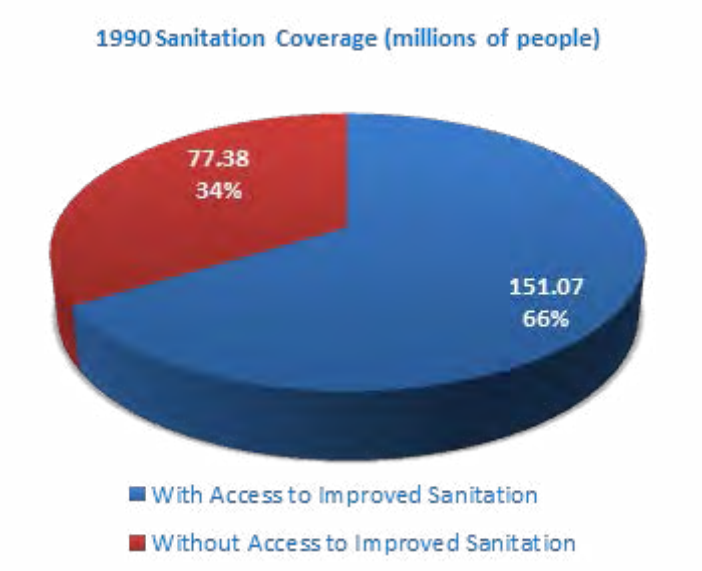

Figure 50c. 1990 Sanitation Coverage in the Arab Region

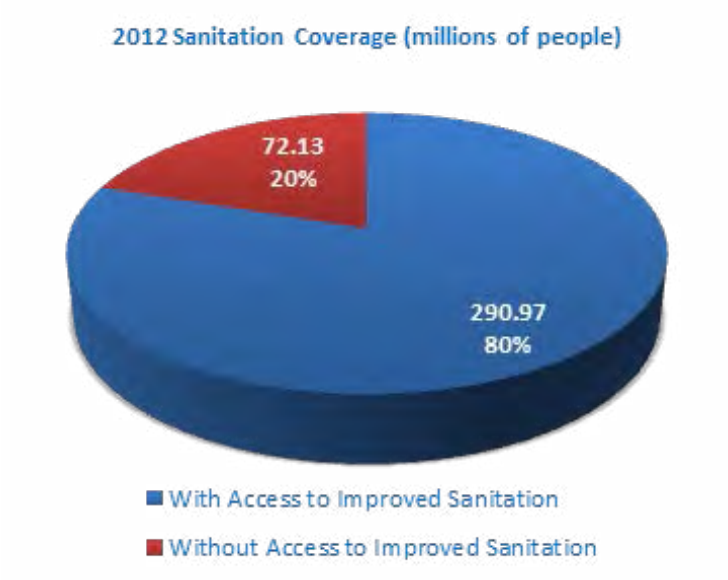

Figure 50d. 2012 Sanitation Coverage in the Arab Region

The percentage of population with improved sanitation has increased from 66% in 1990 (the baseline year) to 80% in 2012, and an extra 135 million people have received sanitation coverage in that period, with 72 million still without improved sanitation. The percentage of population without improved sanitation coverage has dropped from 34% in 1990 to 20% in 2012, and the number of those without improved sanitation has dropped by 5 million people.

The Arab Region as a whole is not on track to reach the MDG sanitation target, with the percentage of population without improved sanitation access decreasing by 41.2% since 1990, as opposed to the MDG target of 50%.

Only 8 countries are on track to meet the MDG sanitation target, namely Algeria, Egypt, Kuwait, Oman, Qatar, Saudi Arabia, Syria and Tunisia.

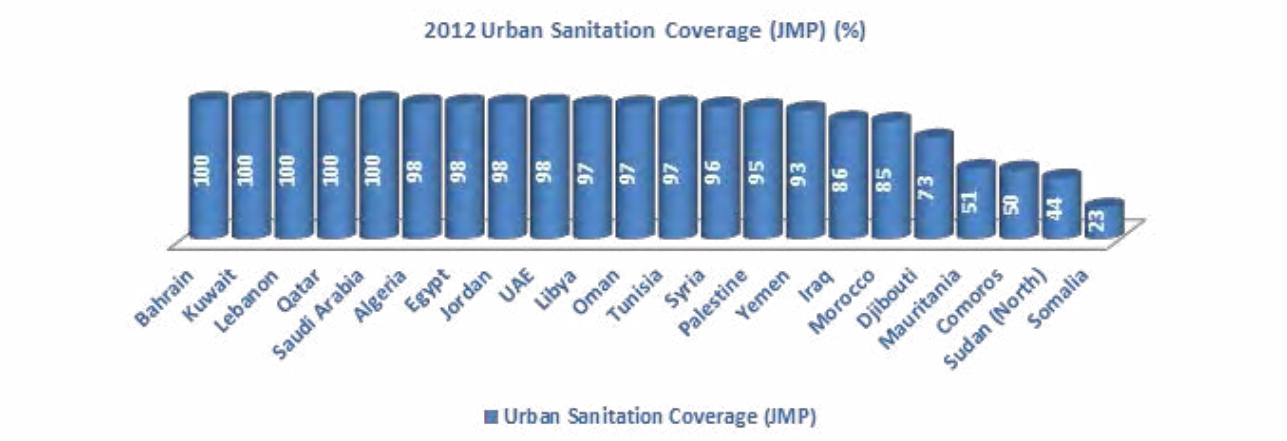

Figure 51a. 2012 Urban Sanitation Coverage in the Arab Region

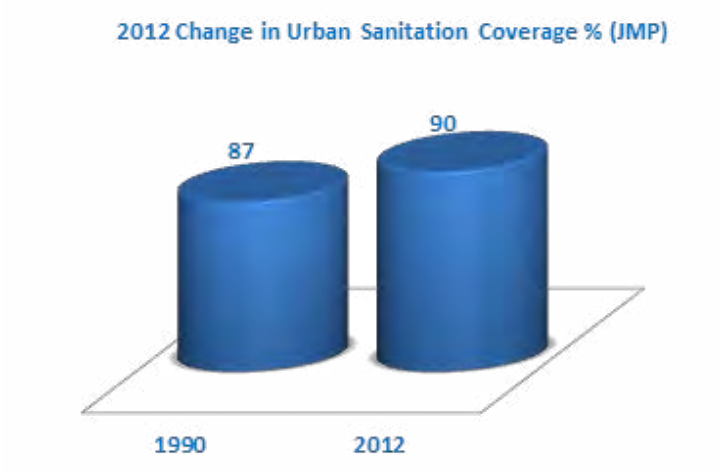

Figure 51b. Change in Urban Sanitation Coverage in the Arab Region

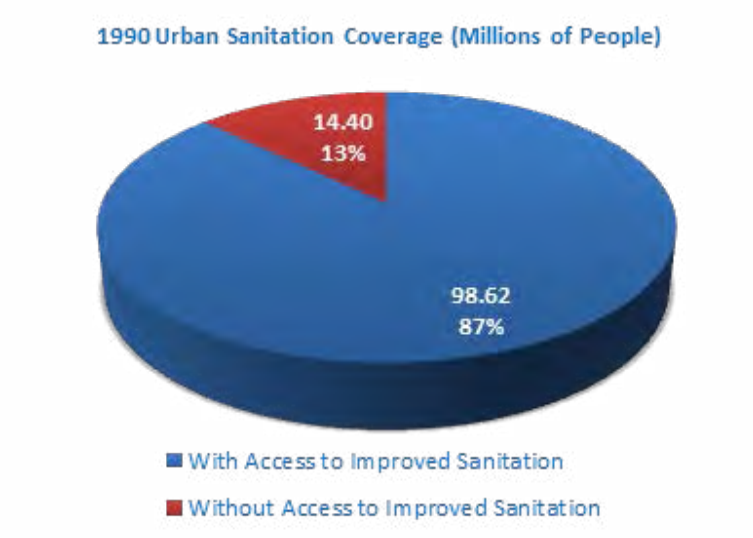

Figure 51c. 1990 Urban Sanitation Coverage in the Arab Region

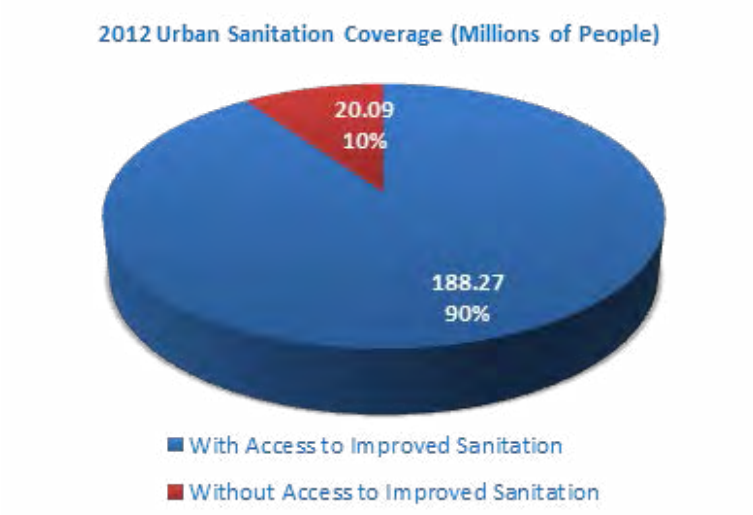

Figure 51d. 2012 Urban Sanitation Coverage in the Arab Region

The percentage of urban population with improved sanitation has increased from 87% in 1990 (the baseline year) to 90% in 2012, and an extra 90 million people in urban areas have received sanitation coverage in that period, with 20 million still without improved sanitation. The percentage of urban population without improved sanitation coverage has dropped from 13% in 1990 to 10% in 2012, but the number of those without improved sanitation has increased by more than 5 million people.

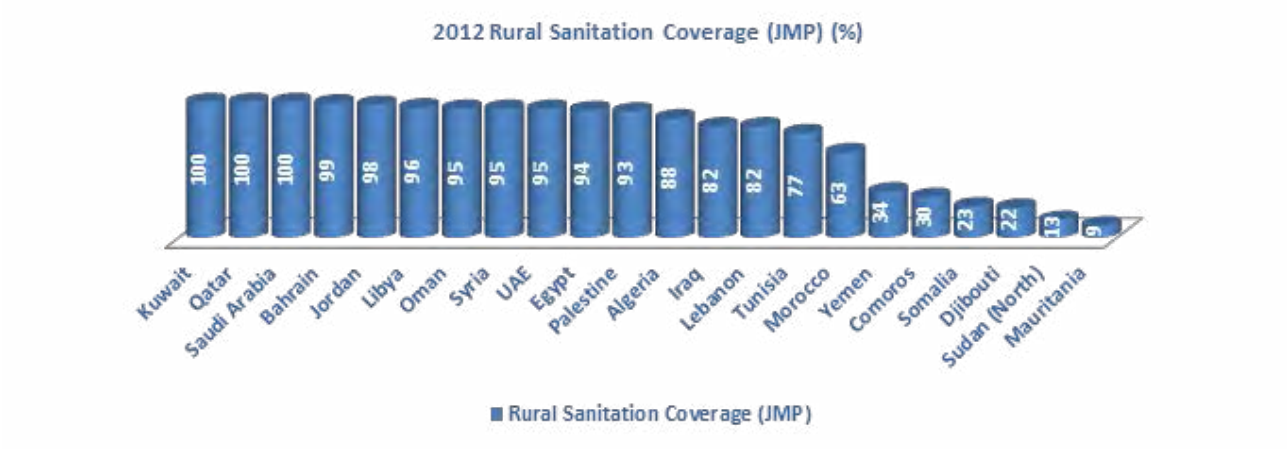

Figure 52a. 2012 Rural Sanitation Coverage in the Arab Region

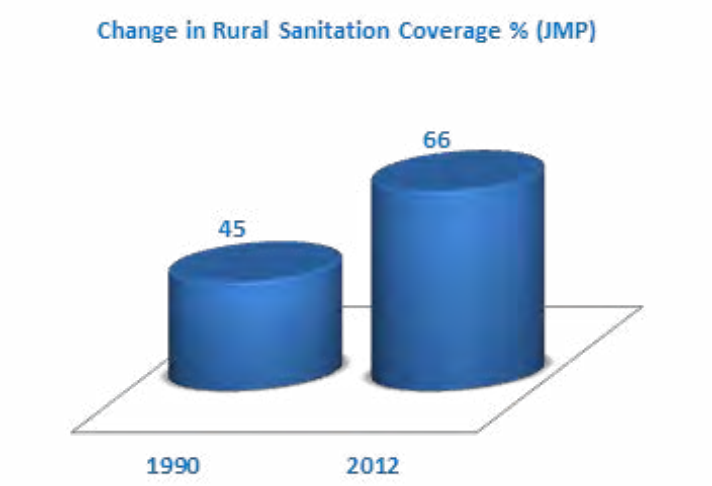

Figure 52b. Change in Rural Sanitation Coverage in the Arab Region

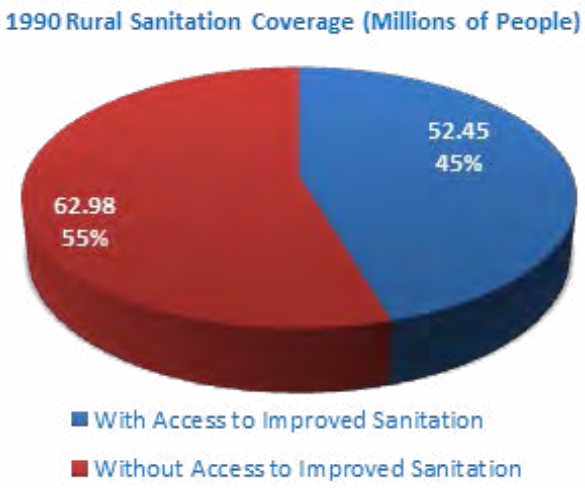

Figure 52c. 1990 Rural Sanitation Coverage in the Arab Region

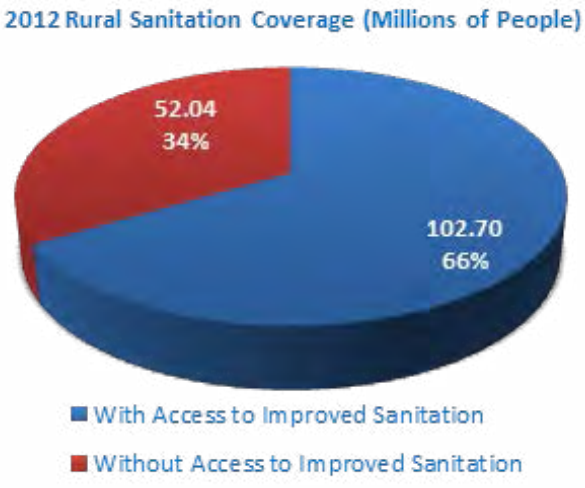

Figure 52d. 2012 Rural Sanitation Coverage in the Arab Region

The percentage of rural population with improved sanitation has increased from 45% in 1990 (the baseline year) to 66% in 2012, and an extra 50 million people in rural areas have received sanitation coverage in that period, with 52 million still without improved sanitation. The percentage of rural population without improved sanitation coverage has dropped from 55% in 1990 to 34% in 2012, and the number of those without improved sanitation has dropped by 11 million people.

The Millennium Development goals were targeted for the year 2015, and with that year fast approaching, the term "Universal Coverage" is starting to rise as the post 2015 alternative to "Water MDGs Achievement". Therefore it is of great importance to assess the financial costs of Universal Coverage against those for MDG Achievement. Figure (53) shows those values for Arab Countries for Sanitation and Figure (54) for water supply.

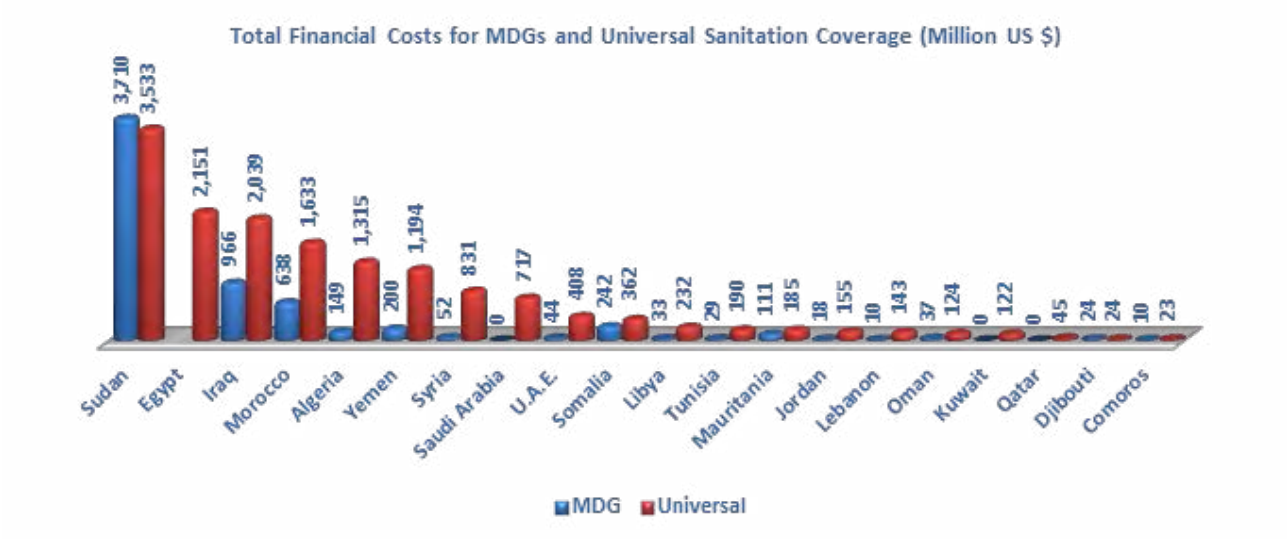

Figure 53. Total Financial Costs for MDGs and Universal Sanitation Coverage

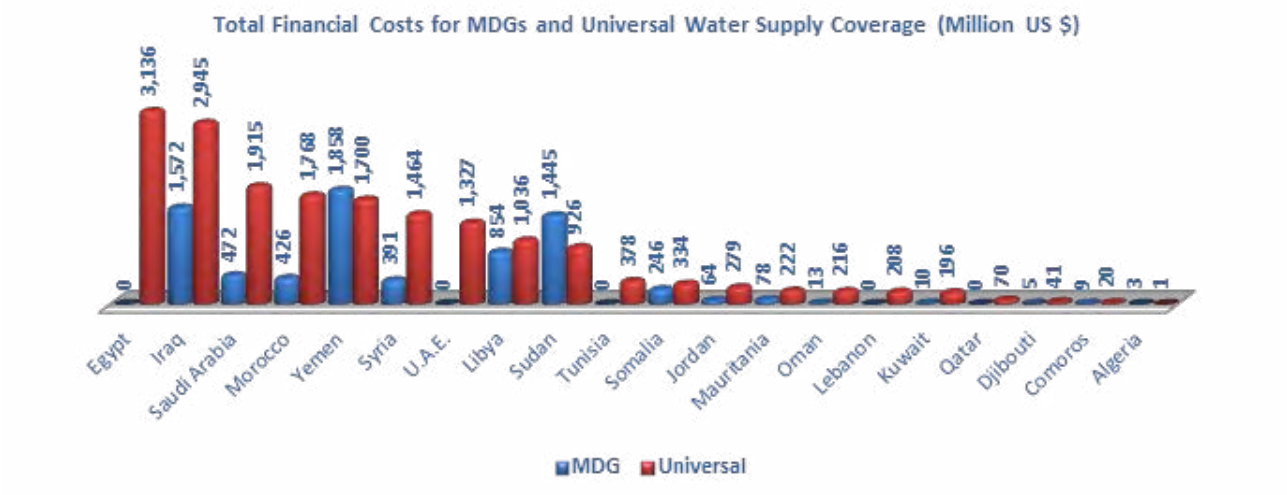

Figure 54. Total Financial Costs for MDGs and Universal Water Supply Coverage

The population without water supply in the whole Arab Region is shown in Figure (55) while the population without sanitation is shown in Figure (56). Three important key years are showcased in figures (55) and (56); the year 1990 data which is the reference year for MDGs assessment, the year 2012 data which is the year for this report, and the year 2015 data which is the target year for the water MDG and is also the year where the world will start considering Universal Coverage for Water Supply and Sanitation. Moreover, Figures (57) and (58) show the distribution of all population without water supply and sanitation in all Arab Countries.

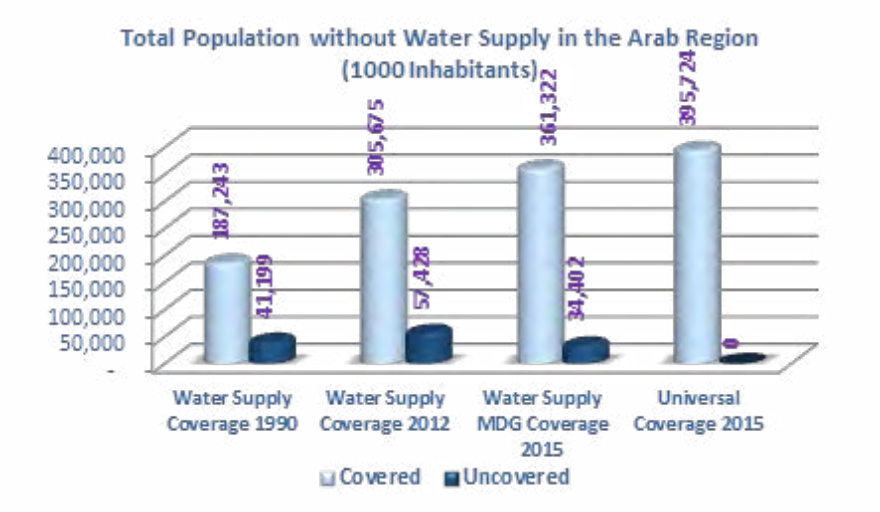

Figure 55. Water Supply Coverage in the Whole Arab Region

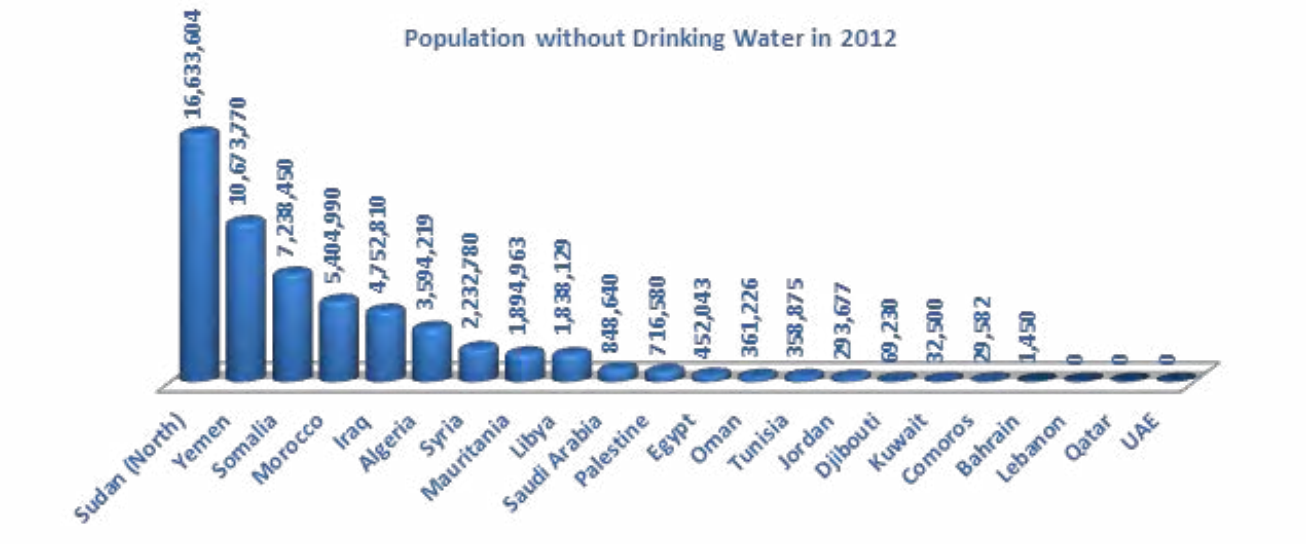

Figure 56. Population Without Drinking Water in the Arab Region

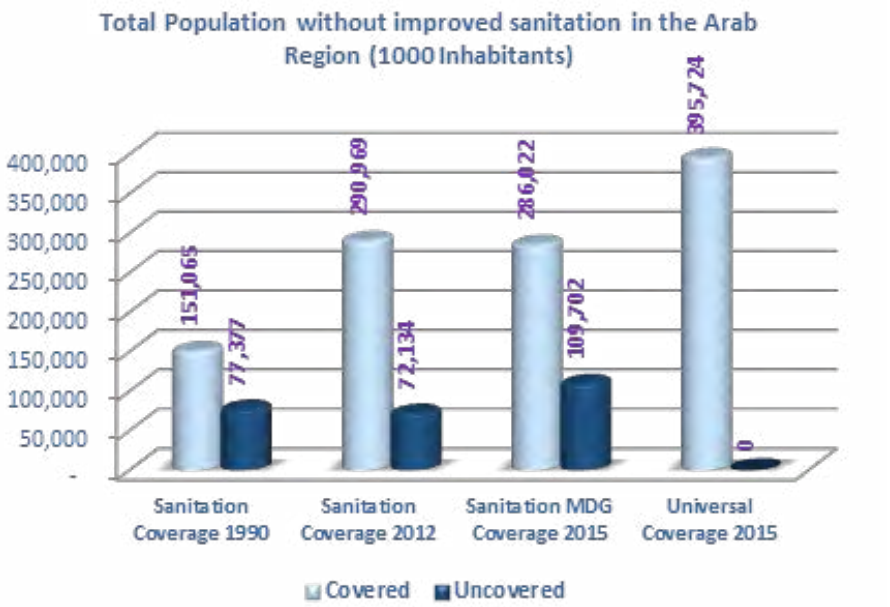

Figure 57. Sanitation Coverage in the Whole Arab Region

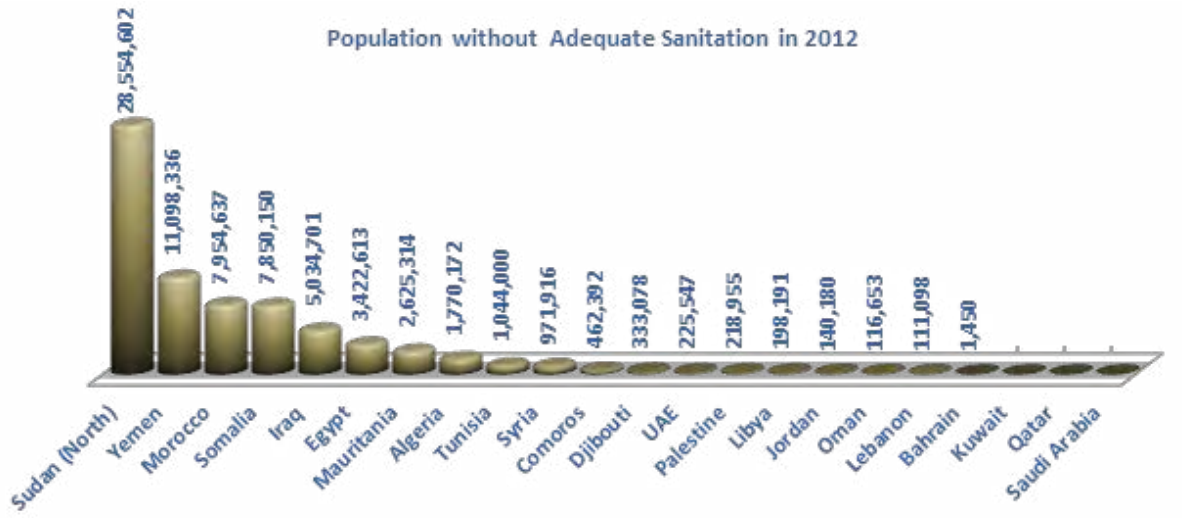

Figure 58. Population without Adequate Sanitation in the Arab Region

g. Water & Health

While many diseases are directly related to food and water, few diseases are purely waterborne. Sudan, Mauritania and Yemen have been affected by the Guinea Worm disease. In 1998 and 2005, Yemen and Mauritania were respectively disease free period. Sudan continues to represent a majority of world's cases of Guinea Worm disease as shown in figure (59).

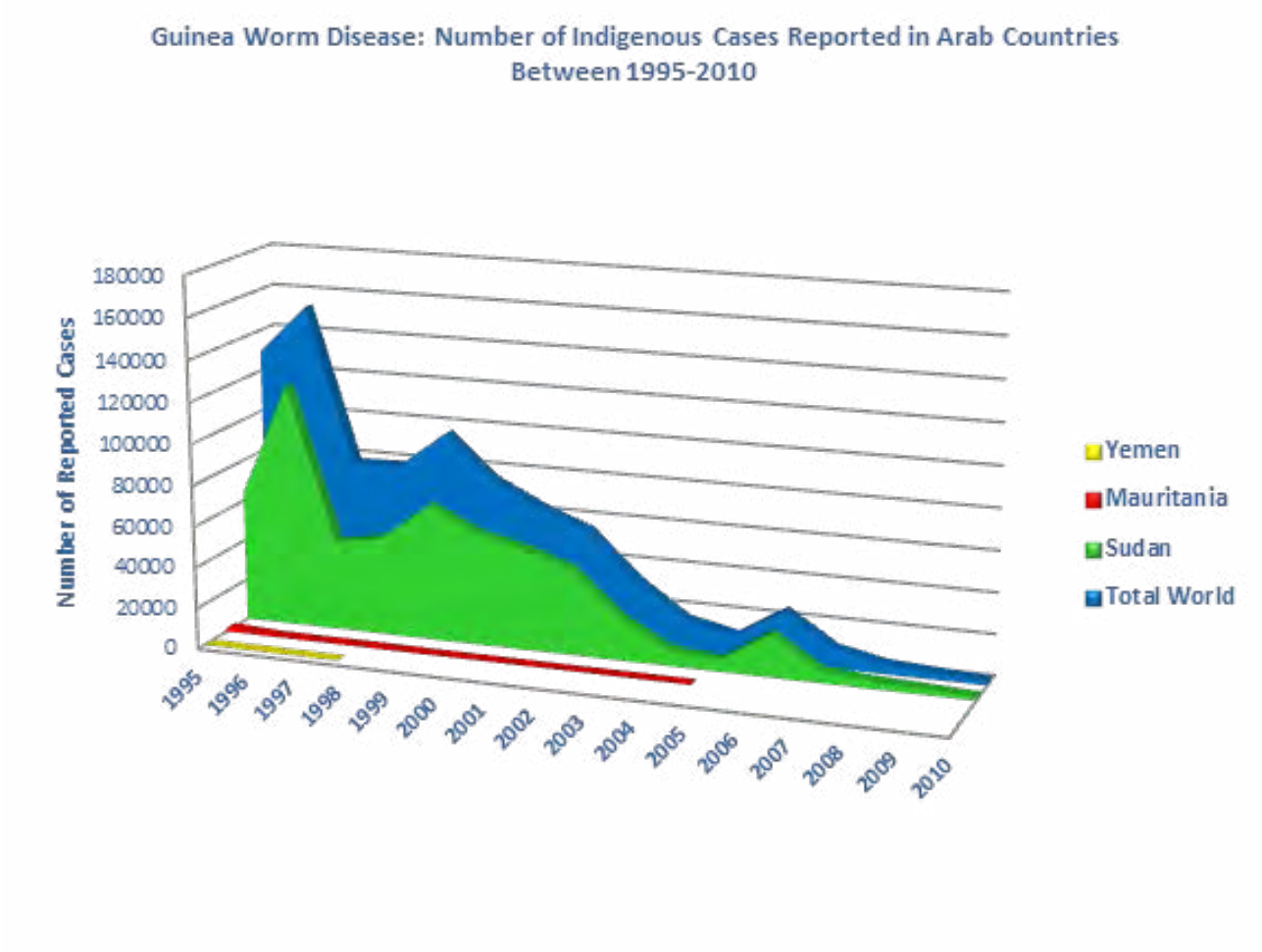

Figure 59. Guniea Worm Reported Cases in the Arab Region

Another important waterborne disease is cholera. Although many Arab Countries have been declared "Cholera Free", it is still a threat in some Arab Countries, as shown in Figure (60).

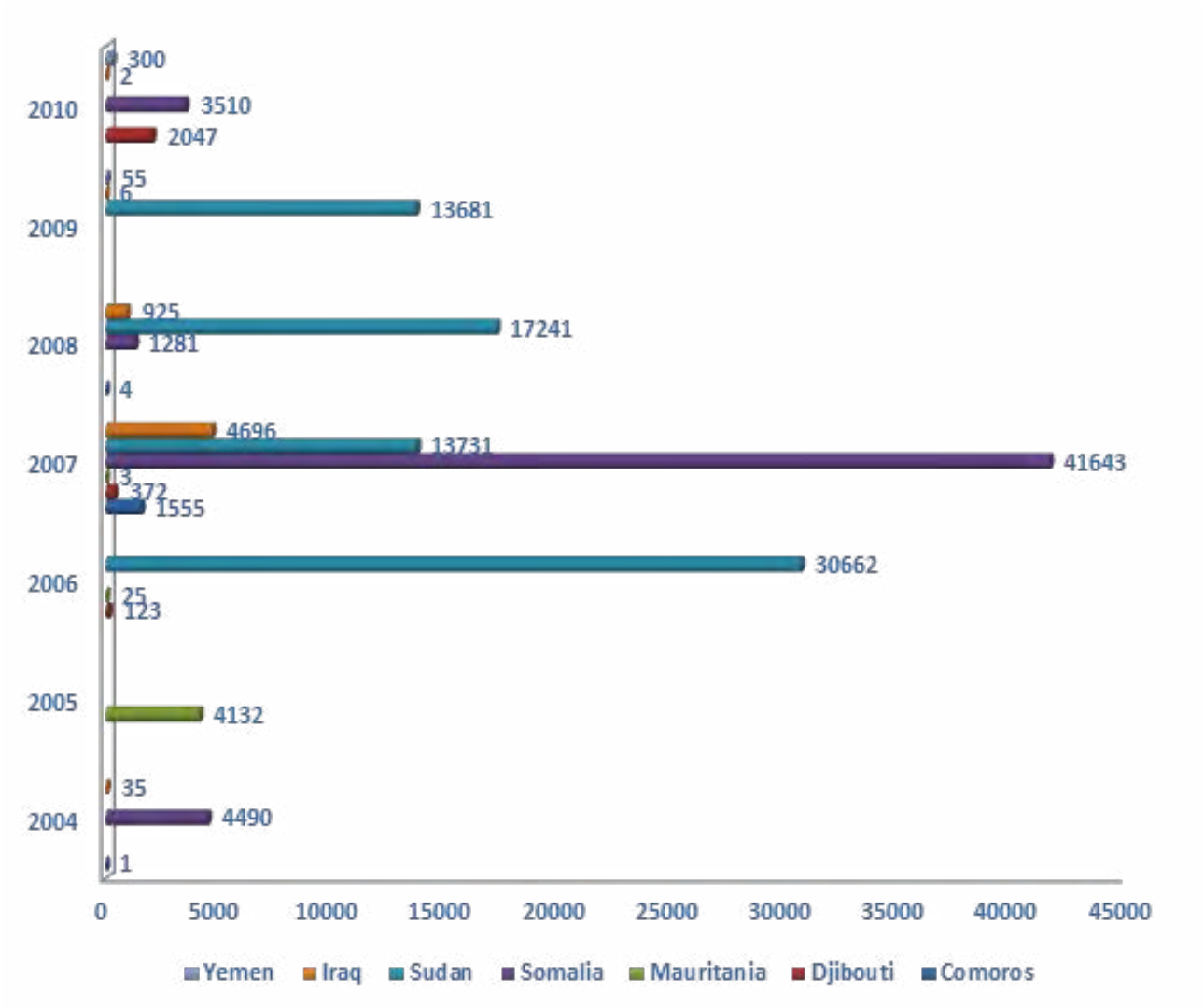

Figure 60. Cholera Reported Cases in the Arab Region from 2004 to 2010

Although diarrhea is attributed to both water and food, it is mostly caused by water for children within the age of 5. Figure (61) shows the prevalence of that disease within the latter group of children in Arab Region between 1998 and 2005.

Aside from diseases that are directly related to water, open defecation is an activity that causes various health threats, therefore, it is important to report the values of this important indicator under this category. Figure (62) shows the percentages of open defecation in the Arab region.

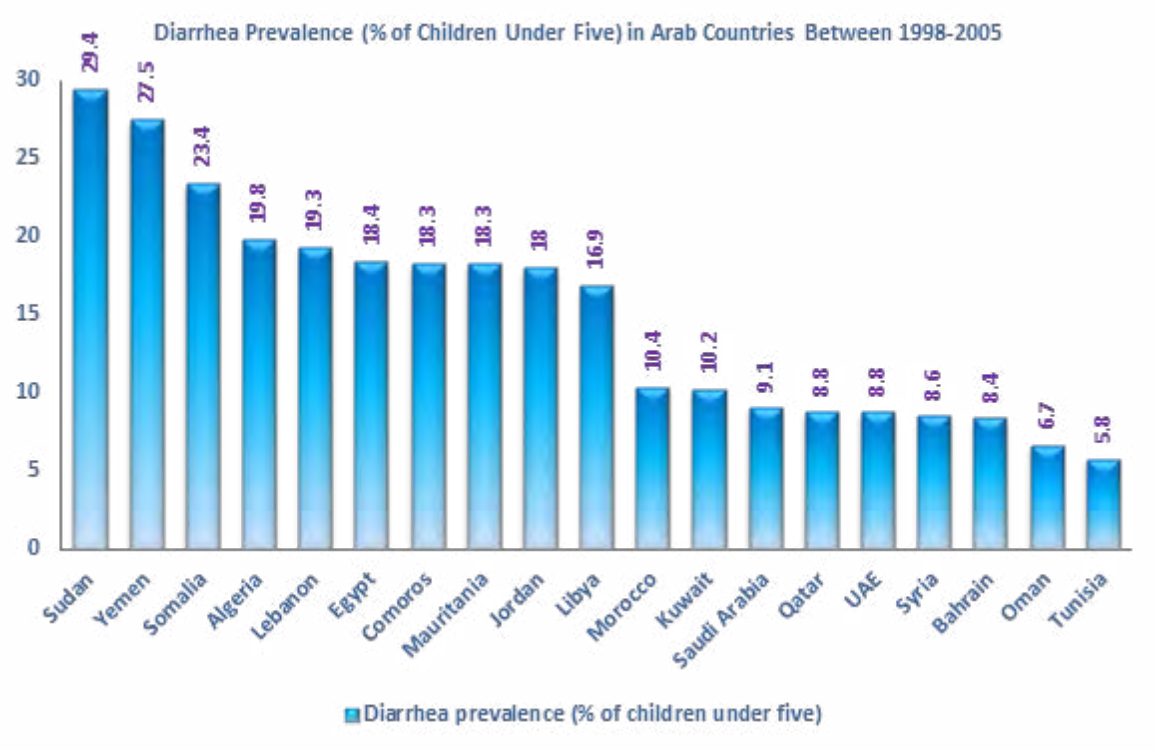

Figure 61. Diarrhea Prevalence in the Arab Region from 1998 to 2005

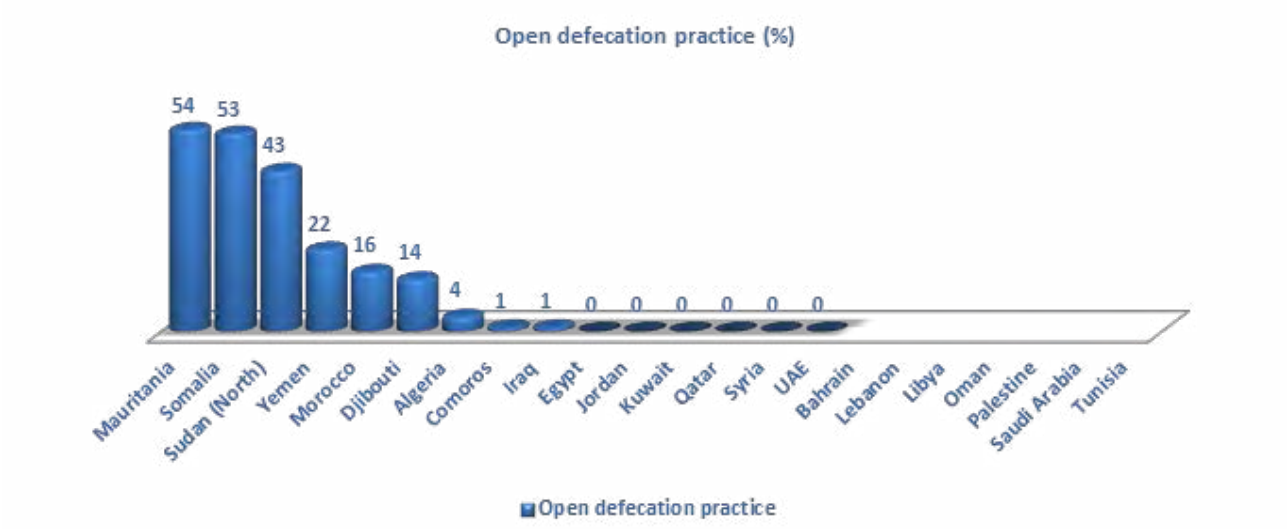

Figure 62. Open defecation in the Arab Region in 2010

h. Water & Climate

Despite the fact that extreme weather events are unpredictible, the statistical records of such events could provide essential information for decision makers in their future development plans. Many Arab Countries have seen Extreme Water Events, recently, such as Algeria in 2012 (Figure 51), Egypt in 2010 and 2012 (Figures (63 through 66), Jordan in 2011 (Figure (67)), Morocco in 2009 (Figure (68), Saudi Arabia in 2011 (Figure (69)), Somalia in 2012(Figure (70), Sudan in 2012 (Figure (71), and Yemen in 2008 (Figure (72)).

Figure 63. Flooding in Algiers, Algeria on 1/9/2012

Figure 64. Flooding in Sinai, Egypt on 9/1/2010

Figure 65. Flooding in Aswan, Egypt on 6/8/2010

Figure 66. Flooding in Alexandria, Egypt on 13/1/2012

Figure 67. Flooding in Amman, Jordan on 21/10/2011

Figure 68. Flooding near Casablanca, Morocco on 5/2/2009

Figure 69. Flooding in Jeddah, Saudi Arabia on 27/1/2011

Figure 70. Flooding in Somalia on 7/10/2012

Figure 71. Flooding in Sudan on 23/8/2012

Figure 72. Flooding in Yemen on 26/10/2008

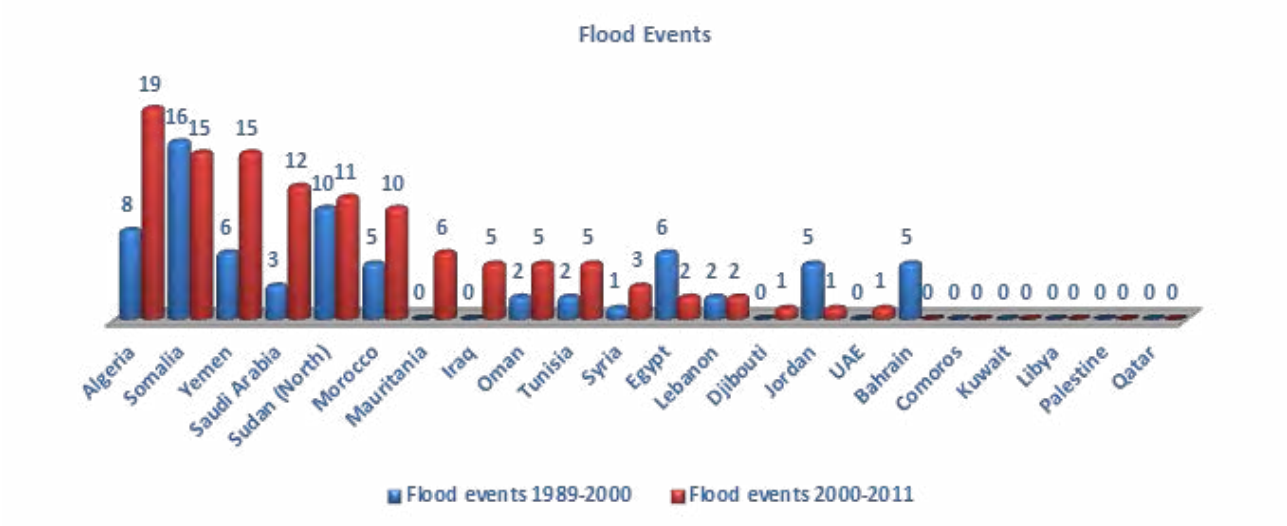

Figure 73. Flood Events in the Arab Region in the Last Two Decades

Figure (73) shows the flood events that occurred in the Arab Region in the last two decades according to the flood observatory of Dartmouth University which classifies floods into three categories as follows:

- Class 1 floods are large flood events causing significant damage to structures or agriculture; fatalities; and/or 1-2 decades-long reported interval since the last similar event
- Class 1.5 floods are very large events with a greater than 2 decades but less than 100 year estimated recurrence interval, and/or a local recurrence interval of at 1-2 decades and affecting a large geographic region (> 5000 sq. km)
- Class 2 flood events are extreme events with an estimated recurrence interval greater than 100 years

Between 1985 and 2011, Algeria had two large flood events with a severity greater than 1, and both occurred in the last decade. In November 2001, one flood of severity class 1.5 was reported, with a total of 24,000 people displaced and total damage of 300 million USD, the total affected area was estimated to be 970 Square Kilometers. In October 2008, one flood of severity class 2 was reported with a total affected area of 34760 square Kilometers. Figure (74) summarizes Algeria's recent history with flood events.

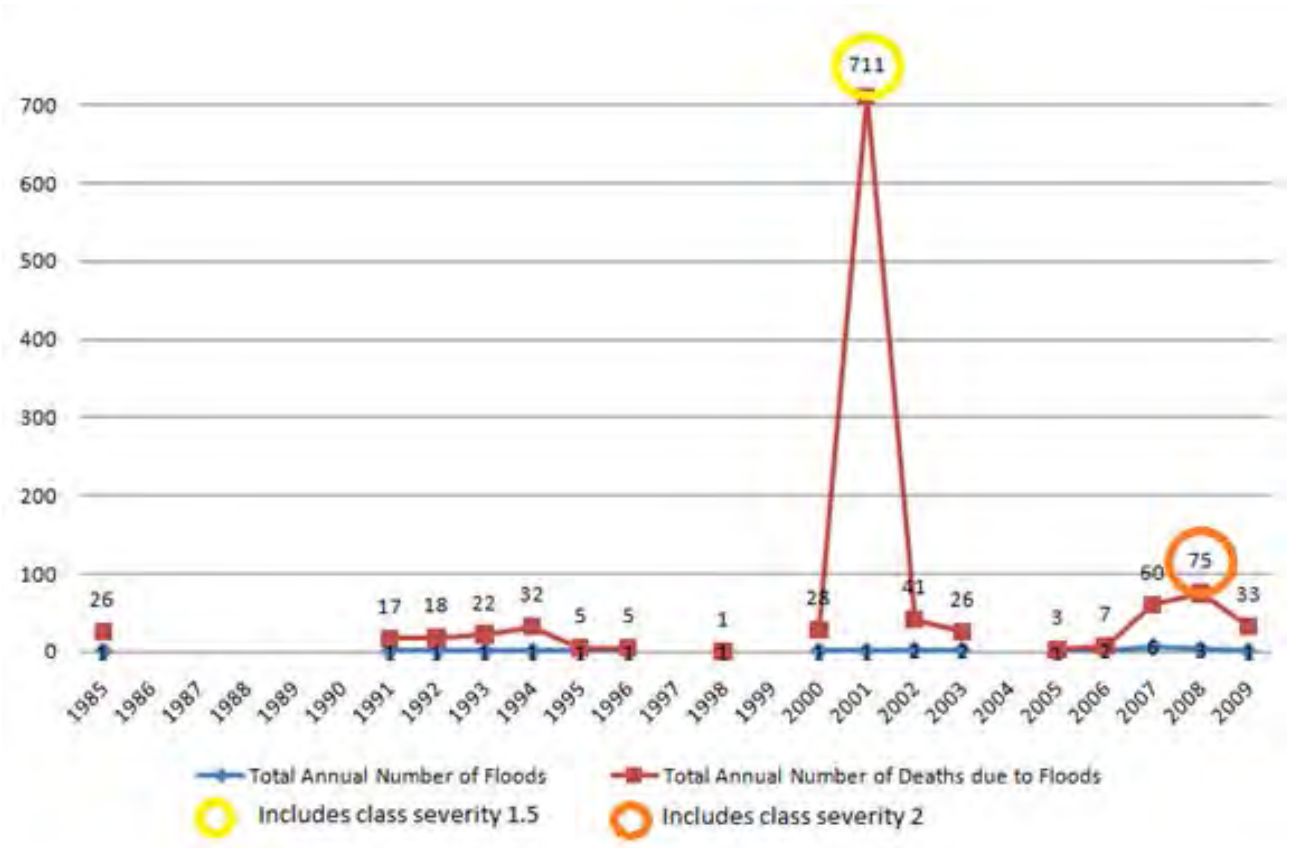

Figure 74. Different Classes of Flood Events in Algeria in the Last Two Decades

Between 1985 and 2011, Yemen had three large flood events with a severity greater than 1, 2 of which occurred in the last four years. In October 2008, one flood of severity class 2 was reported, total number of people displaced as a result of those two floods was 6,800 and the total affected area was 133,200 square kilometers. In July 2010, one flood of severity class 1.5 was reported with a total affected area of 176,300 square kilometers. Figure (75) summarizes Yemen's recent history with flood events.

Figure (76) shows the total number of floods that occurred in each Arab Country in the period between 1989 and 2009 and it shows that Algeria, Yemen, and Somalia were the most vulnerable to floods in that period followed by Sudan, Morrocco, and Mauritania.

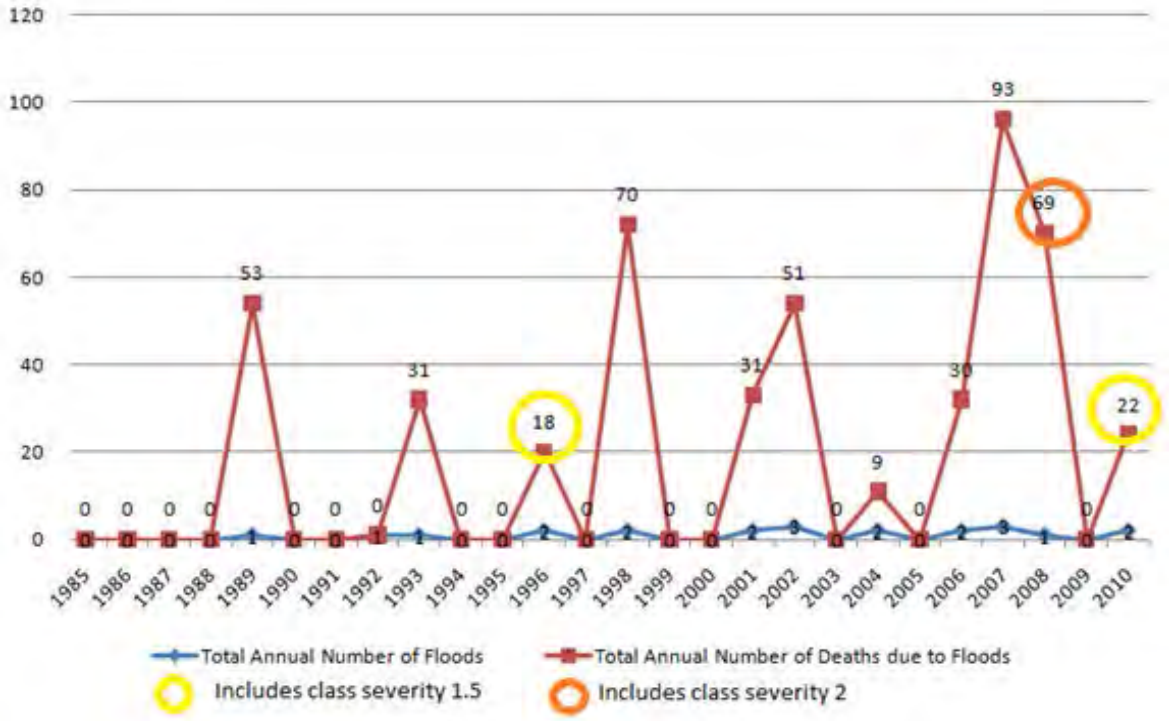

Figure 75. Different Classes of Flood Events in Yemen in the Last Two Decades

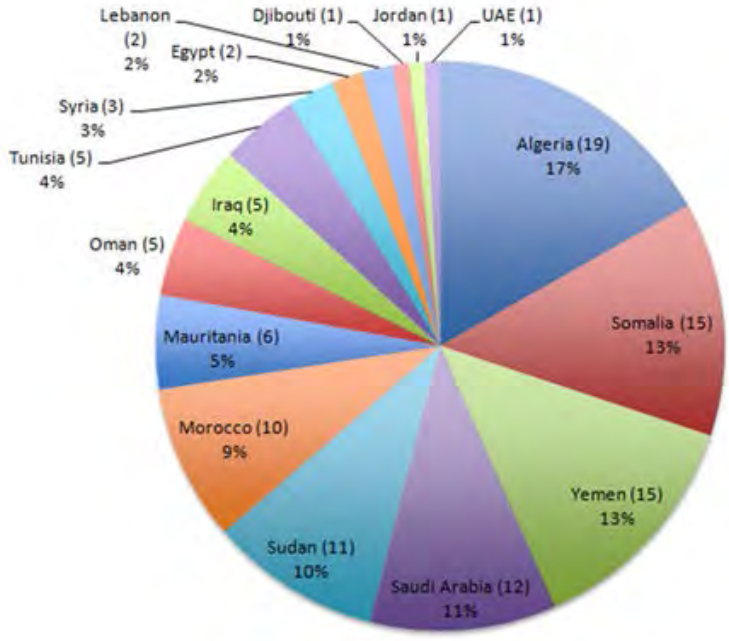

Figure 76. Total Number of Floods in the Arab Region from 1989-2009

i. Water & Economics

This section describes the economics involved in and related to the different aspects of the water sector. Figure (77) shows the public expenditures that some Arab countries directed to the Water Sector between 2011 and 2013, while Figure (78) shows the the Arab and Foreign Aid received by some Arab Countries in 2009. It is clear that Iraq was the highest recipient of aid among all Arab Countries for obvious reasons during the military occupation and post-occupation period.

The relation between Water and Economics could also be manifested through the revenues generated by withdrawing water for different water use sectors which is known as the Water Productivity and is defined as the total GDP added per unit volume of water withdrawn for a particular sector. The two most common water use sectors in the Arab Region are the Agricultural and Industrial sectors. The Agricultural and Industrial Water Productivity in the Arab Region are shown in figures (79) and (80) respectively. While it is clear that the use of water in industry contributes more to the overall National GDP compared to agriculture, there are other aspects that should be considered when the significance of withdrawing water for both sectors is assessed and compared, such as the contribution to National Security, and the jobs created per unit withdrawal.

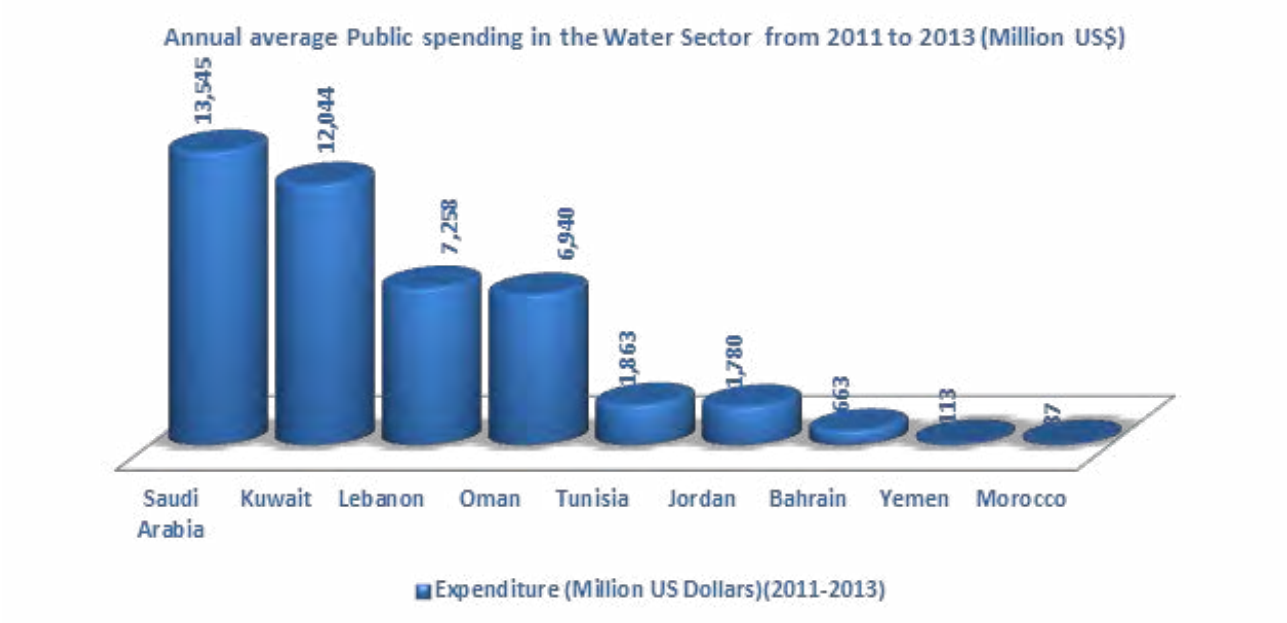

Figure 77. National Average Spending in Selected Arab Countries

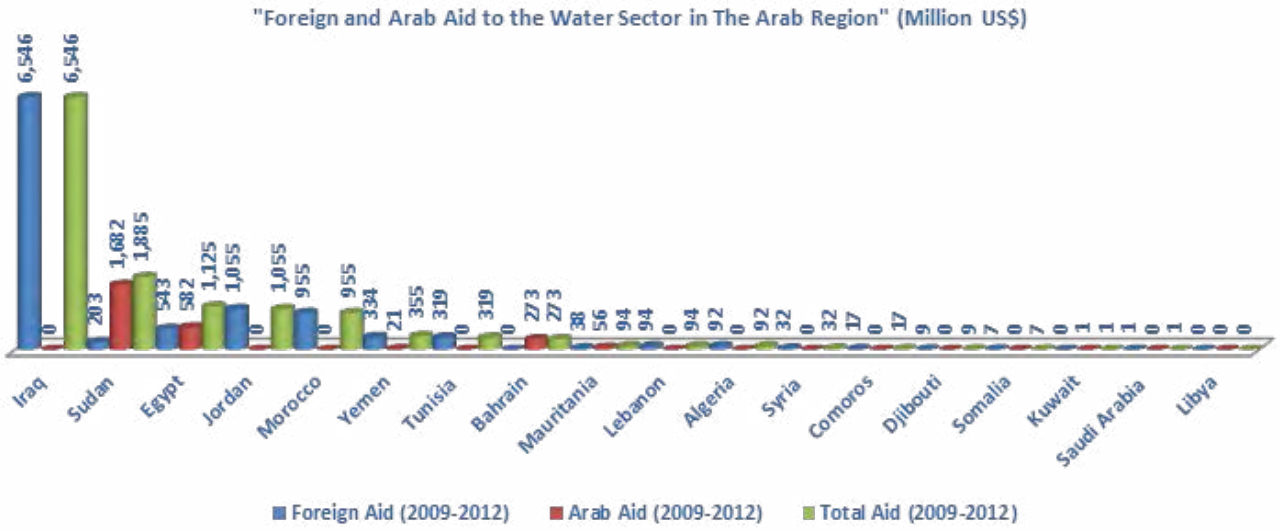

Figure 78. Arab and Foreign Aid directed to the Water Sector in Selected Arab Countries

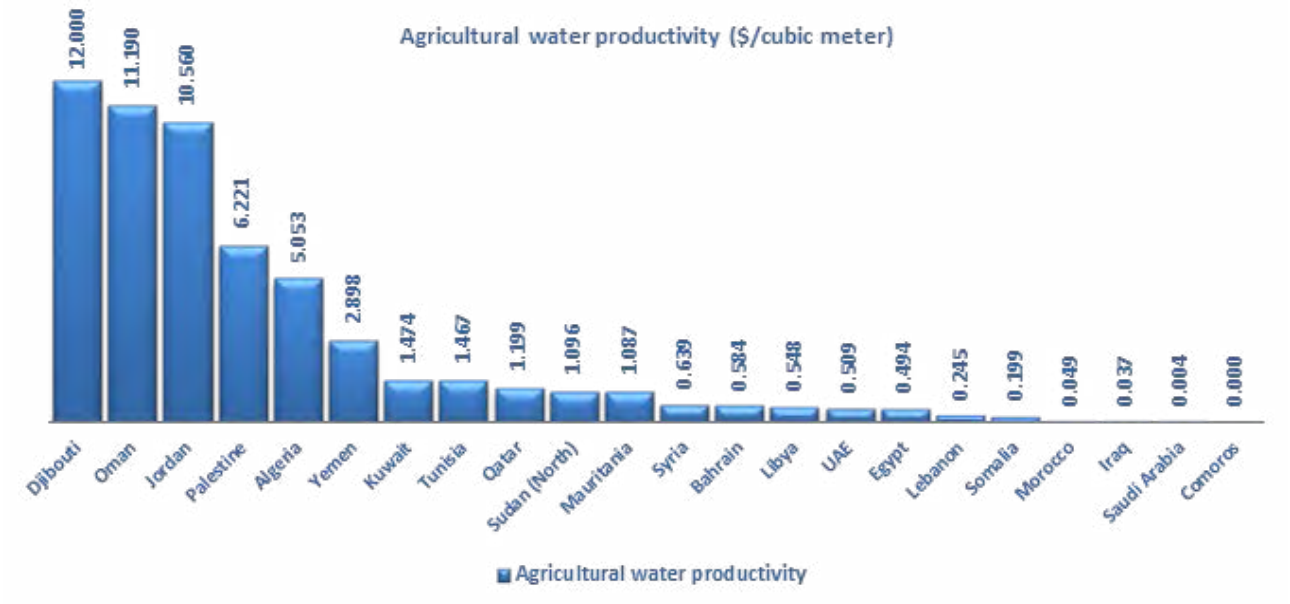

Figure 79. Agricultural Water Productivity in the Arab Region

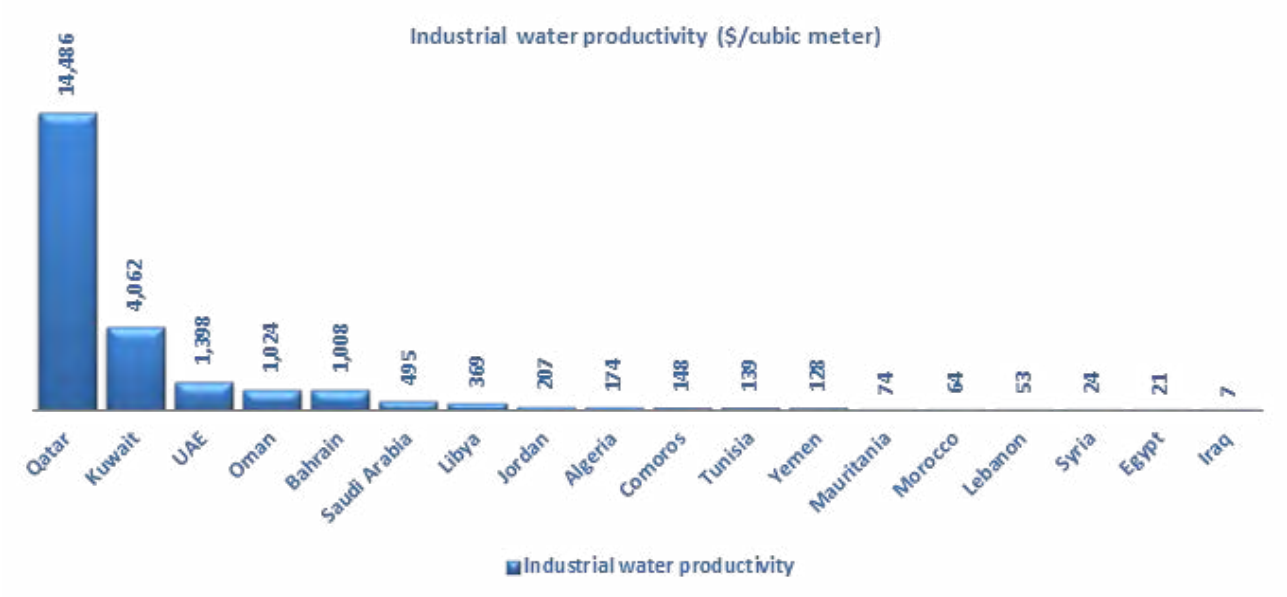

Figure 80. Industrial Water Productivity in the Arab Region

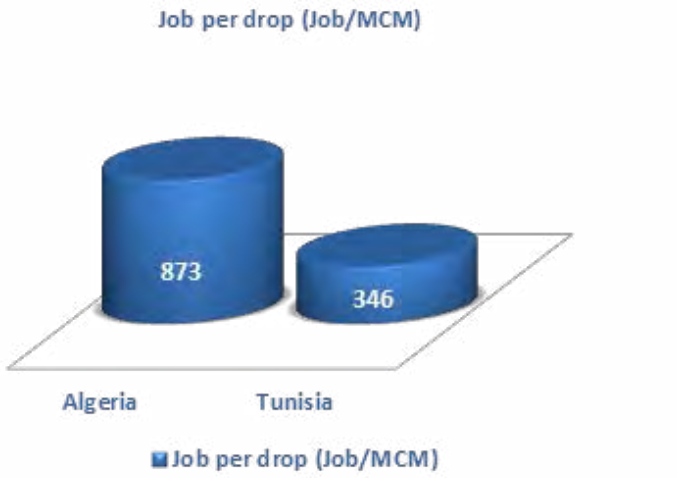

Figure 81. Employment in Agriculture related to Agricultural Water Withdrawals

While Agricultural and Industrial Water Productivity are two important indicators to assess the economic significance of withdrawing water for both sectors, they do not give the complete socio-economic picture, another important aspect to consider would be the number of jobs created and/or maintained by withdrawing water for each sector. Figure (81) shows the jobs in the agricultural sector corresponding to every MCM withdrawn for the same purpose in all Arab Countries. It is clear that Somalia and Algeria have the highest Agricultural "Job per drop".

Another important aspect relating water to economics is the amounts of water embedded within traded goods, which is now globally referred to as "Virtual Water" and is defined as the volume of freshwater used to produce the product, measured at the place where the product was actually produced. Hoekstra and Chapagain (2001) provided reference tables that approximate the volume of water needed to produce one kilogram of different crops, meat, and industrial products. Therefore, the volume of water used to produce a certain product can be estimated

by multiplying these reference values (or any similar values provided in the national and global literature) by the total annual produced amount of the same product. In the same manner, it is possible to estimate the amount of water embedded in imported and exported products. Figure (82) shows the total amounts of imported and exported agricultural and meat and dairy imports seem low. 90% of meat is imported and the equivalent virtual water embedded in them, and Figures (83), and (84) show the total virtual water imports and exports in different Arab Countries.

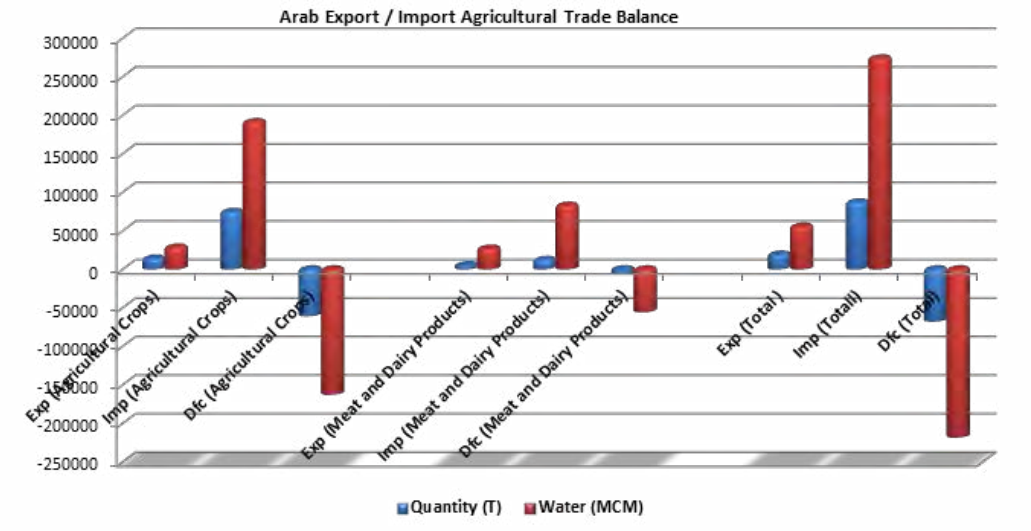

Figure 82. Virtual Water Trade in the Arab Region

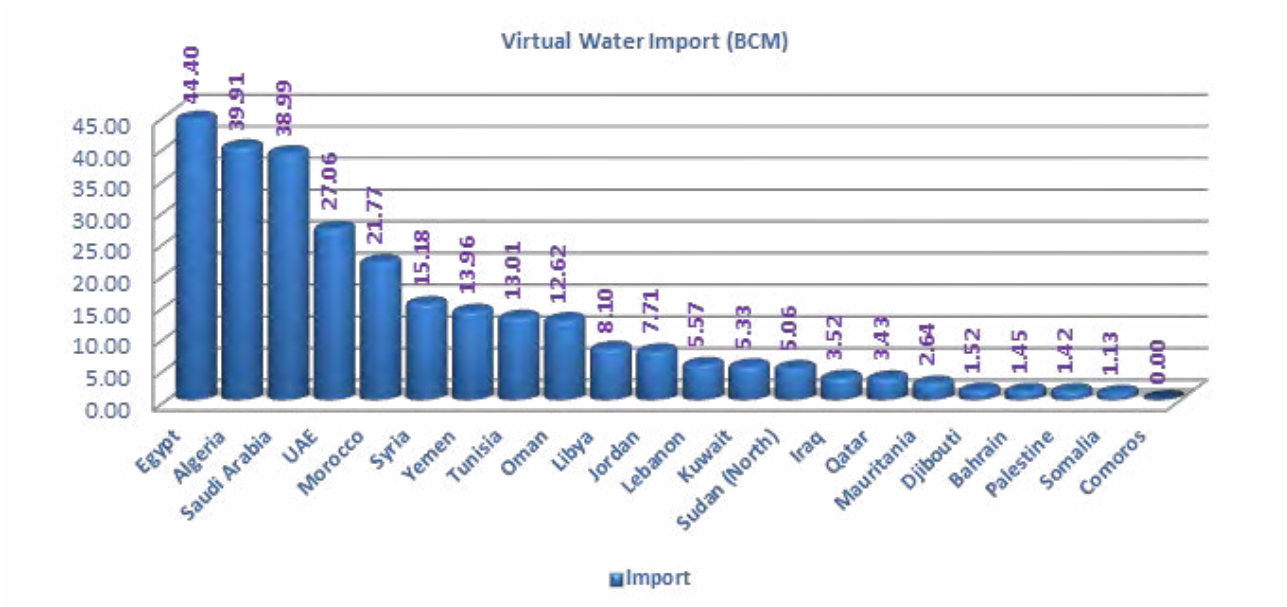

Figure 83. Virtual Water in the Agriculture Sector Imports in the Arab Region

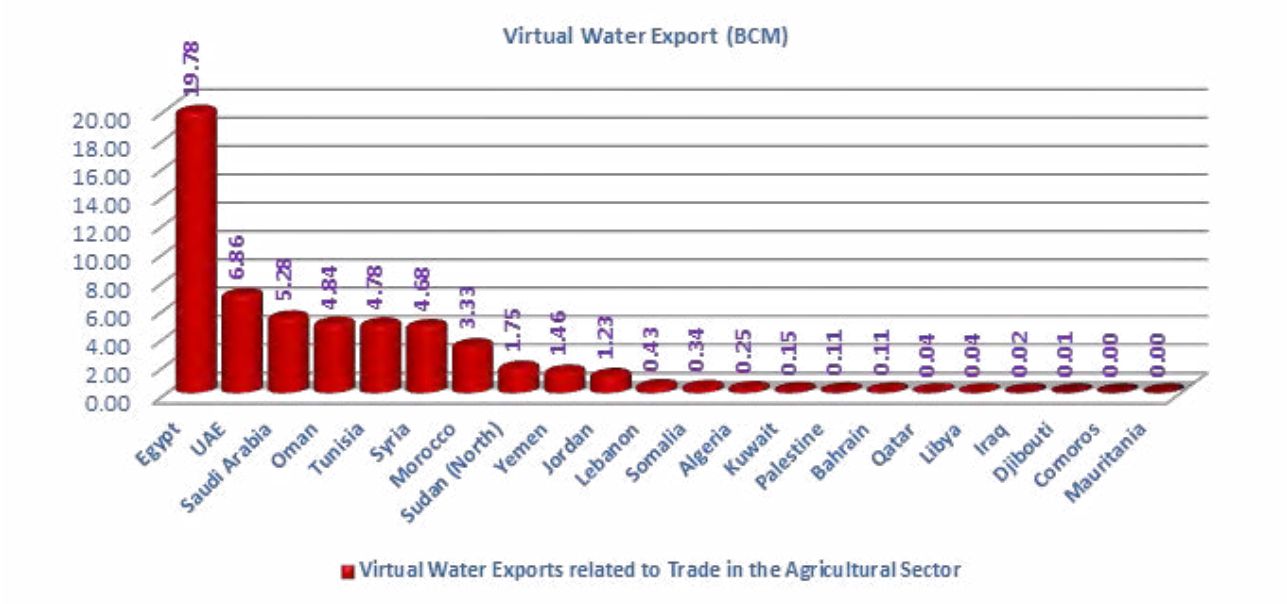

Figure 84. Virtual Water in the Agriculture Sector Exports in the Arab Region

An overall look at food production in the Arab Region shows that 231 BCM of Blue Virtual Water were embedded in Agricultural products in 2012 compared to 169 BCM in 2004 (AWC & CEDARE, 2004), 51 BCM of Virtual Green Water were used for local food production in 2012 compared to 44 BCM/year in 2004 (AWC & CEDARE, 2004, as shown in Figure (85). The total amount of virtual water in locally produced food in the Arab Region amounted to 282 BCM in 2012 out of which 55 BCM of vitual water were expanted. Where as the total volume of imported virtual water reached 274 BCM/year as shown in Figure (86).

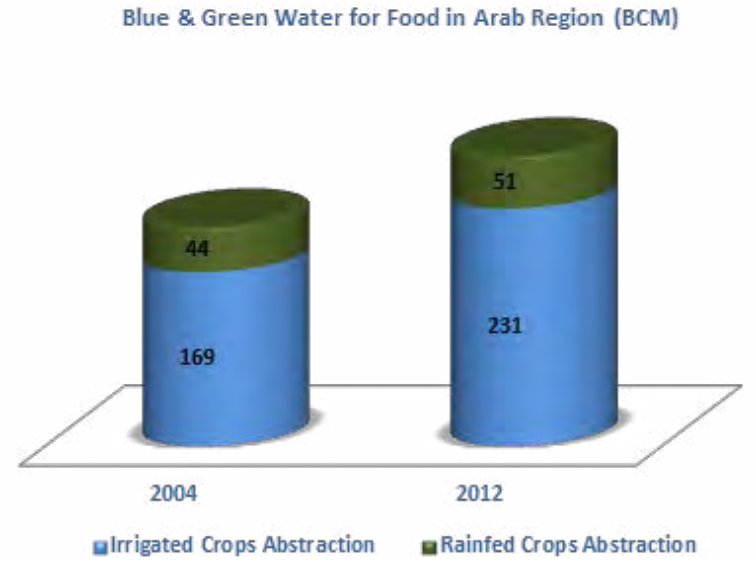

Figure 85. Blue and Green Virtual Water for food in the Arab Region (2004 - 2012)

Compared to data of 2004 (Figure 86) which shows virtual water embedded in locally produced food of 213 BCM/year, exported virtual water of 57 BCM/year (Goueli & Mohamed, 2006) and imported virtual water of 292

BCM/year (Goueli & Mohamed, 2006), may be included it that the Arab countries increased water contribution to local food production and decreased its food imports & exports. It's to be noted that intra Arab food trade was not considered.

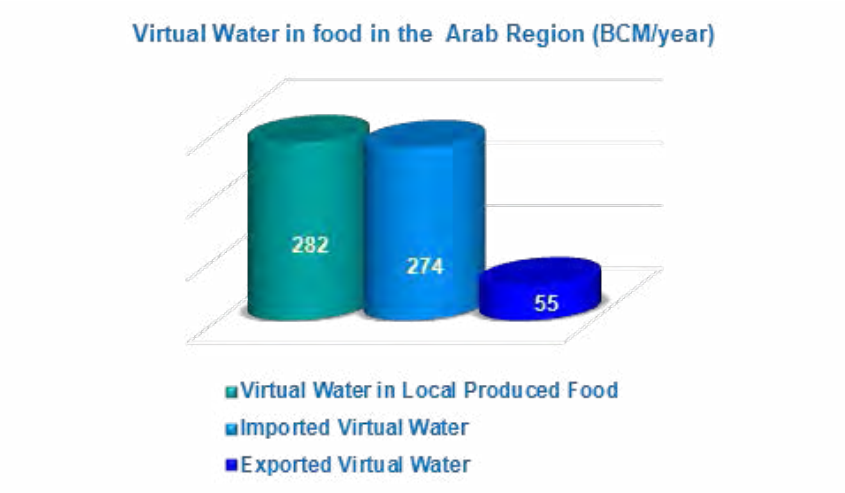

Figure 86a. Virtual Water for food in the Arab Region (2012)

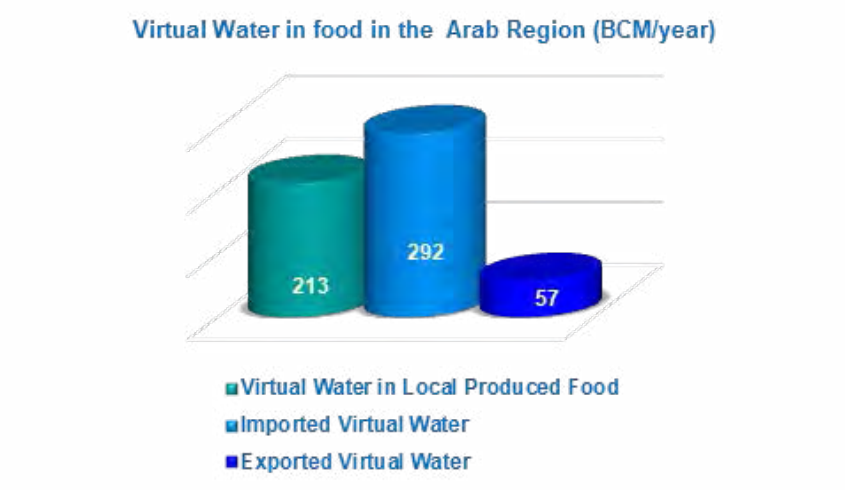

Figure 86b. Virtual Water for food in the Arab Region (2004)

Another important aspect that links water to economics and also to population is affordability, the ability of each household to bear the water and sanitation groups is assessed within the lowest income group in selected Arab countries. The affordability has been reported as a percentage of the average household income as shown in Figure (87).

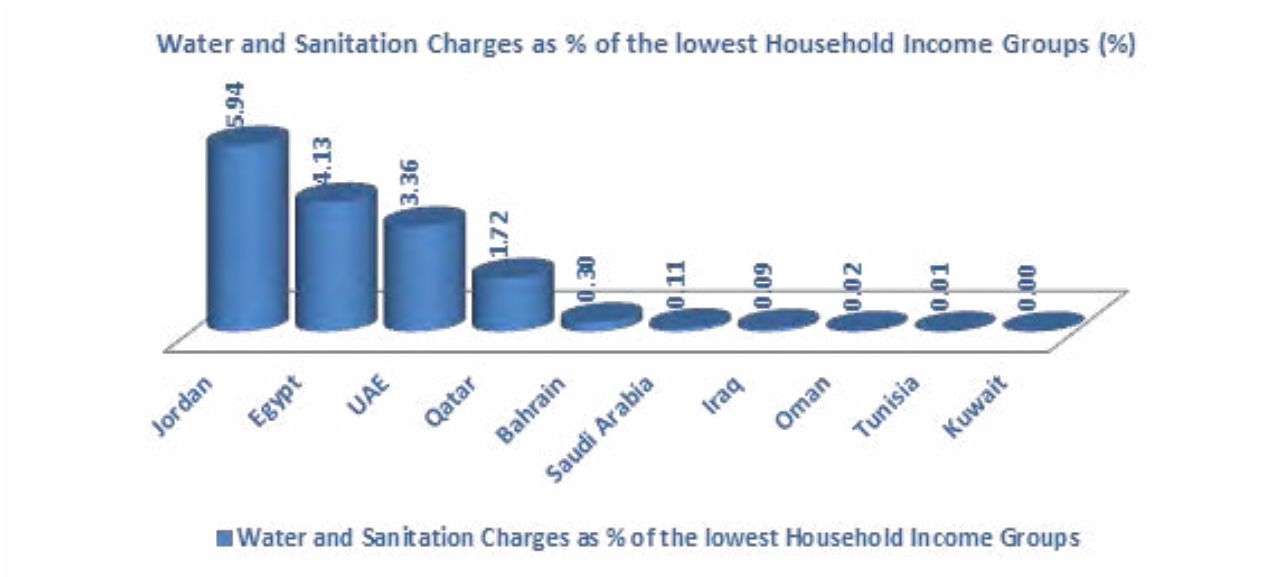

Figure 87. Water and Sanitation Charges in the Arab Region

j. Water & Political Affairs

Water is related to political and foreign affairs through shared water resources. The presence of shared rivers or aquifers imposes a certain level of political understanding and cooperation between different riparians. Figure (88) shows the ratio of internal to external renewable water resources for all Arab countries; it shows that 12 Arab countries depend on external water resources, which showcases the necessity of developing strong political ties between these countries and other riparians in their basins.

One of the most globally renowned documents related to Shared Water Resources is the 1997 UN Convention on the Non-Navigational Use of International Water Bodies. The Arab Region was an important key player in the different phases of progress for that document. While Egypt was the only Arab Country to openly express some concerns related to the convention, many Arab countries voted in favor of that convention in May of 1997 when it was first open for voting, and eventually many Arab countries have ratified the Convention as shown in Figure (89).

Agreements or Memorandums of Understanding between countries that share a water source are essential for peaceful future developments related to the Basin/ Aquifer of interest. There are various issues that riparian countries could agree on including but not limited to: sharing water resources, sharing benefits, water transfer projects, and building water regulating structures.

There are different examples of shared water bodies in the Arab Region, the Nubian Sandstone Aquifer System (Figure (90) that Egypt, Libya, and Sudan share with Chad is one of the biggest fossil aquifers in the world. It has been mostly utilized by Egypt and Libya who have the highest need among the four riparians. Moreover, Libya has been developing huge water transfer projects in different locations in the aquifer domain as shown in Figure (91) . The Disi Aquifer shared between Jordan and Saudi Arabia is another strategic aquifer and is regarded as a potential future alternative to more politically complicated projects such as the "Red-Dead" Canal (Figure (92)).

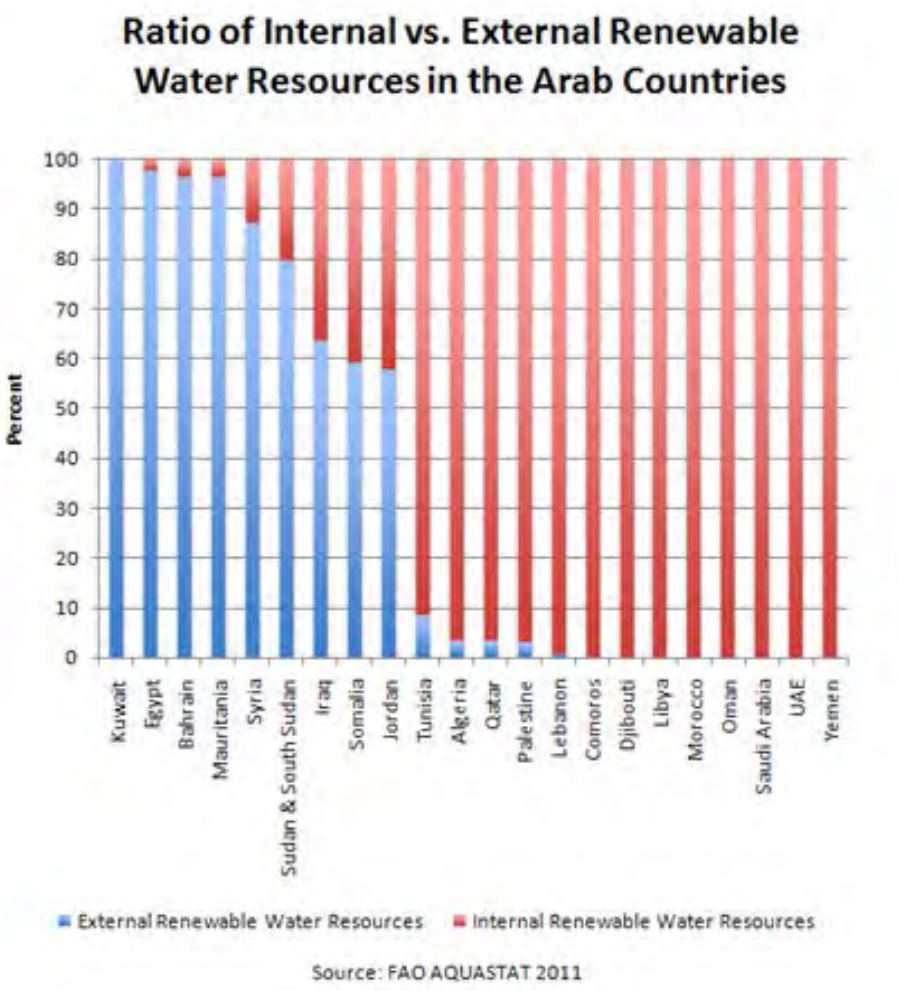

Figure 88. Ratio of Internal to External Water Resources in the Arab Region

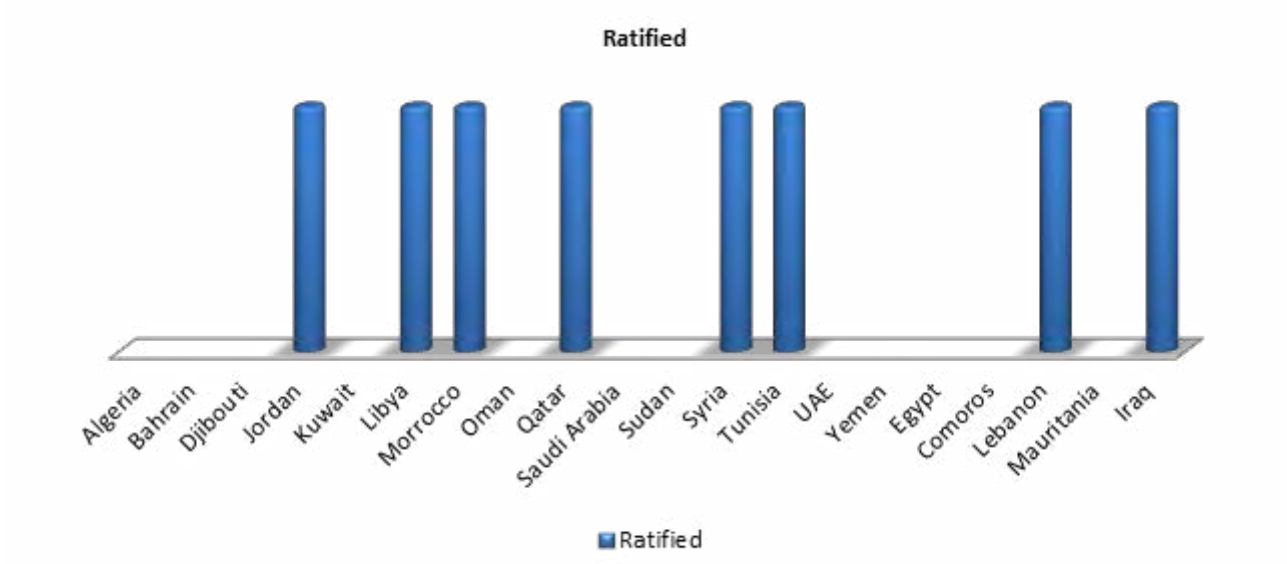

Figure 89. Arab Countries that ratified the 1997 UN Convention

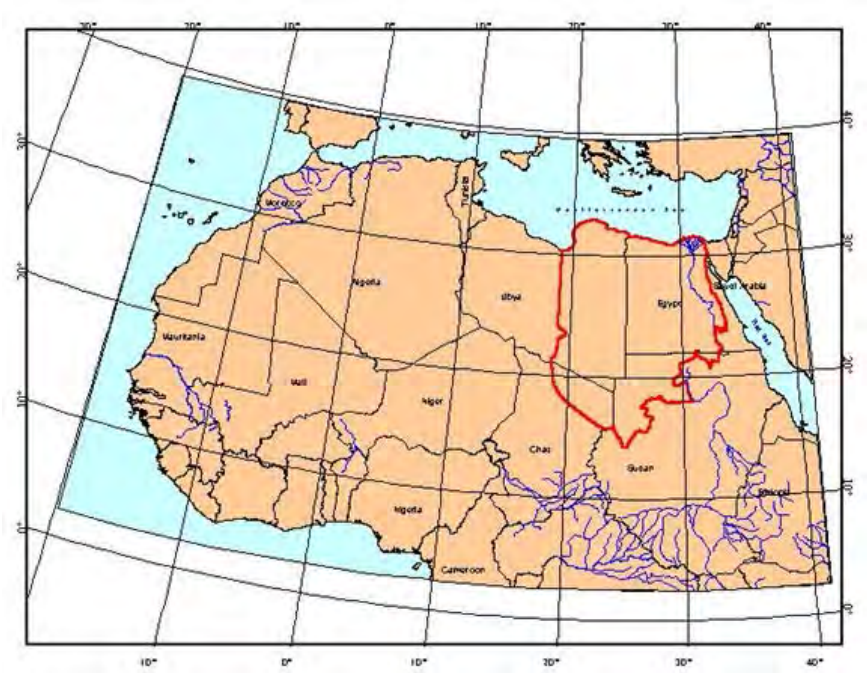

Figure 90. Nubian Sandstone Aquifer

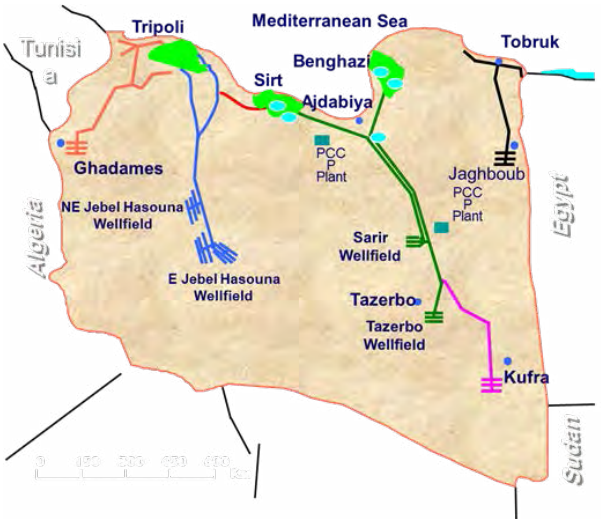

Figure 91. Nubian Aquifer Transfer Projects in Libya

Figure 92. The DISI Aquifer

When water shares in Transboundary basins are considered, it is of great importance to consider the total renewable water resources in the whole basin which is the sum of Blue and Green Water as explained in this chapter. The Total Renewable Water Resources in the Nile Basin is a big portion of the total basin precipitation volume that amounts to 1660 BCM and is distributed among the basin countries as shown in Figure (93) which shows that Egypt have the lowest basin precipitation.

Figure (94) shows the per capita share of Green and Blue Water in the Euphrates Basin for each Basin country with a clear evidence that both Green and Blue Water are of equal significance in Syria and Iraq.

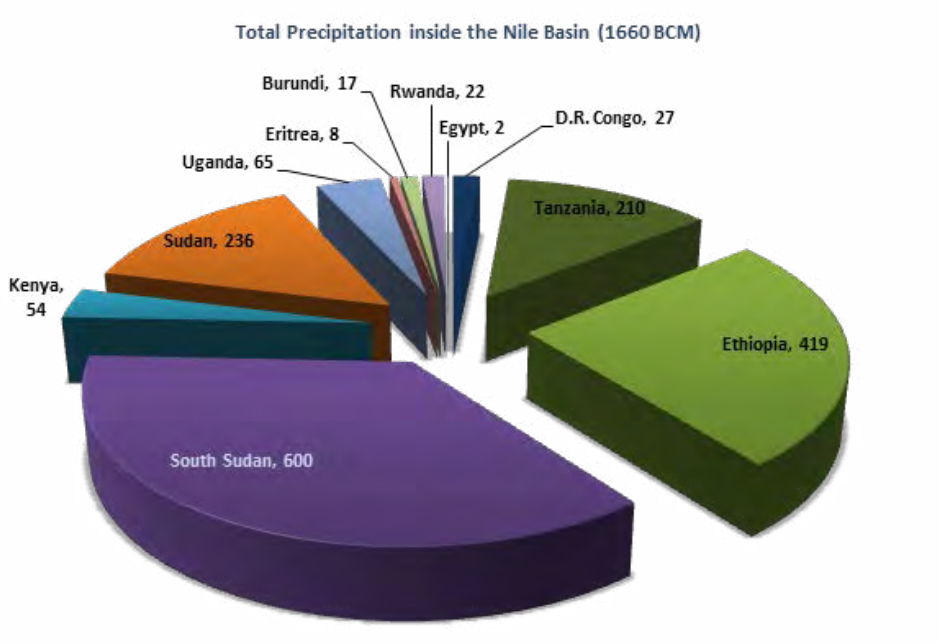

Figure 93. Nile Basin Annual Average Precipitation (BCM/year) (AbuZeid, K., 2012)

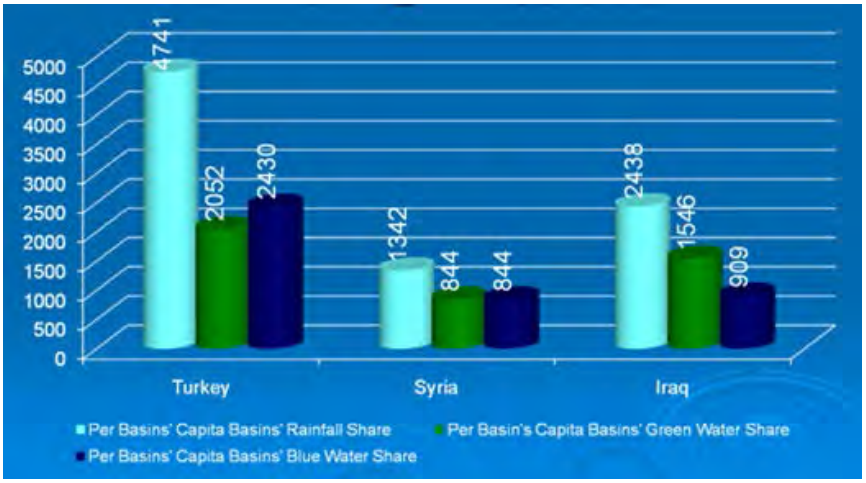

Figure 94. Euphrates Basin Resources per Capita (AbuZeid, K., 2012)

Countries State of the Water Reports

Algeria

Algeria

The average annual rainfall is about 56 mm varying considerably from zero in the southern desert to 1500 mm at the northeastern coastal area which could give an explanation as to why 90% of Algerians live in the Northern part on only 13% of the land. Precipitation, which mainly occurs in winter and early spring, is highly irregular and accounts for 134 BCM/Year of internal renewable water resources. The beneficial uses for rain fed agriculture, pasture, and forest areas which is known as Green Water, is estimated to be 15.56 BCM/Year. Transboundary incoming surface flow (from Tunisia and Morocco) is estimated at 0.12 BCM/Year and the safe extract of nonrenewable fossil water is around 2 BCM/Year. The Total Renewable Blue Water Resources is 28.79 BCM/Year in 2012 where the total population is about 35 million inhabitant, thus generating a per capita share of Renewable Blue Water Resources of 379 CM/capita. The potentially available Blue Water at the northern part is estimated at 8.1 BCM, out of which 1.6 BCM is attributed to groundwater, and 6.5 BCM is surface water which needs regulation by dams. The irrigation potential based on annual Renewable Blue Water Resources is estimated at 510,000 ha. The water supply coverage is assessed as 83 % while the sanitation coverage was 95% (WHO, UNICEF).

The population growth at a rate of 2.3 %, increased demand for food, attempts for industrialization, along with the frequent occurrence of extended dry periods are all putting pressure towards advances in water resource management. Major changes during the last twenty years include the establishment of a series of dams with a total dam capacity of 1.2 BCM. At the beginning of the 1990s a program was set forward for the rehabilitation and extension for existing irrigation schemes to achieve a total area of 500,000 ha of equipped and irrigated land. The total number of dams as of 2010 is 68 with a total dam capacity of 5.7 BCM.

Dam reservoir sedimentation is identified as a main environmental problem which reaches more than 95% of siltation at some locations. Soil salinization tends to be of primary concern during the last decade characterized by extended dry periods. Water purification techniques are below standard and poor drinking water is a leading cause of disease and infant mortality. Alarming pollution of the water reserves at Mitjdja, the main supply for the capital, is encountered due to municipal and industrial wastes along with agricultural drainage. Nitrate concentration in some wells reached 100 mg/l in 1988.

Over the last few years, Algeria has achieved huge water transfer projects in several regions. A huge hydraulic infrastructure was built to allow the transfer of ground water from In Saleh to Tamanrasset via pipes of over 1,200 km of total length, an investment worth a reported sum of about US $ 2 billion. The In Salah-Tamanrasset water transfer project has a water conveyance capacity of 100,000 cubic meters per day (Algeria Press Service).

Algeria has been known to be one of the flood prone countries, a total number of 13 floods have occurred from the period of 2005 to 2009 (Arab Dartmouth flood Report).

Algeria is the tenth largest country in the world, its GDP is estimated at $ 189 billion in 2011 representing the fifth highest GDP in the Arab world. The agriculture share values at 7% of total GDP estimated at $ 13,644 million whereas the share of industry (which includes oil and gas) is about 62% of total GDP. The Gross National Income per Capita in 2011 was estimated at $ 4,470 per year. According to the bilateral commitments

between Development Assistance Committee (DAC) countries of the Organization for Economic Cooperation and Development (OECD) and Arab countries, Algeria has received in the water sector and sanitation Official Development Aid ranging from $ 10.15 million in 2005 to $ 2.23 million in 2011. After the local political unrest erupted in 2011, Algeria received the least amount of aid since 2005. In 2009, Algeria received the highest amount of aid valued at $ 19.09 million. The private sector investment in water and sanitation was estimated at $ 468 million in 2009.

The annualized capital cost for one unit of house connection for water supply in urban areas is estimated at $ 15.1 in 2010 and in rural areas at $ 28.9. The annualized cost of well per unit in rural areas is $ 12.4 and in urban areas $ 12.8. The annualized capital cost per unit for sanitation for one septic tank is $ 11.7 in rural areas and $ 18.8 for a sewage connection in urban areas, and the pit cost is $ 5.8 in rural areas and $ 19.1 for the septic tank in urban areas. The total capital investment needed during the period 2010-2015 to reach the sanitation MDG coverage target is estimated at $ 149 million and about 455 thousand people to be covered. When for the capital investment needed for universal sanitation coverage is estimated at $ 1 billion at the value of 4,106 thousand people to be covered. As for the water supply sector, Algeria requires $ 2 billion to achieve the MDG target which is translated at about 5,133 thousand people to be covered, and $ 1.5 billion to achieve universal water supply coverage which is equal to 2,978 thousand people requires coverage.

Agriculture is the major water use sector in Algeria. The gross agriculture production in 2010 reached 13,644 million $, and food exports in the same year was estimated at $ 5,515 million. In 2010, Algeria produced 4.56 million tons of cereals, and imported 7.93 million tons of cereals at $ 2,325 million. In 2009, Algeria exported 6030 tons of cereals at a value of $ 1.82 million. In 2009, Algeria produced about 4.54 million tons of vegetables, and 2.99 million tons of fruits. In 2010, Algeria's virtual water exports amounted to 251 million cubic meters MCM which had the products value of $ 54.67 million. Total agriculture imports' virtual water was estimated at 39,912 MCM which translates to about $ 5 billion.

Gross Theoretical Hydropower Potential in Algeria was estimated at 12,000 Giga Watt hour per year in 2009, and the technically feasible hydropower potential was estimated at 4,000 Giga Watt hours per year. As of 2008, the installed hydropower capacity reached 278 MegaWatt hours. The hydro power generation reached 560 Giga Watt hours which represents 2.7% of the total power production in Algeria.

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Algeria Water Indicators

Water Related Indicators	Units	Algeria	Notes
Water Availability			
Annual Average Precipitaion Depth	MM/Year	56	
Annual Average Precipitation Volume	BCM/Year	134	
Internal Renewable Surface Water (IRSW)	BCM/Year	11	
Internal Renewable Groundwater (IRG)	BCM/Year	2.5	
Total Internal Renewable Blue Water Resources (TIRBWR)=(IRSW+IRG)	BCM/Year	13.5	
External Surface Water Inflow (ESWI)	BCM/Year	0.12	
External Surface Water Outflow (ESWO)	BCM/Year	0.32	
External Groundwater Inflow (EGI)	BCM/Year	0.03	
External Groundwater Outflow (EGO)	BCM/Year	0.1	
Total External Renewable Blue Water Resources (TERBWR)=(ESWI+EGI)	BCM/Year	0.15	
Total Renewable Blue Surface Water (TRBSW)=(IRSW)+(ESWI)-(ESWO)	BCM/Year	10.8	
Total Renewable Blue Groundwater (TRBG)=(IRG)+(EGI)-(EGO)	BCM/Year	2.43	
Overlap Between Surface Water and Groundwater (OSW)	BCM/Year	0	
Total Renewable Blue Water Resources (TRBWR)=(TRBSW)+(TRBG)-(OSW)	BCM/Year	13.23	
Total Rainfed Agriculture Abstractions	BCM/Year	1.46	
Total Natural Pasture Abstractions	BCM/Year	6.10	
Total Forest Abstractions	BCM/Year	8.00	
Total Renewable Green Water Resources (TRGWR)	BCM/Year	15.56	
Total Renewable Water Resources (TRWR)=(TRBWR+TRGWR)	BCM/Year	28.79	
Produced Municipal and Industrial Wastewater (PMW)	BCM/Year	1.2	
Treated Municipal and Industrial Wastewater	BCM/Year	0.8	
Reused Treated and Industrial Municipal Wastewater	BCM/Year	0	
Produced Agricultural Drainage (PAD)	BCM/Year	0	
Reused Agricultural Drainage	BCM/Year	0	
Produced Desalinated Water (PDW)	BCM/Year	0.54	
Total Non-Conventional Water Resources (TNCWR)=(PMW)+(PAD)+(PDW)	BCM/Year	1.74	
Total Non Renewable Groundwater Resources (TNRGR)	BCM/Year	2	
Total Conventional Water Resources (TCWR)=(TRWR)+(TNRGR)	BCM/Year	30.79	
Total Available Water Resources (TAWR)=(TCWR)+(TNCWR)	BCM/Year	32.53	
Water Withdrawals and Consumption			
Annual Total Water Withdrawal	BCM/Year	4.5	
Withdrawals by the Domestic Sector	BCM/Year	1.13	
Withdrawals by the Industrial Sector	BCM/Year	0.68	
Withdrawals by the Irrigated Agriculture Sector (Blue Water+Non-conventional Water)	BCM/Year	2.7	
Agricultural Consumption from Green Water	BCM/Year	1.46	
Total Agricultural Withdrawals	BCM/Year	4.16	
Withdrawals From Blue Surface Water	BCM/Year	N/A	
Withdrawals From Blue Groundwater	BCM/Year	N/A	

Withdrawals from Non-Renewable Groundwater	BCM/Year	0	
Withdrawals From Non-Conventional Resources	BCM/Year	0.54	
Overall Water Use Efficiency	%	76.19	
Water Sustainability Index	%	0.21	
Wastewater and Drainage Outflows	BCM/Year	1.20	
Water and Land Use Change			
Total Irrigated Agricultural Land	ha	555,500	
Total rain-Fed Agricultural Land	ha	7,865,000	
Total Forest Land	ha	43,152,800	
Total Natural Pasture Land	ha	32,885,000	
Water and Accessibility			
Water Supply Coverage (JMP)	%	N/A	
Water Supply Coverage (Sector Ministry)	%	95	
Urban Water Supply Coverage (JMP)	%	N/A	
Urban Water Supply Coverage (Sector Ministry)	%	N/A	
Rural Water Supply Coverage (JMP)	%	N/A	
Rural Water Supply Coverage (Sector Ministry)	%	N/A	
Sanitation Coverage (JMP)	%	N/A	
Sanitation Coverage (Sector Ministry)	%	86	
Urban Sanitation Coverage (JMP)	%	N/A	
Urban Sanitation Coverage (Sector Ministry)	%	N/A	
Rural Sanitation Coverage (JMP)	%	N/A	
Rural Sanitation Coverage (Sector Ministry)	%	N/A	
Length of water supply pipe networks	Km	N/A	
Length of Sewage pipe networks	Km	N/A	
Length of Irrigation Networks	Km	N/A	
Length of Drainage Network	Km	N/A	
Total drinking water treatment plant capacity	BCM/Year	N/A	
Dam Capacity (Installed)	BCM/Year	5.68	
Desalination Capacity	BCM/Year	N/A	
Electricity Generated Using Hydropower	GWh/Year	560	
Water and Demographics			
Total Population	1000 inhabitants	34,950	
Internal Renewable Water Resources per Capita	CM/capita	386	
Total Renewable Blue Water Resources per Capita	CM/capita	378	
Total Renewable Water Resources per Capita	CM/capita	823	
Blue Water Withdrawal per Capita	CM/capita	128	
Green Water Consumption per Capita	CM/capita	445	
Total Available Water Resources per Capita	CM/capita	930	
Total Water Consumption per Capita	CM/capita	573	
Agricultural Water Withdrawal per Capita	CM/capita	77	
Industrial Water Withdrawal per Capita	CM/capita	19	
Domestic Water Withdrawal per Capita	CM/capita	32	

Population Without Improved Water Supply	1000 inhabitants	5,941	
Population Without Adequate Sanitation	1000 inhabitants	1,747	
Water and Quality			
Average Total Dissolved Solids	mg/l	N/A	
Diarrhea Reported Cases	% of children under 5	19.8	
Dracunculiasis Reported Cases	Number	0	
Cholera Reported cases	Number	N/A	
Open Defecation Practice	%	4	
Water and Climate			
Flood Events in the Last Two Decades.	Number	27	
Flood Events 1989-2000	Number	8	
Flood Events 2000-2011	Number	19	
Water and Economics			
National Climate Change Adaptation Plan	Yes/No	N/A	
Industrial Water Productivity (GDP/Water Use)	$/CM	173	
Employment in Agriculture	Jobs/MCM	567	
Agricultural Water Productivity (GDP/Water Use)	$/CM	3.28	
Water and Sanitation Charges as % of the lowest Household Income Groups	%	N/A	
Subsidy (Domestic-Industrial-Agricultural)	%	N/A	
Public Expenditure on Water Related Projects	Million US$	N/A	
Foreign Development Assistance for Water (Total 2009-2012)	Million US$	91.63	
Foreign Development Assistance for Water (average yearly)	Million US$	30.54	
Virtual Water Imports related to Trade in the Agricultural Sector	BCM/Year	39.91	
Virtual Water Exports related to Trade in the Agricultural Sector	BCM/Year	0.25	
Virtual-Water net Flow Related to Trade in the Agricultural Sector	BCM/Year	39.66	
Water and Political Affairs			
IWRM Plan in Place	Yes/No	N/A	
Water Rights/year	Number	N/A	
Well Permits/year	Number	N/A	
Irrigation related complaints	Number/Year	N/A	
Water Supply and Sanitation related complaints	Number/Year	N/A	
Transboundary Water Bodies Dependency Ratio	%	4	
Standpoint in the 1997 UN Convention	Ratification/ Voting	Voted in Favor	

*All data and estimates are for 2012 unless otherwise mentioned

Bahrain

Bahrain

The average annual rainfall is about 83 mm. The precipitation season extends from November to April, and the total annual precipitation volume is 0.05 BCM, and the total amount of Green Water consumed annually by natural pasture areas is 0.029 BCM. There are no perennial streams in Bahrain and the total annual surface runoff is estimated to be about 0.004 BCM/yr. Transboundary incoming groundwater inflow (from Saudi Arabia) is estimated at about 0.112 BCM/y under steady-state conditions (before 1965) and this figure is considered to be the safe groundwater yield in Bahrain. The internal renewable water resources account for 0.116 BCM/y as of 2011 and the total renewable water resources are estimated at only 0.15 BCM/Year.

Total population is 1,214,000 inhabitants, thus generating a per capita share of Total Renewable Blue Water Resources of 96 CM/y. The population growth at a rate of 2.8% has not only decreased the per capita share of Total Renewable Blue Water Resources but also led to a significant reduction of the cultivated lands. The Total Annual Blue Water withdrawal is 0.26 BCM/y (294m3/cap/y), about 62% of which for irrigation and livestock watering.

Non-conventional water sources accounted for almost 55 % in the total water withdrawal in 2009. The total quantity of desalinated water used in 2011 was 197 MCM/y. About 62 MCM/y of wastewater have been treated as of 2005, 16.2 million CM/y of which was used for irrigation, while the rest was discharged to the sea. The irrigation potential based on Total Renewable Blue Water Resources is estimated at 4000 ha. The water supply coverage (2012) is assessed as 100% and the sanitation coverage is 90%.

There has been a significant reliance on the transboundary Dammam Aquifer in the last three decades, out of a total of 773 wells drilled in the kingdom between 1980 and 2008, 592 were drilled in the Dammam Aquifer. With reports surfacing on the over abstraction of the Dammam Aquifer by the agricultural and domestic sectors and how it led to its salinization by adjacent brackish and saline water bodies, attention has been slightly switched to other aquifers such as Rus-Umm Er Radhuma and Ras Abu-Jarjur. Fig (95) shows the groundwater extraction in Bahrain in 2006.

The salinization of Aquifers is adding another burden to groundwater in Bahrain, where the sustainability of these aquifers is already highly questionable due to lack of recharge. Four types of salinization of the Dammam aquifer are identified: brackish-water up-flow from the underlying brackish-water zones in north-central, western, and eastern regions; seawater intrusion in the eastern region; intrusion of sabkha water in the southwestern region; and irrigation return flow in a local area in the western region (Zubari, 1999).

Bahrain has one of the highest Gross National Income per Capita in the Arab region and the 46th over the world, it is estimated at $ 15,920. In 2008, the GNI per Capita based on the purchasing power parity was $ 24,700. In 2011, the GDP was estimated to be $ 22,945 million, one of the lowest in the Arab region. Being a water scarce country, the gross agriculture production is estimated at $ 93 million which is about 7% of the GDP as of 2010, whereas industry represents 63.7% of GDP in 2011. According to the database of the ODA by bilateral commitments between Arab countries and the development assistance committee (DAC) countries of the OECD and Arab countries, Bahrain was not among the recipient countries. Bahrain received Arab aid in water and sanitation sector amounting to $ 273 million in 2011. The recurrent

government expenditure of the 2011/2012 budget on electricity and water authority reached about $ 663 million.

Agriculture is the largest water consumer. The total agriculture imports was up to 586.19 million $ in 2010, food exports estimated at 527.99 million $. Cereals were imported in 2010 in the value of 85.46 million $ and cereals exported were at the value of 0.15 million $. Bahrain produced 15 million $ of vegetables and 19 million $ of fruits in year 2009. In 2010, Bahrain's virtual water exports in vegetables amounted to 2 billion CM which had products value of 6.81 million $ and exported in fruits 1 billion CM of virtual water with about 1.81 million $.

Bahrain has imported from the Arab countries the amount of 183 million $ of major agriculture commodities in 2010 and exported to Arab countries the amount of 37 million $ of major agriculture commodities. In 2010, employment in the agriculture sector was estimated at 9,120 persons.

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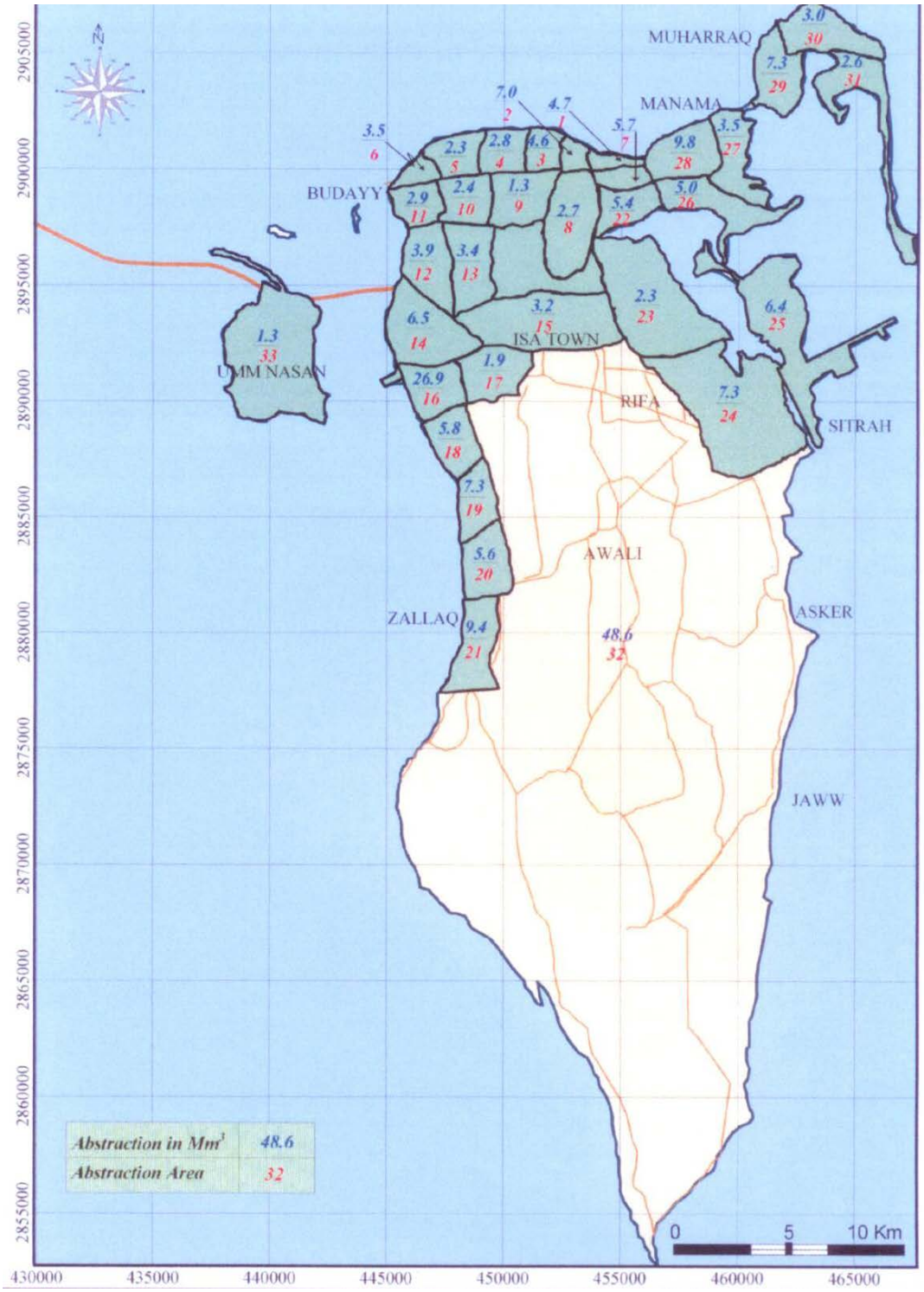

Figure 95. Groundwater Extraction in Bahrain in 2006 (Noaimi,2011).

Bahrain Water Indicators

Water Related Indicators	Units	Bahrain	Notes
Water Availability			
Annual Average Precipitaion Depth	MM/Year	83	
Annual Average Precipitation Volume	BCM/Year	0.05	
Internal Renewable Surface Water (IRSW)	BCM/Year	0.002	
Internal Renewable Groundwater (IRG)	BCM/Year	0.002	
Total Internal Renewable Blue Water Resources (TIRBWR)=(IRSW+IRG)	BCM/Year	0.004	
External Surface Water Inflow (ESWI)	BCM/Year	0	
External Surface Water Outflow (ESWO)	BCM/Year	0	
External Groundwater Inflow (EGI)	BCM/Year	0.11	
External Groundwater Outflow (EGO)	BCM/Year	0	
Total External Renewable Blue Water Resources (TERBWR)=(ESWI+EGI)	BCM/Year	0.11	
Total Renewable Blue Surface Water (TRBSW)=(IRSW)+(ESWI)-(ESWO)	BCM/Year	0	
Total Renewable Blue Groundwater (TRBG)=(IRG)+(EGI)-(EGO)	BCM/Year	0.11	
Overlap Between Surface Water and Groundwater (OSW)	BCM/Year	0	
Total Renewable Blue Water Resources (TRBWR)=(TRBSW)+(TRBG)-(OSW)	BCM/Year	0.12	
Total Rainfed Agriculture Abstractions	BCM/Year	0	
Total Natural Pasture Abstractions	BCM/Year	0.03	
Total Forest Abstractions	BCM/Year	0	
Total Renewable Green Water Resources (TRGWR)	BCM/Year	0.03	
Total Renewable Water Resources (TRWR)=(TRBWR+TRGWR)	BCM/Year	0.15	
Produced Municipal and Industrial Wastewater (PMW)	BCM/Year	0.06	
Treated Municipal and Industrial Wastewater	BCM/Year	0.04	
Reused Treated and Industrial Municipal Wastewater	BCM/Year	0.0160	
Produced Agricultural Drainage (PAD)	BCM/Year	0.0398	
Reused Agricultural Drainage	BCM/Year	0	
Produced Desalinated Water (PDW)	BCM/Year	0.10	
Total Non-Conventional Water Resources (TNCWR)=(PMW)+(PAD)+(PDW)	BCM/Year	0.20	
Total Non Renewable Groundwater Resources (TNRGR)	BCM/Year	0.11	
Total Conventional Water Resources (TCWR)=(TRWR)+(TNRGR)	BCM/Year	0.26	
Total Available Water Resources (TAWR)=(TCWR)+(TNCWR)	BCM/Year	0.46	
Water Withdrawals and Consumption			
Annual Total Water Withdrawal	BCM/Year	0.36	
Withdrawals by the Domestic Sector	BCM/Year	0.18	
Withdrawals by the Industrial Sector	BCM/Year	0.02	
Withdrawals by the Irrigated Agriculture Sector (Blue Water+Non-conventional Water)	BCM/Year	0.16	
Agricultural Consumption from Green Water	BCM/Year	0	
Total Agricultural Withdrawals	BCM/Year	0.16	
Withdrawals From Blue Surface Water	BCM/Year	0	
Withdrawals From Blue Groundwater	BCM/Year	0.26	
Withdrawals from Non-Renewable Groundwater	BCM/Year	0.26	

Withdrawals From Non-Conventional Resources	BCM/Year	0.12	
Overall Water Use Efficiency	%	72.08	
Water Sustainability Index	%	348.14	
Wastewater and Drainage Outflows	BCM/Year	0.08	
Water and Land Use Change			
Total Irrigated Agricultural Land	ha	3,200	
Total rain-Fed Agricultural Land	ha	0	
Total Forest Land	ha	497	
Total Natural Pasture Land	ha	4,000	
Water and Accessibility			
Water Supply Coverage (JMP)	%	–	
Water Supply Coverage (Sector Ministry)	%	100	
Urban Water Supply Coverage (JMP)	%	100	
Urban Water Supply Coverage (Sector Ministry)	%	N/A	
Rural Water Supply Coverage (JMP)	%	–	
Rural Water Supply Coverage (Sector Ministry)	%	N/A	
Sanitation Coverage (JMP)	%	–	
Sanitation Coverage (Sector Ministry)	%	90	
Urban Sanitation Coverage (JMP)	%	100	
Urban Sanitation Coverage (Sector Ministry)	%	N/A	
Rural Sanitation Coverage (JMP)	%	–	
Rural Sanitation Coverage (Sector Ministry)	%	N/A	
Length of water supply pipe networks	Km	N/A	
Length of Sewage pipe networks	Km	N/A	
Length of Irrigation Networks	Km	N/A	
Length of Drainage Network	Km	N/A	
Total drinking water treatment plant capacity	BCM/Year	N/A	
Dam Capacity (Installed)	BCM/Year	0	
Desalination Capacity	BCM/Year	0.14	
Electricity Generated Using Hydropower	GWh/Year	N/A	
Water and Demographics			
Total Population	1000 inhabitants	1,214	
Internal Renewable Water Resources per Capita	CM/capita	3.29	
Total Renewable Blue Water Resources per Capita	CM/capita	95.55	
Total Renewable Water Resources per Capita	CM/capita	119.44	
Blue Water Withdrawal per Capita	CM/capita	294.39	
Green Water Consumption per Capita	CM/capita	23.89	
Total Available Water Resources per Capita	CM/capita	378.25	
Total Water Consumption per Capita	CM/capita	318.28	
Agricultural Water Withdrawal per Capita	CM/capita	131.13	
Industrial Water Withdrawal per Capita	CM/capita	16.72	
Domestic Water Withdrawal per Capita	CM/capita	146.54	
Population Without Improved Water Supply	1000 inhabitants	0	

Population Without Adequate Sanitation	1000 inhabitants	121.40	
Water and Quality			
Average Total Dissolved Solids	mg/l	N/A	
Diarrhea Reported Cases	% of children under 5	8.40	
Dracunculiasis Reported Cases	Number	0	
Cholera Reported cases	Number	N/A	
Open Defecation Practice	%	–	
Water and Climate			
Flood Events in the Last Two Decades.	Number	5	
Flood Events 1989-2000	Number	5	
Flood Events 2000-2011	Number	0	
Water and Economics			
National Climate Change Adaptation Plan	Yes/No	N/A	
Industrial Water Productivity (GDP/Water Use)	$/CM	1,008	
Employment in Agriculture	Jobs/MCM	57.29	
Agricultural Water Productivity (GDP/Water Use)	$/CM	0.58	
Water and Sanitation Charges as % of the lowest Household Income Groups	%	0.3	
Subsidy (Domestic-Industrial-Agricultural)	%	N/A	
Public Expenditure on Water Related Projects	Million US$	662.9	
Foreign Development Assistance for Water (Total 2009-2012)	Million US$	273	
Foreign Development Assistance for Water (average yearly)	Million US$	91	
Virtual Water Imports related to Trade in the Agricultural Sector	BCM/Year	1.45	
Virtual Water Exports related to Trade in the Agricultural Sector	BCM/Year	0.11	
Virtual-Water net Flow Related to Trade in the Agricultural Sector	BCM/Year	1.34	
Water and Political Affairs			
IWRM Plan in Place	Yes/No	N/A	
Water Rights/year	Number	N/A	
Well Permits/year	Number	N/A	
Irrigation related complaints	Number/Year	N/A	
Water Supply and Sanitation related complaints	Number/Year	N/A	
Transboundary Water Bodies Dependency Ratio	%	96	
Standpoint in the 1997 UN Convention	Ratification/ Voting	Voted in Favor	

*All data and estimates are for 2012 unless otherwise mentioned

Comoros

Comoros

The average annual rainfall on the islands is about 900 mm varying considerably with space and time. The rainy season starts in November and lasts till May, The total annual precipitation volume is 1.7 km3/y. Internal Renewable Blue Water resources are estimated at (0.2 BCM/Year). The total renewable water resources are considered also to be 1.1 BCM/Year as of 2012 where the total population is 0.737 million inhabitant, thus generating a per capita share 1423 CM/capita. The available surface water resources are very limited on the Grande-Comore island due to very high soil permeability. The other two major islands have surface runoffs. However, as a result of deforestation and urbanization the available surface conveying routes decreased from 42 in 1925 to about 19 in1992 thus presenting a potential threat. The total cultivated area in 2009 is estimated as 140,000 ha with 60,000 ha of permanent crops. Soil degradation and erosion often results from crop cultivation on slopes without proper terracing.

The water supply coverage is assessed as 95% while the sanitation coverage is 36%. Inaccessibility of water resources in many locations of the islands as a result of its geology is a major constraint against the efficient utilization of available resources. The total annual water withdrawal amounts to only 0.01 BCM/Y, 48% of which is consumed by the domestic sector, 47% consumed by the agricultural sector, and 5% consumed by the industrial sector.

The GDP of Comoros was estimated at $ 610.3 million in 2011. The agriculture share was in the value of 46 % of it whereas industry was at 12.10 %. The Gross National Income per Capita based on the purchasing power parity was $ 1090 in 2011. Comoros has received in 2011, $ 3.07 million ODA in the water supply and sanitation sector according to the bilateral commitments from DAC countries (OECD) with Arab countries. This is evaluated as the highest amount of aid that Comoros obtained since 2008 as the ODA donated to Comoros ranged between $ 0.01 million in 2008 and $ 5.83 million in 2010.

The gross agriculture production is $ 247.9 million in 2009, of which the cereals production was estimated at 0.024 million tons, vegetables production is at 0.005 million tons and fruits production at 0.074 million tons. The annual financial costs of meeting new coverage needs to achieve the MDG WSS target between 2010-2015, one house connection for water supply in Comoros costs $ 15.1 in rural areas and $ 28.9 in urban areas. The annualized capital cost of installing one well in rural area is estimated at $ 12.4 and urban areas $ 12.8. The annualized capital cost for sanitation to build one septic tank is $ 12 in rural areas and 13.3 $ for a sewage connection in urban areas, and the pit cost is 4.3 $ in rural areas and $ 12.1 for the septic tank in urban areas.

Agriculture is the largest water consumer. The total financial capital required during the period 2010-2015 to reach the water supply MDG coverage target is estimated at $ 9 million and 18 thousand people when to access to universal coverage $ 20 million are needed to cover 90 thousand people. As for the sanitation target, $ 10 million is the total financial cost required for the MDG coverage and 177 thousand people also $ 23 million for the universal coverage in the number of 344 thousand people.

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Comoros Water Indicators

Water Related Indicators	Units	Comoros	Notes
Water Availability			
Annual Average Precipitaion Depth	MM/Year	900	
Annual Average Precipitation Volume	BCM/Year	1.68	
Internal Renewable Surface Water (IRSW)	BCM/Year	0	
Internal Renewable Groundwater (IRG)	BCM/Year	0.20	
Total Internal Renewable Blue Water Resources (TIRBWR)=(IRSW+IRG)	BCM/Year	0.20	
External Surface Water Inflow (ESWI)	BCM/Year	0	
External Surface Water Outflow (ESWO)	BCM/Year	0	
External Groundwater Inflow (EGI)	BCM/Year	0	
External Groundwater Outflow (EGO)	BCM/Year	0	
Total External Renewable Blue Water Resources (TERBWR)=(ESWI+EGI)	BCM/Year	0	
Total Renewable Blue Surface Water (TRBSW)=(IRSW)+(ESWI)-(ESWO)	BCM/Year	0	
Total Renewable Blue Groundwater (TRBG)=(IRG)+(EGI)-(EGO)	BCM/Year	0.20	
Overlap Between Surface Water and Groundwater (OSW)	BCM/Year	0	
Total Renewable Blue Water Resources (TRBWR)=(TRBSW)+(TRBG)-(OSW)	BCM/Year	0.20	
Total Rainfed Agriculture Abstractions	BCM/Year	0.50	
Total Natural Pasture Abstractions	BCM/Year	0.20	
Total Forest Abstractions	BCM/Year	0.20	
Total Renewable Green Water Resources (TRGWR)	BCM/Year	0.90	
Total Renewable Water Resources (TRWR)=(TRBWR+TRGWR)	BCM/Year	1.10	
Produced Municipal and Industrial Wastewater (PMW)	BCM/Year	0	
Treated Municipal and Industrial Wastewater	BCM/Year	N/A	
Reused Treated and Industrial Municipal Wastewater	BCM/Year	0	
Produced Agricultural Drainage (PAD)	BCM/Year	0.0012	
Reused Agricultural Drainage	BCM/Year	0	
Produced Desalinated Water (PDW)	BCM/Year	0	
Total Non-Conventional Water Resources (TNCWR)=(PMW)+(PAD)+(PDW)	BCM/Year	0.01	
Total Non Renewable Groundwater Resources (TNRGR)	BCM/Year	N/A	
Total Conventional Water Resources (TCWR)=(TRWR)+(TNRGR)	BCM/Year	1.10	
Total Available Water Resources (TAWR)=(TCWR)+(TNCWR)	BCM/Year	1.11	
Water Withdrawals and Consumption			
Annual Total Water Withdrawal	BCM/Year	0.01	
Withdrawals by the Domestic Sector	BCM/Year	0	
Withdrawals by the Industrial Sector	BCM/Year	0	
Withdrawals by the Irrigated Agriculture Sector (Blue Water+Non-conventional Water)	BCM/Year	0	
Agricultural Consumption from Green Water	BCM/Year	0	
Total Agricultural Withdrawals	BCM/Year	0	
Withdrawals From Blue Surface Water	BCM/Year	N/A	
Withdrawals From Blue Groundwater	BCM/Year	N/A	
Withdrawals from Non-Renewable Groundwater	BCM/Year	0	

Withdrawals From Non-Conventional Resources	BCM/Year	0	
Overall Water Use Efficiency	%	49.85	
Water Sustainability Index	%	0.46	
Wastewater and Drainage Outflows	BCM/Year	0.01	
Water and Land Use Change			
Total Irrigated Agricultural Land	ha	0	
Total rain-Fed Agricultural Land	ha	140,000	
Total Forest Land	ha	55,000	
Total Natural Pasture Land	ha	55,000	
Water and Accessibility			
Water Supply Coverage (JMP)	%	95	
Water Supply Coverage (Sector Ministry)	%	N/A	
Urban Water Supply Coverage (JMP)	%	91	
Urban Water Supply Coverage (Sector Ministry)	%	N/A	
Rural Water Supply Coverage (JMP)	%	97	
Rural Water Supply Coverage (Sector Ministry)	%	N/A	
Sanitation Coverage (JMP)	%	36	
Sanitation Coverage (Sector Ministry)	%	N/A	
Urban Sanitation Coverage (JMP)	%	50	
Urban Sanitation Coverage (Sector Ministry)	%	N/A	
Rural Sanitation Coverage (JMP)	%	30	
Rural Sanitation Coverage (Sector Ministry)	%	N/A	
Length of water supply pipe networks	Km	N/A	
Length of Sewage pipe networks	Km	N/A	
Length of Irrigation Networks	Km	N/A	
Length of Drainage Network	Km	N/A	
Total drinking water treatment plant capacity	BCM/Year	N/A	
Dam Capacity (Installed)	BCM/Year	N/A	
Desalination Capacity	BCM/Year	N/A	
Electricity Generated Using Hydropower	GWh/Year	2	
Water and Demographics			
Total Population	1000 inhabitants	773	
Internal Renewable Water Resources per Capita	CM/capita	258	
Total Renewable Blue Water Resources per Capita	CM/capita	258	
Total Renewable Water Resources per Capita	CM/capita	1,423	
Blue Water Withdrawal per Capita	CM/capita	12.94	
Green Water Consumption per Capita	CM/capita	1,164	
Total Available Water Resources per Capita	CM/capita	1,429	
Total Water Consumption per Capita	CM/capita	1,177	
Agricultural Water Withdrawal per Capita	CM/capita	6.08	
Industrial Water Withdrawal per Capita	CM/capita	0.65	
Domestic Water Withdrawal per Capita	CM/capita	6.21	
Population Without Improved Water Supply	1000 inhabitants	38.65	

Population Without Adequate Sanitation	1000 inhabitants	494	
Water and Quality			
Average Total Dissolved Solids	mg/l	N/A	
Diarrhea Reported Cases	% of children under 5	18.30	
Dracunculiasis Reported Cases	Number	0	
Cholera Reported cases	Number	N/A	
Open Defecation Practice	%	1	
Water and Climate			
Flood Events in the Last Two Decades.	Number	N/A	
Flood Events 1989-2000	Number	0	
Flood Events 2000-2011	Number	0	
Water and Economics			
National Climate Change Adaptation Plan	Yes/No	N/A	
Industrial Water Productivity (GDP/Water Use)	$/CM	147.71	
Employment in Agriculture	Jobs/MCM	N/A	
Agricultural Water Productivity (GDP/Water Use)	$/CM	0	
Water and Sanitation Charges as % of the lowest Household Income Groups	%	N/A	
Subsidy (Domestic-Industrial-Agricultural)	%	N/A	
Public Expenditure on Water Related Projects	Million US$	N/A	
Foreign Development Assistance for Water (Total 2009-2012)	Million US$	16.96	
Foreign Development Assistance for Water (average yearly)	Million US$	5.65	
Virtual Water Imports related to Trade in the Agricultural Sector	BCM/Year	0	
Virtual Water Exports related to Trade in the Agricultural Sector	BCM/Year	0	
Virtual-Water net Flow Related to Trade in the Agricultural Sector	BCM/Year	N/A	
Water and Political Affairs			
IWRM Plan in Place	Yes/No	N/A	
Water Rights/year	Number	N/A	
Well Permits/year	Number	N/A	
Irrigation related complaints	Number/Year	N/A	
Water Supply and Sanitation related complaints	Number/Year	N/A	
Transboundary Water Bodies Dependency Ratio	%	0	
Standpoint in the 1997 UN Convention	Ratification/ Voting	Absent	

*All data and estimates are for 2012 unless otherwise mentioned

Djibouti

Djibouti

The average annual rainfall is about 220 mm varying from 50 mm in the northeast to 300 mm at the western region. Irregular precipitation allows for few days of surface runoff to occur after events of heavy rainfall. The total annual precipitation volume is 3.4 BCM. The total annual volume of Green Water that has been beneficially used by rainfed agriculture, forests, and pasture areas is 1.5 BCM. The catchment system is divided into two zones, one draining to the sea (45%), while the other draining to the western plains (55%). The Internal Renewable Blue Water Resources are estimated at 0.3 BCM/y. A transboundary incoming surface flow (from Ethiopia) is estimated at 2 km3/y of saline water which is not beneficial without further treatment. The total Renewable Blue Water Resources is thus considered as 0.3 BCM/y as of 2012 where the total population was 0.775 million inhabitant, thus generating a per capita share of Blue Water Resources of 387 m^3/y. The groundwater resources in general suffer from excessive salinity and high Boron content except for the northwestern part of the country.

The total annual Blue Water withdrawal is 0.0189 km3/y as of 2000, 16% of which is directed to agriculture and 86% to domestic. The irrigation potential based on Renewable Blue Water is estimated at about 700 ha, 407 of which are cultivated and supplied by water through shallow wells. The water supply coverage is assessed as 88 % and the sanitation coverage is 50%.

Political dependence on the neighbouring countries and the African horn is reflected on management of resources. Djibouti's environment is generally harsh and is poorly endowed with natural resources. Having lots in common, Djibouti and Somaliland expressed on many occasions that it is important that they have an ongoing collaboration and partnership in the interest of their people and nations (Somaliland press, 2012).

Djibouti's GDP was estimated at $ 1.10 billion in 2010. The agriculture share is at the value of 36.00 million $ of total GDP. The Gross National Income per Capita based on power purchase parity in 2011 was estimated at $ 2460. According to the bilateral commitments between Development Assistance Committee (DAC) countries of the Organization for Economic Cooperation and Development (OECD) and the Arab countries, Djibouti has received in the water sector and sanitation Official Development Aid (ODA) of $ 8.51 million in 2011.

The total capital investment needed during the period 2010-2015 to reach the sanitation MDG coverage target is estimated at $ 24 million , while for the capital investment needed for universal sanitation coverage is estimated at $ 32 million. As for the water supply sector, Djibouti requires $ 5 million to achieve the MDG target, and $ 41 million to achieve universal water supply coverage. The population needed to be covered to achieve the MDG in the sanitation sector is estimated at 192 thousand people and the population needed to reach the universal coverage 263 thousand people. As for the water sector the number of population that needs coverage is 30 thousand people for MDG target and 99 thousand people for the universal coverage.

Agriculture is the largest water consumer. The gross agriculture production in 2010 reached $ 36.00 million, the total agriculture imports were estimated at $ 143.03 million, and food exports in the same year were estimated at $ 48.42 million. In 2010, Djibouti exported 0.13 thousand tons of cereals valued at $ 0.13 million, and imported 201.12 million tons of cereals at the value of $ 54.66 million. In 2010, Djibouti's imports in fruits' imports of virtual water were estimated to be 0.1547 MCM with the products valued at $ 4.71 million. The

fruits exports to Djibouti in 2010 were estimated at $ 0.12 million which translates to about 250,770 CM of virtual water exports. The total virtual water imports in agriculture were estimated at 1.5 billion cm which is translated to about $ 197.65 million, whereas the total virtual water exports in agriculture were estimated at 7 mcm which is translated to about $ 1.24 million.

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Djibouti Water Indicators

Water Related Indicators	Units	Djibouti	Notes
Water Availability			
Annual Average Precipitaion Depth	MM/Year	220	
Annual Average Precipitation Volume	BCM/Year	3.40	
Internal Renewable Surface Water (IRSW)	BCM/Year	0.30	
Internal Renewable Groundwater (IRG)	BCM/Year	0.02	
Total Internal Renewable Blue Water Resources (TIRBWR)=(IRSW+IRG)	BCM/Year	0.32	
External Surface Water Inflow (ESWI)	BCM/Year	0	
External Surface Water Outflow (ESWO)	BCM/Year	0	
External Groundwater Inflow (EGI)	BCM/Year	0	
External Groundwater Outflow (EGO)	BCM/Year	N/A	
Total External Renewable Blue Water Resources (TERBWR)=(ESWI+EGI)	BCM/Year	0	
Total Renewable Blue Surface Water (TRBSW)=(IRSW)+(ESWI)-(ESWO)	BCM/Year	0.30	
Total Renewable Blue Groundwater (TRBG)=(IRG)+(EGI)-(EGO)	BCM/Year	0.02	
Overlap Between Surface Water and Groundwater (OSW)	BCM/Year	0.02	
Total Renewable Blue Water Resources (TRBWR)=(TRBSW)+(TRBG)-(OSW)	BCM/Year	0.30	
Total Rainfed Agriculture Abstractions	BCM/Year	0.50	
Total Natural Pasture Abstractions	BCM/Year	0.50	
Total Forest Abstractions	BCM/Year	0.50	
Total Renewable Green Water Resources (TRGWR)	BCM/Year	1.50	
Total Renewable Water Resources (TRWR)=(TRBWR+TRGWR)	BCM/Year	1.80	
Produced Municipal and Industrial Wastewater (PMW)	BCM/Year	0.01	
Treated Municipal and Industrial Wastewater	BCM/Year	0	
Reused Treated and Industrial Municipal Wastewater	BCM/Year	0	
Produced Agricultural Drainage (PAD)	BCM/Year	0.0008	
Reused Agricultural Drainage	BCM/Year	0	
Produced Desalinated Water (PDW)	BCM/Year	0	
Total Non-Conventional Water Resources (TNCWR)=(PMW)+(PAD)+(PDW)	BCM/Year	0.01	
Total Non Renewable Groundwater Resources (TNRGR)	BCM/Year	N/A	
Total Conventional Water Resources (TCWR)=(TRWR)+(TNRGR)	BCM/Year	0.30	
Total Available Water Resources (TAWR)=(TCWR)+(TNCWR)	BCM/Year	0.31	
Water Withdrawals and Consumption			
Annual Total Water Withdrawal	BCM/Year	0.02	
Withdrawals by the Domestic Sector	BCM/Year	0.02	
Withdrawals by the Industrial Sector	BCM/Year	0	
Withdrawals by the Irrigated Agriculture Sector (Blue Water+Non-conventional Water)	BCM/Year	0	
Agricultural Consumption from Green Water	BCM/Year	0	
Total Agricultural Withdrawals	BCM/Year	0	
Withdrawals From Blue Surface Water	BCM/Year	0	
Withdrawals From Blue Groundwater	BCM/Year	0.02	
Withdrawals from Non-Renewable Groundwater	BCM/Year	0	

Withdrawals From Non-Conventional Resources	BCM/Year	0	
Overall Water Use Efficiency	%	29.06	
Water Sustainability Index	%	673.07	
Wastewater and Drainage Outflows	BCM/Year	0.01	
Water and Land Use Change			
Total Irrigated Agricultural Land	ha	0	
Total rain-Fed Agricultural Land	ha	64,500	
Total Forest Land	ha	64,600	
Total Natural Pasture Land	ha	64,600	
Water and Accessibility			
Water Supply Coverage (JMP)	%	88	
Water Supply Coverage (Sector Ministry)	%	N/A	
Urban Water Supply Coverage (JMP)	%	99	
Urban Water Supply Coverage (Sector Ministry)	%	N/A	
Rural Water Supply Coverage (JMP)	%	54	
Rural Water Supply Coverage (Sector Ministry)	%	N/A	
Sanitation Coverage (JMP)	%	50	
Sanitation Coverage (Sector Ministry)	%	N/A	
Urban Sanitation Coverage (JMP)	%	63	
Urban Sanitation Coverage (Sector Ministry)	%	N/A	
Rural Sanitation Coverage (JMP)	%	10	
Rural Sanitation Coverage (Sector Ministry)	%	N/A	
Length of water supply pipe networks	Km	N/A	
Length of Sewage pipe networks	Km	N/A	
Length of Irrigation Networks	Km	N/A	
Length of Drainage Network	Km	N/A	
Total drinking water treatment plant capacity	BCM/Year	N/A	
Dam Capacity (Installed)	BCM/Year	N/A	
Desalination Capacity	BCM/Year	N/A	
Electricity Generated Using Hydropower	GWh/Year	N/A	
Water and Demographics			
Total Population	1000 inhabitants	775	
Internal Renewable Water Resources per Capita	CM/capita	406	
Total Renewable Blue Water Resources per Capita	CM/capita	387	
Total Renewable Water Resources per Capita	CM/capita	387	
Blue Water Withdrawal per Capita	CM/capita	24.52	
Green Water Consumption per Capita	CM/capita	1,935	
Total Available Water Resources per Capita	CM/capita	404	
Total Water Consumption per Capita	CM/capita	1,960	
Agricultural Water Withdrawal per Capita	CM/capita	3.87	
Industrial Water Withdrawal per Capita	CM/capita	0	
Domestic Water Withdrawal per Capita	CM/capita	20.65	
Population Without Improved Water Supply	1000 inhabitants	93	

Population Without Adequate Sanitation	1000 inhabitants	387	
Water and Quality			
Average Total Dissolved Solids	mg/l	N/A	
Diarrhea Reported Cases	% of children under 5	N/A	
Dracunculiasis Reported Cases	Number	0	
Cholera Reported cases	Number	N/A	
Open Defecation Practice	%	14	
Water and Climate			
Flood Events in the Last Two Decades.	Number	N/A	
Flood Events 1989-2000	Number	0	
Flood Events 2000-2011	Number	1	
Water and Economics			
National Climate Change Adaptation Plan	Yes/No	N/A	
Industrial Water Productivity (GDP/Water Use)	$/CM	#DIV/0!	
Employment in Agriculture	Jobs/MCM	93,356	
Agricultural Water Productivity (GDP/Water Use)	$/CM	12	
Water and Sanitation Charges as % of the lowest Household Income Groups	%	N/A	
Subsidy (Domestic-Industrial-Agricultural)	%	N/A	
Public Expenditure on Water Related Projects	Million US$	N/A	
Foreign Development Assistance for Water (Total 2009-2012)	Million US$	9.09	
Foreign Development Assistance for Water (average yearly)	Million US$	3.03	
Virtual Water Imports related to Trade in the Agricultural Sector	BCM/Year	1.52	
Virtual Water Exports related to Trade in the Agricultural Sector	BCM/Year	0.01	
Virtual-Water net Flow Related to Trade in the Agricultural Sector	BCM/Year	1.51	
Water and Political Affairs			
IWRM Plan in Place	Yes/No	N/A	
Water Rights/year	Number	N/A	
Well Permits/year	Number	N/A	
Irrigation related complaints	Number/Year	N/A	
Water Supply and Sanitation related complaints	Number/Year	N/A	
Transboundary Water Bodies Dependency Ratio	%	0	
Standpoint in the 1997 UN Convention	Ratification/ Voting	Voted in Favor	

*All data and estimates are for 2012 unless otherwise mentioned

Egypt

Egypt

Egypt is semi-arid Country and depends entirely on The Nile water. The average annual rainfall depth is 51 mm while the average annual precipitation volume is about 3 BCM/Year, mainly occurring at the northern coast, 0.7 BCM of which are directly abstracted as Green Water. The southern Upper Egypt, Sinai, and the Red sea coast occasionally have short storms, and destructive flash floods. Precipitation occurs in winter and late autumn and accounts for 1.5 BCM/y of Internal Renewable Blue Water Resources out of which 1.3 BCM/y recharges shallow aquifers, and 0.5 BCM/y supplying surface water resources. It is also worth mentioning that 8.5 BCM/y is considered as an overlap between Surface and Groundwater as it is the annual groundwater recharge from the Nile System, which increases the theoretical annual internal renewable groundwater to 9.8 BCM/y.

Out of the Nile's average natural flow of 84 BCM/y reaching Aswan, a transboundary incoming surface flow from Sudan of 55.5 BCM/y is allowed to pass according to the mutual Nile water agreement between Egypt and Sudan in 1959. The agreement allocates the former share of 55.5 BCM/y to Egypt and a share of 18.5 BCM/y to Sudan, while about 10 BCM/y is lost in evaporation from the high dam reservoir. The total Renewable Blue Water Resources is considered as 57 BCM/y as of 2012 where the total population is 91 million inhabitant, thus generating a per capita share of annual Renewable Blue Water Resources of 629.7 CM/ capita.

The government of Egypt has always taken the lead in pushing forward basin-wide cooperation , this was highly emphasized in 1999 by the establishment of the Nile Basin Initiative as an inter-governmental organization dedicated to equitable and sustainable management and development of the shared water resources of the Nile Basin under a shared vision aiming " to achieve sustainable socio-economic development through the equitable utilization of ,and benefit from, the common Nile Basin water resources". However, recently, Egypt has been excluded from a collaborative cooperation effort pertaining to a new agreement that was signed by six upstream countries. Moreover, some countries have undertaken individual endeavours without consulting other Nile basin riparians, as in the case of Ethiopia and the construction of the Renaissance dam.

Egypt's extensive efforts to meet the water demand resulted in a total water development potential of 66.9 BCM/y as of year 2012 which is divided as:

- 55.5 BCM/y from surface water resources, (including 6.2 BCM/y of renewable groundwater that is part of the Nile system).
- 10.30 BCM/y from precipitation and shallow renewable groundwater.
- 4.0 BCM/y from non-renewable groundwater resources,
- 5.5 BCM/y from reused agriculture drainage water,
- 0.3 BCM/y from reused treated municipal waste water.
- 0.20 BCM/y from desalinated seawater

79% of the annual water withdrawal is utilized by agriculture, 11% by the domestic sector and 10% consumed by industry. Evaporation losses from the 31,000 Km long water conveyance network are estimated at 2 BCM/y. Water resources management, hydraulic control, channel design, distribution networks, and water discharge monitoring has been practiced by Egyptians for over 4000 years. The total dam capacity in 2012 is about 169 BCM mainly attributed to the reservoir of the Aswan high

dam. About 90% of the Nile's hydro-potential in Egypt has been exploited to generate 11 Twh. The total water managed area in 2002 is 3.4 million ha representing all of the cultivated area. Agricultural drainage through primitive pumping stations and excavation of main drains has been practiced in Egypt as early as 1898. Evidence from history extends to even far beyond this date.

Ditch drainage was introduced in 1938 followed by sub-surface drainage in 1942. The drainage network has been projected to cover 90% of the cultivated area in 1993. The water supply coverage (2011) is 99%. The total amount of produced waste water in 2011 is 6.5 BCM/y out of which 3.65 BCM/y is treated and 0.3 BCM/y is reused. The fresh water annual fish catch is estimated at 240,000 metric tons/yr.

Efforts have been devoted to achieve the following:
- Improving the level of economic growth,
- Establishing a solid national industrial base,
- Shifting towards privatization,
- Renovation of the country's infrastructure, and
- Development of agriculture in an attempt to meet the increasing demands of the growing population,

Trying to achieve the above targets resulted into a lot of environmental impacts, sometimes positive and in many times negative, on the available natural resources with water being the most effected resource. Over exploitation of ground water resources over the last 20 years has led to notable depletion of these resources at the oasis of the western desert. Over extraction from the delta shallow aquifer led to increased water Stalinization and to the inland advancing of the salt water interface at alarming rates.

Egypt's GDP was estimated at $ 218 billion in 2010. The agriculture share was up to 14% which is at the value of $ 29 billion whereas the industry share (including oil and gas) was estimated at 36.7% of total GDP. The Gross National Income per Capita based on purchasing power parity in 2011 was estimated at $ 6060. According to the bilateral commitments between Development Assistance Committee (DAC) countries of the Organization for Economic Cooperation and Development (OECD), Egypt has received in the water sector and sanitation Official Development Aid estimated at $ 17.24 million in 2011. Regarding Arab Aid, Egypt has received $ 582.188 thousands in the water and sanitation sector from the Kuwait fund for Economic Development. As for the actual government budget for the fiscal year of 2012-2013, Egypt is planned to spend on the Water and Sanitation sector about $ 1.5 billion.

The total capital investment needed during the period 2010-2015 to reach the sanitation universal coverage target is estimated at $ 2 billion and 11 million person to be covered, the capital investment for MDG in sanitation coverage is actually achieved. As for the water supply sector, Egypt has also achieved the MDG target and still requires $ 3 billion to achieve universal water supply coverage and 7 million person to be covered.

Agriculture is the major water use sector. The gross agriculture production in 2010 reached $ 29 billion. In 2010, Egypt exported 931.29 thousand tons of cereals with $ 476.00 million, and imported 15773.80 thousand tons of cereals at the value of $ 438.49 million. Food imports in the same year were estimated at $ 8 billion. In 2010, Egypt's imports in vegetables amounted to 0.6903 MCM which had a monetary value of $ 5.07 million and imported in fruits 262.1892 MCM with the monetary value of $ 235.65 million. Egypt virtual water exports in agriculture were estimated at 19.7 billion CM which had a product value of $ 39.9 billion. Regarding imports of virtual water in agriculture

were estimated at 44 billion CM which is translated in products value at about $ 8.5 billion.

The technically feasible hydropower potential is estimated at 50,000 Gigawatt hour per year and the installed hydro capacity is 2,842 Megawatt hour. The hydro power generation in 2008 reached 15,510 Gigawatt hour which represents 12.6 % of the total power production in Egypt.

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Egypt Water Indicators

Water Related Indicators	Units	Egypt	Notes
Water Availability			
Annual Average Precipitaion Depth	MM/Year	51	
Annual Average Precipitation Volume	BCM/Year	3	
Internal Renewable Surface Water (IRSW)	BCM/Year	0.50	
Internal Renewable Groundwater (IRG)	BCM/Year	9.80	
Total Internal Renewable Blue Water Resources (TIRBWR)=(IRSW+IRG)	BCM/Year	10.30	
External Surface Water Inflow (ESWI)	BCM/Year	55.50	
External Surface Water Outflow (ESWO)	BCM/Year	0	
External Groundwater Inflow (EGI)	BCM/Year	0	
External Groundwater Outflow (EGO)	BCM/Year	0	
Total External Renewable Blue Water Resources (TERBWR)=(ESWI+EGI)	BCM/Year	55.50	
Total Renewable Blue Surface Water (TRBSW)=(IRSW)+(ESWI)-(ESWO)	BCM/Year	56	
Total Renewable Blue Groundwater (TRBG)=(IRG)+(EGI)-(EGO)	BCM/Year	9.80	
Overlap Between Surface Water and Groundwater (OSW)	BCM/Year	8.50	
Total Renewable Blue Water Resources (TRBWR)=(TRBSW)+(TRBG)-(OSW)	BCM/Year	57.30	
Total Rainfed Agriculture Abstractions	BCM/Year	0.41	
Total Natural Pasture Abstractions	BCM/Year	0	
Total Forest Abstractions	BCM/Year	0.26	
Total Renewable Green Water Resources (TRGWR)	BCM/Year	0.67	
Total Renewable Water Resources (TRWR)=(TRBWR+TRGWR)	BCM/Year	57.97	
Produced Municipal and Industrial Wastewater (PMW)	BCM/Year	6.50	
Treated Municipal and Industrial Wastewater	BCM/Year	3.37	
Reused Treated and Industrial Municipal Wastewater	BCM/Year	0.30	
Produced Agricultural Drainage (PAD)	BCM/Year	7.50	
Reused Agricultural Drainage	BCM/Year	5.50	
Produced Desalinated Water (PDW)	BCM/Year	0.20	
Total Non-Conventional Water Resources (TNCWR)=(PMW)+(PAD)+(PDW)	BCM/Year	14.20	
Total Non Renewable Groundwater Resources (TNRGR)	BCM/Year	4	
Total Conventional Water Resources (TCWR)=(TRWR)+(TNRGR)	BCM/Year	61.97	
Total Available Water Resources (TAWR)=(TCWR)+(TNCWR)	BCM/Year	76.17	
Water Withdrawals and Consumption			
Annual Total Water Withdrawal	BCM/Year	68.30	
Withdrawals by the Domestic Sector	BCM/Year	9.6	
Withdrawals by the Industrial Sector	BCM/Year	4	
Withdrawals by the Irrigated Agriculture Sector (Blue Water+Non-conventional Water)	BCM/Year	59	
Agricultural Consumption from Green Water	BCM/Year	0.41	
Total Agricultural Withdrawals	BCM/Year	59.41	
Withdrawals From Blue Surface Water	BCM/Year	54.53	
Withdrawals From Blue Groundwater	BCM/Year	10.70	
Withdrawals from Non-Renewable Groundwater	BCM/Year	2.20	

Withdrawals From Non-Conventional Resources	BCM/Year	6	
Overall Water Use Efficiency	%	80.90	
Water Sustainability Index	%	125.08	
Wastewater and Drainage Outflows	BCM/Year	12.20	
Water and Land Use Change			
Total Irrigated Agricultural Land	ha	3,246,000	
Total rain-Fed Agricultural Land	ha	159,000	
Total Forest Land	ha	99,500	
Total Natural Pasture Land	ha	0	
Water and Accessibility			
Water Supply Coverage (JMP)	%	99	
Water Supply Coverage (Sector Ministry)	%	99	
Urban Water Supply Coverage (JMP)	%	100	
Urban Water Supply Coverage (Sector Ministry)	%	97	
Rural Water Supply Coverage (JMP)	%	99	
Rural Water Supply Coverage (Sector Ministry)	%	97	
Sanitation Coverage (JMP)	%	95	
Sanitation Coverage (Sector Ministry)	%	66	
Urban Sanitation Coverage (JMP)	%	97	
Urban Sanitation Coverage (Sector Ministry)	%	80	
Rural Sanitation Coverage (JMP)	%	93	
Rural Sanitation Coverage (Sector Ministry)	%	11	
Length of water supply pipe networks	Km	N/A	
Length of Sewage pipe networks	Km	39,000	
Length of Irrigation Networks	Km	33,550	
Length of Drainage Network	Km	18,000	
Total drinking water treatment plant capacity	BCM/Year	8.76	
Dam Capacity (Installed)	BCM/Year	168	
Desalination Capacity	BCM/Year	0.10	
Electricity Generated Using Hydropower	GWh/Year	15,510	
Water and Demographics			
Total Population	1000 inhabitants	91,000	
Internal Renewable Water Resources per Capita	CM/capita	113	
Total Renewable Blue Water Resources per Capita	CM/capita	629	
Total Renewable Water Resources per Capita	CM/capita	636	
Blue Water Withdrawal per Capita	CM/capita	750	
Green Water Consumption per Capita	CM/capita	7.31	
Total Available Water Resources per Capita	CM/capita	836	
Total Water Consumption per Capita	CM/capita	757	
Agricultural Water Withdrawal per Capita	CM/capita	648	
Industrial Water Withdrawal per Capita	CM/capita	43.96	
Domestic Water Withdrawal per Capita	CM/capita	58.24	
Population Without Improved Water Supply	1000 inhabitants	910	

Population Without Adequate Sanitation	1000 inhabitants	4,550	
Water and Quality			
Average Total Dissolved Solids	mg/l	N/A	
Diarrhea Reported Cases	% of children under 5	18.40	
Dracunculiasis Reported Cases	Number	0	
Cholera Reported cases	Number	0	
Open Defecation Practice	%	0	
Water and Climate			
Flood Events in the Last Two Decades.	Number	8	
Flood Events 1989-2000	Number	6	
Flood Events 2000-2011	Number	2	
Water and Economics			
National Climate Change Adaptation Plan	Yes/No	yes	
Industrial Water Productivity (GDP/Water Use)	$/CM	21.06	
Employment in Agriculture	Jobs/MCM	113.25	
Agricultural Water Productivity (GDP/Water Use)	$/CM	0.49	
Water and Sanitation Charges as % of the lowest Household Income Groups	%	4.13	
Subsidy (Domestic-Industrial-Agricultural)	%	N/A	
Public Expenditure on Water Related Projects	Million US$	1,500	
Foreign Development Assistance for Water (Total 2009-2012)	Million US$	1,124.93	
Foreign Development Assistance for Water (average yearly)	Million US$	374.98	
Virtual Water Imports related to Trade in the Agricultural Sector	BCM/Year	44.40	
Virtual Water Exports related to Trade in the Agricultural Sector	BCM/Year	19.78	
Virtual-Water net Flow Related to Trade in the Agricultural Sector	BCM/Year	24.63	
Water and Political Affairs			
IWRM Plan in Place	Yes/No	YES	
Water Rights/year	Number	N/A	
Well Permits/year	Number	N/A	
Irrigation related complaints	Number/Year	740	
Water Supply and Sanitation related complaints	Number/Year	N/A	
Transboundary Water Bodies Dependency Ratio	%	97	
Standpoint in the 1997 UN Convention	Ratification/ Voting	Abstained	

*All data and estimates are for 2012 unless otherwise mentioned

Iraq

Iraq

The population of Iraq is estimated to be 31.12 million as of 2011. Average population density is estimated at 71/km^2. The average population growth before the end of the last millennium was estimated at 3.6 percent, this rate has been significantly reduced by the so called "War on Terrorism", reaching a low of 2.3 percent in 2011.

The average annual rainfall is about 216 mm which exhibits considerable spatial variation due to the large area of the country and the different climatic regimes prevailing at different regions. Rainfall varies from less than 100 mm/y over 60% of the country in the south up to 1200 mm/y in the north-east. Precipitation mainly occurs in winter from December to February (or November to April in the mountains), with an annual volume of 94 BCM/y, 12 of which are annually abstracted by rain fed areas, pasture lands, and forests in what is known as Green Water . Internal Renewable Blue Water Resources are estimated at about 37.2 BCM/y and the External Renewable Water Resources account to 61.41 BCM/y. Current estimates of water available for Iraq are 2,400 CM per person per year, which is more than all corresponding availabilities of Iraq neighbors except Turkey.

Water resources are abundant in Iraq: the Tigris and Euphrates Rivers supply the major share of irrigation water for agriculture production in the country at 77 billion CM in good years and 44 billion CM in drought years. Rainfall in Iraq provides some 50 percent of the water supply flowing into the Tigris and contributes 10 percent of the flow into the Euphrates. The average annual flow of the Euphrates as it enters Iraq is estimated at 30 BCM, with a fluctuating annual value ranging from 10 to 40 BCM. Unlike the Tigris, the Euphrates receives no tributaries during its passage in Iraq. Agriculture consumes 92% of Iraq's water resources.

Water availability and sanitation are major problems for post occupation Iraq. Insufficiency existed even before the occupation: access rates to potable water in cities and rural areas were reported at 92 percent and 46 percent respectively.

The country wide water supply coverage reached 79% and the sanitation coverage was 73%.

Water shortage occurrences have been reported in many areas in Iraq, In August, 2009, a water shortage described as the worst since the ancient days of Iraqi civilization was reported in the south of the country. Some 2 million inhabitants were deprived from electricity and drinking water due to a 50% fall of the levels of the Euphrates.

As of 2009, the dam capacity reached 4941 cubic meters per capita, with ongoing projects to increase this capacity. Al-shahabi dam is one of the new dams under construction; it is designed to store 0.8 MCM for agricultural purposes.

Iraq's GDP was estimated at $ 121 billion in 2010. The gross agriculture share was to $ 7.2 billion whereas the industry share (including oil and gas) was estimated at 60.5 % of total GDP. The Gross National Income per Capita based on purchasing power parity in 2011 was estimated at $ 3370. According to the bilateral commitments between Development Assistance Committee (DAC) countries of the Organization for Economic Cooperation and Development (OECD), Djibouti has received in the water sector and sanitation Official Development Aid (ODA) of $ 22.51 million in 2011.

The total capital investment needed during the period 2010-2015 to reach the sanitation universal coverage target is

estimated at $ 2 billion and 9,786 thousand people need to be covered, whereas for the capital investment needed for MDG sanitation coverage $ 966 million are required to cover 3,135 thousand people. As for the water supply sector, Iraq still requires 1.5 billion $ to achieve MDG target to cover 1,572 thousand people, and $ 2.9 billion to achieve universal water supply coverage in order to cover 7,238 thousand people.

Agriculture is the largest water consumer. The gross agriculture production in 2010 reached $ 7,294 million, the total food imports in the same year were estimated at $ 1174.31 million. In 2010, Iraq exported 0.68 thousand tons of cereals with $ 0.14 million, and imported 275.12 thousand tons of cereals at the value of $ 362.61 million. In 2010, Iraq's total agriculture imports of virtual water were estimated at 3524.74 MCM with the products valued at $ 1233.99 million. The total agriculture exports to Iraq in 2010 were estimated at $ 10.59 million which translates to about 23.21 MCM of virtual water exports.

The technically feasible hydropower potential is estimated at 90,000, whereas the economically feasible hydropower potential 67,000 Gigawatt hour per year and the installed hydro capacity is 2,273 Megawatt hour. The hydro power generation in 2008 represents 13 % of the total power production in Egypt.

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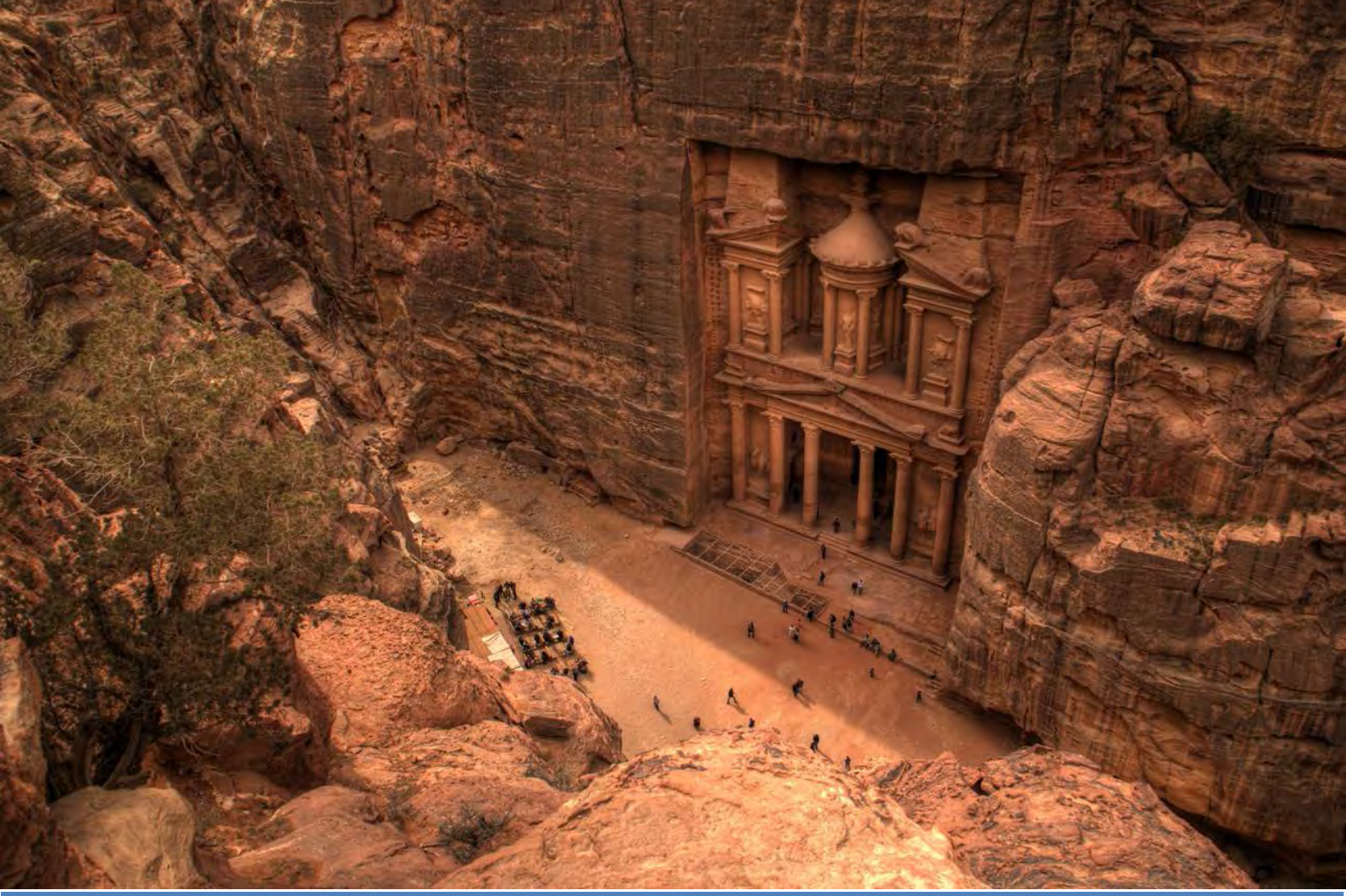
Iraq Water Indicators

Water Related Indicators	Units	Iraq	Notes
Water Availability			
Annual Average Precipitaion Depth	MM/Year	216	
Annual Average Precipitation Volume	BCM/Year	94.01	
Internal Renewable Surface Water (IRSW)	BCM/Year	34	
Internal Renewable Groundwater (IRG)	BCM/Year	3.20	
Total Internal Renewable Blue Water Resources (TIRBWR)=(IRSW+IRG)	BCM/Year	37.20	
External Surface Water Inflow (ESWI)	BCM/Year	61.33	
External Surface Water Outflow (ESWO)	BCM/Year	10	
External Groundwater Inflow (EGI)	BCM/Year	0.08	
External Groundwater Outflow (EGO)	BCM/Year	0	
Total External Renewable Blue Water Resources (TERBWR)=(ESWI+EGI)	BCM/Year	61.41	
Total Renewable Blue Surface Water (TRBSW)=(IRSW)+(ESWI)-(ESWO)	BCM/Year	85.33	
Total Renewable Blue Groundwater (TRBG)=(IRG)+(EGI)-(EGO)	BCM/Year	3.28	
Overlap Between Surface Water and Groundwater (OSW)	BCM/Year	2	
Total Renewable Blue Water Resources (TRBWR)=(TRBSW)+(TRBG)-(OSW)	BCM/Year	86.61	
Total Rainfed Agriculture Abstractions	BCM/Year	2.39	
Total Natural Pasture Abstractions	BCM/Year	7.82	
Total Forest Abstractions	BCM/Year	1.62	
Total Renewable Green Water Resources (TRGWR)	BCM/Year	11.84	
Total Renewable Water Resources (TRWR)=(TRBWR+TRGWR)	BCM/Year	98.45	
Produced Municipal and Industrial Wastewater (PMW)	BCM/Year	4.72	
Treated Municipal and Industrial Wastewater	BCM/Year	N/A	
Reused Treated and Industrial Municipal Wastewater	BCM/Year	0	
Produced Agricultural Drainage (PAD)	BCM/Year	7.8	
Reused Agricultural Drainage	BCM/Year	N/A	
Produced Desalinated Water (PDW)	BCM/Year	0.007	
Total Non-Conventional Water Resources (TNCWR)=(PMW)+(PAD)+(PDW)	BCM/Year	12.53	
Total Non Renewable Groundwater Resources (TNRGR)	BCM/Year	N/A	
Total Conventional Water Resources (TCWR)=(TRWR)+(TNRGR)	BCM/Year	98.45	
Total Available Water Resources (TAWR)=(TCWR)+(TNCWR)	BCM/Year	110.98	
Water Withdrawals and Consumption			
Annual Total Water Withdrawal	BCM/Year	90.61	
Withdrawals by the Domestic Sector	BCM/Year	5.90	
Withdrawals by the Industrial Sector	BCM/Year	13.32	
Withdrawals by the Irrigated Agriculture Sector (Blue Water+Non-conventional Water)	BCM/Year	71.39	
Agricultural Consumption from Green Water	BCM/Year	2.39	
Total Agricultural Withdrawals	BCM/Year	73.78	
Withdrawals From Blue Surface Water	BCM/Year	N/A	
Withdrawals From Blue Groundwater	BCM/Year	N/A	
Withdrawals from Non-Renewable Groundwater	BCM/Year	0	

Withdrawals From Non-Conventional Resources	BCM/Year	0.01	
Overall Water Use Efficiency	%	86.18	
Water Sustainability Index	%	0.94	
Wastewater and Drainage Outflows	BCM/Year	12.52	
Water and Land Use Change			
Total Irrigated Agricultural Land	ha	3,525,000	
Total rain-Fed Agricultural Land	ha	1,225,000	
Total Forest Land	ha	830,300	
Total Natural Pasture Land	ha	4,000,000	
Water and Accessibility			
Water Supply Coverage (JMP)	%	79	
Water Supply Coverage (Sector Ministry)	%	N/A	
Urban Water Supply Coverage (JMP)	%	91	
Urban Water Supply Coverage (Sector Ministry)	%	N/A	
Rural Water Supply Coverage (JMP)	%	56	
Rural Water Supply Coverage (Sector Ministry)	%	N/A	
Sanitation Coverage (JMP)	%	73	
Sanitation Coverage (Sector Ministry)	%	N/A	
Urban Sanitation Coverage (JMP)	%	76	
Urban Sanitation Coverage (Sector Ministry)	%	N/A	
Rural Sanitation Coverage (JMP)	%	67	
Rural Sanitation Coverage (Sector Ministry)	%	N/A	
Length of water supply pipe networks	Km	N/A	
Length of Sewage pipe networks	Km	N/A	
Length of Irrigation Networks	Km	N/A	
Length of Drainage Network	Km	N/A	
Total drinking water treatment plant capacity	BCM/Year	N/A	
Dam Capacity (Installed)	BCM/Year	151.80	
Desalination Capacity	BCM/Year	N/A	
Electricity Generated Using Hydropower	GWh/Year	N/A	
Water and Demographics			
Total Population	1000 inhabitants	31,120	
Internal Renewable Water Resources per Capita	CM/capita	1,195	
Total Renewable Blue Water Resources per Capita	CM/capita	2,783	
Total Renewable Water Resources per Capita	CM/capita	3,163	
Blue Water Withdrawal per Capita	CM/capita	2,911	
Green Water Consumption per Capita	CM/capita	380	
Total Available Water Resources per Capita	CM/capita	3,566	
Total Water Consumption per Capita	CM/capita	3,291	
Agricultural Water Withdrawal per Capita	CM/capita	2,293	
Industrial Water Withdrawal per Capita	CM/capita	427	
Domestic Water Withdrawal per Capita	CM/capita	189	
Population Without Improved Water Supply	1000 inhabitants	6,535	

Population Without Adequate Sanitation	1000 inhabitants	8,402	
Water and Quality			
Average Total Dissolved Solids	mg/l	N/A	
Diarrhea Reported Cases	% of children under 5	N/A	
Dracunculiasis Reported Cases	Number	0	
Cholera Reported cases	Number	2	
Open Defecation Practice	%	1	
Water and Climate			
Flood Events in the Last Two Decades.	Number	5	
Flood Events 1989-2000	Number	0	
Flood Events 2000-2011	Number	5	
Water and Economics			
National Climate Change Adaptation Plan	Yes/No	N/A	
Industrial Water Productivity (GDP/Water Use)	$/CM	6.53	
Employment in Agriculture	Jobs/MCM	19.88	
Agricultural Water Productivity (GDP/Water Use)	$/CM	0.04	
Water and Sanitation Charges as % of the lowest Household Income Groups	%	0.09	
Subsidy (Domestic-Industrial-Agricultural)	%	N/A	
Public Expenditure on Water Related Projects	Million US$	2,610,000,000	
Foreign Development Assistance for Water (Total 2009-2012)	Million US$	6,546	
Foreign Development Assistance for Water (average yearly)	Million US$	2,182	
Virtual Water Imports related to Trade in the Agricultural Sector	BCM/Year	3.52	
Virtual Water Exports related to Trade in the Agricultural Sector	BCM/Year	0.02	
Virtual-Water net Flow Related to Trade in the Agricultural Sector	BCM/Year	3.50	
Water and Political Affairs			
IWRM Plan in Place	Yes/No	N/A	
Water Rights/year	Number	N/A	
Well Permits/year	Number	N/A	
Irrigation related complaints	Number/Year	N/A	
Water Supply and Sanitation related complaints	Number/Year	N/A	
Transboundary Water Bodies Dependency Ratio	%	64	
Standpoint in the 1997 UN Convention	Ratification/ Voting	Ratified	

*All data and estimates are for 2012 unless otherwise mentioned



Jordan

Jordan

The Hashemite Kingdom is one of the world's water poorest nations, a situation which is being exacerbated by a rapidly growing population. The average annual rainfall is about 111 mm varying considerably from the eastern and southern desert to the northern highlands Figure (95). Precipitation, which mainly occurs in winter, is highly irregular and accounts for 8.43 BCM/y, 2.055 of which are directly and beneficially used from the atmosphere by rain fed areas, pasture areas, and forests in what is known as Green Water. The total Internal Renewable Blue Water Resources are 0.94 BCM/y.

The actual transboundary incoming surface flow is estimated recently at 0.165 BCM/y after the upstream Syrian development works, whereas the Natural flow would have been 0.68 BCM/y. The Yarmouk River accounts for about 40 % of the surface water resources of Jordan. Other major basins include Zarqa, Jordan rivere side wadis, Mujib, Hasa and Wadi Araba.

The internal renewable groundwater is estimated at 0.45 BCM/y while the annual renewable transboundary inflow of groundwater is estimated at 0.09 BCM/y. Fig (96) shows the groundwater basins in the kingdom. Agriculture consumes 64% of the kingdom's water resources, with the rest divided between the municipal and industrial sector, 31 % for the municipal sector and 4 % for Industry.

The total annual water withdrawal 1.06 BCM/y which corresponds to an annual per capita share of 164 CM. The irrigation potential is estimated at 85,000 ha.

The total desalinated seawater amounted for almost 0.01 BCM/y in 2005, while the treated wastewater amounted for 0.1 BCM/y in the same year. The Water Supply coverage is 97% while the sanitation coverage is 88% in the same year.

Total dam capacity is estimated at 0.27 BCM/y. The King Talal dam on the Zarqa River is the largest dam in Jordan and has a capacity of 0.08 BCM/y.

Jordan is a riparian to one of the most famous rivers in the world, which is the Jordan River. Under the Jordan Israel Peace Treaty, Jordan is entitled to a minimum average of 20 MCM of winter floodwaters from the Jordan River, in addition to the 20 MCM which Jordan receives from the Jordan River in exchange for Yarmouk waters. The quality of the Water that Jordan receives is a major issue that was either not covered intensively in the agreement, or is an abuse of Jordanian rights by the Israeli side.

Jordan's GDP was estimated at $ 26.4 billion in 2010. The agriculture share was up to 3% of the total GDP whereas the industry share (including oil and gas) was estimated at 31.1 % of GDP. The Gross National Income per Capita based on purchasing power parity in 2011 was estimated at $ 5800. According to the bilateral commitments between Development Assistance Committee (DAC) countries of the Organization for Economic Cooperation and Development (OECD), Jordan has received in the water sector and sanitation Official Development Aid estimated at $ 311.18 million in 2011. This amount states the highest amount of aid disbursed to Arab recipient countries in the water supply and sanitation sector in 2011. Regarding Arab Aid, Jordan has received $ 240 thousands in the water and sanitation sector from the Kuwait fund for Economic Development in 2008. As for the actual government budget for 2011-2013, Jordan has planned to spend on the Water and Sanitation sector about $ 1.4 billion.

The total capital investment needed during the period 2010-2015 to reach the

sanitation universal coverage target is estimated at $ 155 million and 559 thousand people to be covered, the capital investment for MDG in sanitation coverage is at the value of $ 18 million translated to 55 thousand people. Regarding the water supply coverage, Jordan needs to invest the amount of $ 64 million and to cover 134 thousand people to reach the MDG target, and the amount of $ 279 million and 564 thousand people to be covered.

Agriculture is the major water use sector. The gross agriculture production in 2010 reached $ 791 million. Jordan virtual water exports in agriculture were estimated at 1227.57 MCM which had a product value of $ 781.78 million. Imports of virtual water in agriculture were estimated at 7.7 billion CM which is translated in products value at about $ 1.6 billion.

The technically feasible hydropower potential is estimated at 500 MegaWatthour per year and the installed hydro capacity is 12 Megawatt hour. The hydro power generation in 2008 reached 62 Gigawatt hour which represents 0.45 % of the total power production in Jordan.

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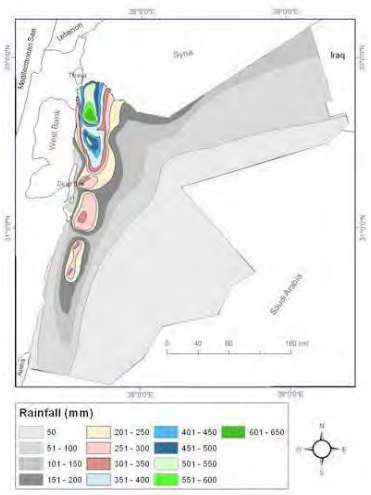

Figure 96. Rainfall Distribution in Jordan (Jordanian Ministry of Environment)

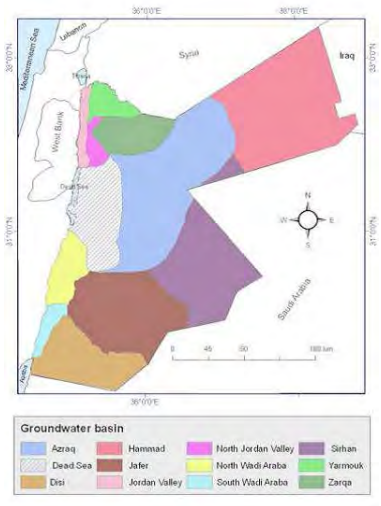

Figure 97. Groundwater Basins in Jordan (Jordanian Ministry of Environment)

Jordan Water Indicators

Water Related Indicators	Units	Jordan	Notes
Water Availability			
Annual Average Precipitaion Depth	MM/Year	111	
Annual Average Precipitation Volume	BCM/Year	8.43	
Internal Renewable Surface Water (IRSW)	BCM/Year	0.49	
Internal Renewable Groundwater (IRG)	BCM/Year	0.45	
Total Internal Renewable Blue Water Resources (TIRBWR)=(IRSW+IRG)	BCM/Year	0.94	
External Surface Water Inflow (ESWI)	BCM/Year	0.67	
External Surface Water Outflow (ESWO)	BCM/Year	0	
External Groundwater Inflow (EGI)	BCM/Year	0.27	
External Groundwater Outflow (EGO)	BCM/Year	0	
Total External Renewable Blue Water Resources (TERBWR)=(ESWI+EGI)	BCM/Year	0.94	
Total Renewable Blue Surface Water (TRBSW)=(IRSW)+(ESWI)-(ESWO)	BCM/Year	1.16	
Total Renewable Blue Groundwater (TRBG)=(IRG)+(EGI)-(EGO)	BCM/Year	0.72	
Overlap Between Surface Water and Groundwater (OSW)	BCM/Year	0.25	
Total Renewable Blue Water Resources (TRBWR)=(TRBSW)+(TRBG)-(OSW)	BCM/Year	1.62	
Total Rainfed Agriculture Abstractions	BCM/Year	0.40	
Total Natural Pasture Abstractions	BCM/Year	1.49	
Total Forest Abstractions	BCM/Year	0.16	
Total Renewable Green Water Resources (TRGWR)	BCM/Year	2.06	
Total Renewable Water Resources (TRWR)=(TRBWR+TRGWR)	BCM/Year	3.68	
Produced Municipal and Industrial Wastewater (PMW)	BCM/Year	0.18	
Treated Municipal and Industrial Wastewater	BCM/Year	0.11	
Reused Treated and Industrial Municipal Wastewater	BCM/Year	0.08	
Produced Agricultural Drainage (PAD)	BCM/Year	0.17	
Reused Agricultural Drainage	BCM/Year	0	
Produced Desalinated Water (PDW)	BCM/Year	0.01	
Total Non-Conventional Water Resources (TNCWR)=(PMW)+(PAD)+(PDW)	BCM/Year	0.36	
Total Non Renewable Groundwater Resources (TNRGR)	BCM/Year	N/A	
Total Conventional Water Resources (TCWR)=(TRWR)+(TNRGR)	BCM/Year	3.68	
Total Available Water Resources (TAWR)=(TCWR)+(TNCWR)	BCM/Year	4.04	
Water Withdrawals and Consumption			
Annual Total Water Withdrawal	BCM/Year	1.06	
Withdrawals by the Domestic Sector	BCM/Year	0.33	
Withdrawals by the Industrial Sector	BCM/Year	0.04	
Withdrawals by the Irrigated Agriculture Sector (Blue Water+Non-conventional Water)	BCM/Year	0.69	
Agricultural Consumption from Green Water	BCM/Year	0.40	
Total Agricultural Withdrawals	BCM/Year	1.09	
Withdrawals From Blue Surface Water	BCM/Year	0.43	
Withdrawals From Blue Groundwater	BCM/Year	0.63	
Withdrawals from Non-Renewable Groundwater	BCM/Year	0.50	

Withdrawals From Non-Conventional Resources	BCM/Year	0.09	
Overall Water Use Efficiency	%	66.60	
Water Sustainability Index	%	98.27	
Wastewater and Drainage Outflows	BCM/Year	0.27	
Water and Land Use Change			
Total Irrigated Agricultural Land	ha	64,300	
Total rain-Fed Agricultural Land	ha	201,000	
Total Forest Land	ha	79,200	
Total Natural Pasture Land	ha	743,000	
Water and Accessibility			
Water Supply Coverage (JMP)	%	97	
Water Supply Coverage (Sector Ministry)	%	N/A	
Urban Water Supply Coverage (JMP)	%	98	
Urban Water Supply Coverage (Sector Ministry)	%	N/A	
Rural Water Supply Coverage (JMP)	%	92	
Rural Water Supply Coverage (Sector Ministry)	%	N/A	
Sanitation Coverage (JMP)	%	98	
Sanitation Coverage (Sector Ministry)	%	N/A	
Urban Sanitation Coverage (JMP)	%	98	
Urban Sanitation Coverage (Sector Ministry)	%	N/A	
Rural Sanitation Coverage (JMP)	%	98	
Rural Sanitation Coverage (Sector Ministry)	%	N/A	
Length of water supply pipe networks	Km	N/A	
Length of Sewage pipe networks	Km	N/A	
Length of Irrigation Networks	Km	N/A	
Length of Drainage Network	Km	N/A	
Total drinking water treatment plant capacity	BCM/Year	N/A	
Dam Capacity (Installed)	BCM/Year	0.27	
Desalination Capacity	BCM/Year	N/A	
Electricity Generated Using Hydropower	GWh/Year	62	
Water and Demographics			
Total Population	1000 inhabitants	6,508	
Internal Renewable Water Resources per Capita	CM/capita	143	
Total Renewable Blue Water Resources per Capita	CM/capita	249	
Total Renewable Water Resources per Capita	CM/capita	565	
Blue Water Withdrawal per Capita	CM/capita	163	
Green Water Consumption per Capita	CM/capita	315	
Total Available Water Resources per Capita	CM/capita	621	
Total Water Consumption per Capita	CM/capita	479	
Agricultural Water Withdrawal per Capita	CM/capita	106	
Industrial Water Withdrawal per Capita	CM/capita	6.67	
Domestic Water Withdrawal per Capita	CM/capita	50.58	
Population Without Improved Water Supply	1000 inhabitants	195	

Population Without Adequate Sanitation	1000 inhabitants	130.16	
Water and Quality			
Average Total Dissolved Solids	mg/l	N/A	
Diarrhea Reported Cases	% of children under 5	18	
Dracunculiasis Reported Cases	Number	0	
Cholera Reported cases	Number	N/A	
Open Defecation Practice	%	0	
Water and Climate			
Flood Events in the Last Two Decades.	Number	6	
Flood Events 1989-2000	Number	5	
Flood Events 2000-2011	Number	1	
Water and Economics			
National Climate Change Adaptation Plan	Yes/No	N/A	
Industrial Water Productivity (GDP/Water Use)	$/CM	206.69	
Employment in Agriculture	Jobs/MCM	114.22	
Agricultural Water Productivity (GDP/Water Use)	$/CM	6.66	
Water and Sanitation Charges as % of the lowest Household Income Groups	%	5.94	
Subsidy (Domestic-Industrial-Agricultural)	%	N/A	
Public Expenditure on Water Related Projects	Million US$	1,779	
Foreign Development Assistance for Water (Total 2009-2012)	Million US$	1,055	
Foreign Development Assistance for Water (average yearly)	Million US$	351.79	
Virtual Water Imports related to Trade in the Agricultural Sector	BCM/Year	7.71	
Virtual Water Exports related to Trade in the Agricultural Sector	BCM/Year	1.23	
Virtual-Water net Flow Related to Trade in the Agricultural Sector	BCM/Year	6.49	
Water and Political Affairs			
IWRM Plan in Place	Yes/No	N/A	
Water Rights/year	Number	N/A	
Well Permits/year	Number	N/A	
Irrigation related complaints	Number/Year	N/A	
Water Supply and Sanitation related complaints	Number/Year	N/A	
Transboundary Water Bodies Dependency Ratio	%	58	
Standpoint in the 1997 UN Convention	Ratification/ Voting	Ratified	

*All data and estimates are for 2012 unless otherwise mentioned

Kuwait

Kuwait

The average annual rainfall is about 121 mm corresponding to an annual volume of 3.14 BCM, it mainly occurs from October to May. While an annual amount of 1.72 BCM is consumed by rainfed agriculture, only small part of the rain water contribute to the groundwater due to the high evaporation, There are two major aquifers: the Kuwait group (upper layer) and the Damman group (lower layer). Transboundary incoming groundwater inflow (lateral under-flow from Saudi Arabia) is estimated at about 0.02 BCM/y. The groundwater in Kuwait can be classified into three categories according to salinity:

- < 1 000 PPM for drinking and domestic purposes
- 1 000 - 10 000 for irrigation
- > 10 000 for limited uses

The groundwater quality and quantity are deteriorating because of continuous groundwater depletion. The Renewable Blue Water Resources, as of 2012, is 0.03 BCM/Year where the total population is 2.6 million inhabitant, thus generating per capita share of only 7.7 CM/y.

The annual withdrawals are supplemented by the following amounts of non-conventional water resources:

- 0.42 km3/y from desalination
- 0.25 km3/y from treated wastewater

Kuwait's GDP was estimated at $ 39.2 billion in 2010. The agriculture share was up 6% of GDP which is translated to $ 1.9 billion, whereas the industry share (including oil and gas) was estimated at 21.4 of total GDP. The Gross National Income per Capita based on purchasing power parity in 2010 was estimated at $ 14100. According to the bilateral commitments between Development Assistance Committee (DAC) countries of the Organization for Economic Cooperation and Development (OECD), Kuwait has received $ 25.49 million Official Development Aid. According to the government's budget of 2012, Kuwait has allocated for the Ministry of Energy and Water the total amount of $ 12.5 billion. The total capital investment needed during the period 2010-2015 to reach the sanitation universal coverage target is estimated at $ 143 million , whereas for the capital investment needed for MDG sanitation coverage is about $ 10 million. As for the water supply sector, Kuwait has achieved the MDG target and still requires $ 208 million to achieve universal water supply coverage. The population that needs to be covered to reach the universal coverage in the sanitation sector is estimated by 327 thousands person, as for the MDG target, it is already covered. In water sector, 17 thousand person need to be covered to reach the MDG target and 341 thousand person for universal coverage.

Agriculture is the major water use sector. Kuwait virtual water imports in agriculture were estimated at 5 billion CM which had a product value of $ 1.5 billion. Exports of virtual water in agriculture were estimated at 147.43 MCM which is translated in products value of $ 32.66 million.

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Kuwait Water Indicators

Water Related Indicators	Units	Kuwait	Notes
Water Availability			
Annual Average Precipitaion Depth	MM/Year	121	
Annual Average Precipitation Volume	BCM/Year	3.14	
Internal Renewable Surface Water (IRSW)	BCM/Year	0	
Internal Renewable Groundwater (IRG)	BCM/Year	0.01	
Total Internal Renewable Blue Water Resources (TIRBWR)=(IRSW+IRG)	BCM/Year	0.01	
External Surface Water Inflow (ESWI)	BCM/Year	0	
External Surface Water Outflow (ESWO)	BCM/Year	0	
External Groundwater Inflow (EGI)	BCM/Year	0.02	
External Groundwater Outflow (EGO)	BCM/Year	0	
Total External Renewable Blue Water Resources (TERBWR)=(ESWI+EGI)	BCM/Year	0.02	
Total Renewable Blue Surface Water (TRBSW)=(IRSW)+(ESWI)-(ESWO)	BCM/Year	0	
Total Renewable Blue Groundwater (TRBG)=(IRG)+(EGI)-(EGO)	BCM/Year	0.03	
Overlap Between Surface Water and Groundwater (OSW)	BCM/Year	0	
Total Renewable Blue Water Resources (TRBWR)=(TRBSW)+(TRBG)-(OSW)	BCM/Year	0.03	
Total Rainfed Agriculture Abstractions	BCM/Year	0.06	
Total Natural Pasture Abstractions	BCM/Year	1.60	
Total Forest Abstractions	BCM/Year	0.06	
Total Renewable Green Water Resources (TRGWR)	BCM/Year	1.72	
Total Renewable Water Resources (TRWR)=(TRBWR+TRGWR)	BCM/Year	1.75	
Produced Municipal and Industrial Wastewater (PMW)	BCM/Year	0.27	
Treated Municipal and Industrial Wastewater	BCM/Year	0.25	
Reused Treated and Industrial Municipal Wastewater	BCM/Year	0.08	
Produced Agricultural Drainage (PAD)	BCM/Year	0.13	
Reused Agricultural Drainage	BCM/Year	0	
Produced Desalinated Water (PDW)	BCM/Year	0.42	
Total Non-Conventional Water Resources (TNCWR)=(PMW)+(PAD)+(PDW)	BCM/Year	0.82	
Total Non Renewable Groundwater Resources (TNRGR)	BCM/Year	N/A	
Total Conventional Water Resources (TCWR)=(TRWR)+(TNRGR)	BCM/Year	1.75	
Total Available Water Resources (TAWR)=(TCWR)+(TNCWR)	BCM/Year	2.58	
Water Withdrawals and Consumption			
Annual Total Water Withdrawal	BCM/Year	1	
Withdrawals by the Domestic Sector	BCM/Year	0.44	
Withdrawals by the Industrial Sector	BCM/Year	0.02	
Withdrawals by the Irrigated Agriculture Sector (Blue Water+Non-conventional Water)	BCM/Year	0.54	
Agricultural Consumption from Green Water	BCM/Year	0.06	
Total Agricultural Withdrawals	BCM/Year	0.60	
Withdrawals From Blue Surface Water	BCM/Year	0	
Withdrawals From Blue Groundwater	BCM/Year	0.54	
Withdrawals from Non-Renewable Groundwater	BCM/Year	0.54	

Withdrawals From Non-Conventional Resources	BCM/Year	0.50	
Overall Water Use Efficiency	%	57.81	
Water Sustainability Index	%	184.67	
Wastewater and Drainage Outflows	BCM/Year	0.33	
Water and Land Use Change			
Total Irrigated Agricultural Land	ha	4,800	
Total rain-Fed Agricultural Land	ha	5,000	
Total Forest Land	ha	5,400	
Total Natural Pasture Land	ha	136,000	
Water and Accessibility			
Water Supply Coverage (JMP)	%	99	
Water Supply Coverage (Sector Ministry)	%	N/A	
Urban Water Supply Coverage (JMP)	%	99	
Urban Water Supply Coverage (Sector Ministry)	%	N/A	
Rural Water Supply Coverage (JMP)	%	99	
Rural Water Supply Coverage (Sector Ministry)	%	N/A	
Sanitation Coverage (JMP)	%	100	
Sanitation Coverage (Sector Ministry)	%	N/A	
Urban Sanitation Coverage (JMP)	%	100	
Urban Sanitation Coverage (Sector Ministry)	%	N/A	
Rural Sanitation Coverage (JMP)	%	100	
Rural Sanitation Coverage (Sector Ministry)	%	N/A	
Length of water supply pipe networks	Km	N/A	
Length of Sewage pipe networks	Km	N/A	
Length of Irrigation Networks	Km	N/A	
Length of Drainage Network	Km	N/A	
Total drinking water treatment plant capacity	BCM/Year	N/A	
Dam Capacity (Installed)	BCM/Year	N/A	
Desalination Capacity	BCM/Year	0.61	
Electricity Generated Using Hydropower	GWh/Year	N/A	
Water and Demographics			
Total Population	1000 inhabitants	2,600	
Internal Renewable Water Resources per Capita	CM/capita	3.85	
Total Renewable Blue Water Resources per Capita	CM/capita	11.5	
Total Renewable Water Resources per Capita	CM/capita	674	
Blue Water Withdrawal per Capita	CM/capita	383	
Green Water Consumption per Capita	CM/capita	663	
Total Available Water Resources per Capita	CM/capita	991	
Total Water Consumption per Capita	CM/capita	1,046	
Agricultural Water Withdrawal per Capita	CM/capita	206	
Industrial Water Withdrawal per Capita	CM/capita	8.73	
Domestic Water Withdrawal per Capita	CM/capita	168	
Population Without Improved Water Supply	1000 inhabitants	26	

Population Without Adequate Sanitation	1000 inhabitants	0	
Water and Quality			
Average Total Dissolved Solids	mg/l	N/A	
Diarrhea Reported Cases	% of children under 5	10.20	
Dracunculiasis Reported Cases	Number	0	
Cholera Reported cases	Number	N/A	
Open Defecation Practice	%	0	
Water and Climate			
Flood Events in the Last Two Decades.	Number	N/A	
Flood Events 1989-2000	Number	0	
Flood Events 2000-2011	Number	0	
Water and Economics			
National Climate Change Adaptation Plan	Yes/No	N/A	
Industrial Water Productivity (GDP/Water Use)	$/CM	4,062	
Employment in Agriculture	Jobs/MCM	470.43	
Agricultural Water Productivity (GDP/Water Use)	$/CM	1.33	
Water and Sanitation Charges as % of the lowest Household Income Groups	%	0	
Subsidy (Domestic-Industrial-Agricultural)	%	N/A	
Public Expenditure on Water Related Projects	Million US$	12,044	
Foreign Development Assistance for Water (Total 2009-2012)	Million US$	0.62	
Foreign Development Assistance for Water (average yearly)	Million US$	0.21	
Virtual Water Imports related to Trade in the Agricultural Sector	BCM/Year	5.33	
Virtual Water Exports related to Trade in the Agricultural Sector	BCM/Year	0.15	
Virtual-Water net Flow Related to Trade in the Agricultural Sector	BCM/Year	5.18	
Water and Political Affairs			
IWRM Plan in Place	Yes/No	N/A	
Water Rights/year	Number	N/A	
Well Permits/year	Number	N/A	
Irrigation related complaints	Number/Year	N/A	
Water Supply and Sanitation related complaints	Number/Year	N/A	
Transboundary Water Bodies Dependency Ratio	%	100	
Standpoint in the 1997 UN Convention	Ratification/ Voting	Voted in Favor	

*All data and estimates are for 2012 unless otherwise mentioned

Lebanon

Lebanon

Lebanon, remains blessed with relatively more water in comparison with its neighbouring countries. The average annual rainfall is about 823 mm varying from 600 – 900 mm along the coastal zones to 1,400 mm on the high mountains and decreasing to 400 mm in the eastern parts and less than 200 mm in the north-east. Precipitation mainly occurs between October and April and amounts to about 8 BCM/y, 1.23 of which are consumed directly by rainfed agriculture, pasture areas, and forests in what is known as Green Water. The surface water in Lebanon can be divided into five regions: the El Assi (Orontes) river basin in the north, the Litani river basin in the east and south, the Hasbani river basin south east, coastal river basins in the west, and small scattered sub-catchments.

Transboundary surface outflow to Syria is estimated at 0.510 BCM/y through the El-Assi (Orontes) river and El Kebir River. Surface water flow contributed to Jordan River is estimated at 0.138 BCM/y. Estimated average annual groundwater outflow is 1.03 BCM divided as 0.13 BCM/y to Syria, 0.18 to south Lebanon and 0.72 to the sea.

The Total Renewable Blue Water Resources is considered 7 BCM/y 3.23 BCM/Year as of 2012 where the total population is be 4.14 million inhabitant, thus generating a per capita share of Annual Renewable Water of 1690 CM/y.

The total dam capacity in 2008 was 0.228 BCM. Large dames in Lebanon include Karaoun dam on the Litani river, the Bisri dam on the Awali river, and the Kardalé dam on the middle reach of the Litani river. As of 2010 the annual water allocations were as follows:

- 59% agriculture,
- 31% domestic uses
- 11% industrial uses

As of 2006, the Water supply and Sanitation coverage were 100%. Figure (98) shows the frequency of the water supply service in different areas of Lebanon during both the high season (spring-summer) and the low season (autumn-winter).

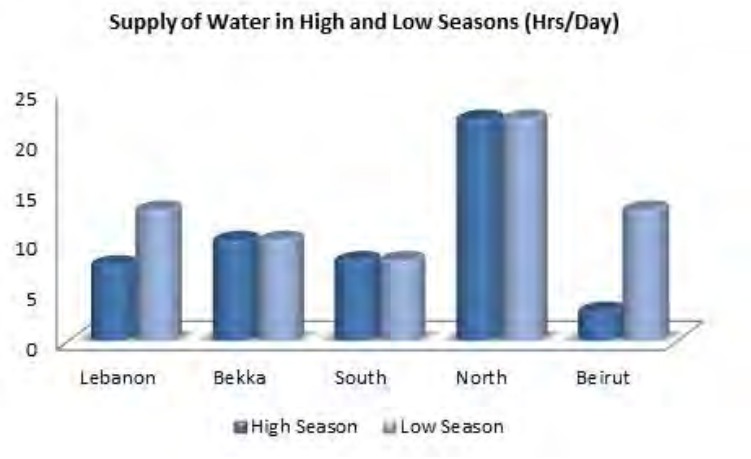

Figure 98. Water Supply in Lebanese Regions (World Bank)

Alternative Water resources are less developed in Lebanon compared to its neighbors, with the annual desalinated sea water not exceeding 0.05 BCM and the annual treated waste water not exceeding 0.004 BCM

Lebanon's GDP was estimated at $ 39 billion in 2010. The agriculture share was up 6% of GDP which is translated to $ 1 billion, whereas the industry share (including oil and gas) was estimated at 21.4 of total GDP. The Gross National Income per Capita based on purchasing power parity in 2010 was estimated at $ 14100. According to the bilateral commitments between Development Assistance Committee (DAC) countries of the Organization for Economic Cooperation and Development (OECD) and Arab countries, Lebanon

has received $ 25.49 million Official Development Aid. According to the government's budget of 2012, Lebanon has allocated for the Ministry of Energy and Water the total amount of $ 715 million.

The total capital investment needed during the period 2010-2015 to reach the sanitation universal coverage target is estimated at $ 143 million, whereas for the capital investment needed for MDG sanitation coverage is about $ 10 million. As for the water supply sector, Lebanon has achieved the MDG target and still requires $ 208 million to achieve universal water supply coverage.

Agriculture is the major water use sector. Lebanon virtual water imports in agriculture were estimated at 5.5 billion CM which had a product value of $ 1 billion. Exports of virtual water in agriculture were estimated at 428.5579 MCM which is translated in products value of $ 140.99 million.

The installed hydro capacity is 280 Megawatt hour. The hydro power generation in 2008 reached 750 Gigawatt hour which represents 7% of the total power production in Lebanon.

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Lebanon Water Indicators

Water Related Indicators	Units	Lebanon	Notes
Water Availability			
Annual Average Precipitaion Depth	MM/Year	823	
Annual Average Precipitation Volume	BCM/Year	8	
Internal Renewable Surface Water (IRSW)	BCM/Year	4.10	
Internal Renewable Groundwater (IRG)	BCM/Year	3.20	
Total Internal Renewable Blue Water Resources (TIRBWR)=(IRSW+IRG)	BCM/Year	7.30	
External Surface Water Inflow (ESWI)	BCM/Year	0.04	
External Surface Water Outflow (ESWO)	BCM/Year	0.58	
External Groundwater Inflow (EGI)	BCM/Year	0	
External Groundwater Outflow (EGO)	BCM/Year	1.03	
Total External Renewable Blue Water Resources (TERBWR)=(ESWI+EGI)	BCM/Year	0.04	
Total Renewable Blue Surface Water (TRBSW)=(IRSW)+(ESWI)-(ESWO)	BCM/Year	3.56	
Total Renewable Blue Groundwater (TRBG)=(IRG)+(EGI)-(EGO)	BCM/Year	2.17	
Overlap Between Surface Water and Groundwater (OSW)	BCM/Year	2.50	
Total Renewable Blue Water Resources (TRBWR)=(TRBSW)+(TRBG)-(OSW)	BCM/Year	3.23	
Total Rainfed Agriculture Abstractions	BCM/Year	0.35	
Total Natural Pasture Abstractions	BCM/Year	0.70	
Total Forest Abstractions	BCM/Year	0.24	
Total Renewable Green Water Resources (TRGWR)	BCM/Year	1.29	
Total Renewable Water Resources (TRWR)=(TRBWR+TRGWR)	BCM/Year	4.52	
Produced Municipal and Industrial Wastewater (PMW)	BCM/Year	0.31	
Treated Municipal and Industrial Wastewater	BCM/Year	0.004	
Reused Treated and Industrial Municipal Wastewater	BCM/Year	0.002	
Produced Agricultural Drainage (PAD)	BCM/Year	0.21	
Reused Agricultural Drainage	BCM/Year	N/A	
Produced Desalinated Water (PDW)	BCM/Year	0.05	
Total Non-Conventional Water Resources (TNCWR)=(PMW)+(PAD)+(PDW)	BCM/Year	0.57	
Total Non Renewable Groundwater Resources (TNRGR)	BCM/Year	N/A	
Total Conventional Water Resources (TCWR)=(TRWR)+(TNRGR)	BCM/Year	4.52	
Total Available Water Resources (TAWR)=(TCWR)+(TNCWR)	BCM/Year	5.09	
Water Withdrawals and Consumption			
Annual Total Water Withdrawal	BCM/Year	1.42	
Withdrawals by the Domestic Sector	BCM/Year	0.41	
Withdrawals by the Industrial Sector	BCM/Year	0.16	
Withdrawals by the Irrigated Agriculture Sector (Blue Water+Non-conventional Water)	BCM/Year	0.84	
Agricultural Consumption from Green Water	BCM/Year	0.35	
Total Agricultural Withdrawals	BCM/Year	1.19	
Withdrawals From Blue Surface Water	BCM/Year	0.61	
Withdrawals From Blue Groundwater	BCM/Year	0.76	
Withdrawals from Non-Renewable Groundwater	BCM/Year	0	

Withdrawals From Non-Conventional Resources	BCM/Year	0.05	
Overall Water Use Efficiency	%	63.15	
Water Sustainability Index	%	68.50	
Wastewater and Drainage Outflows	BCM/Year	0.52	
Water and Land Use Change			
Total Irrigated Agricultural Land	ha	87,500	
Total rain-Fed Agricultural Land	ha	198,000	
Total Forest Land	ha	136,000	
Total Natural Pasture Land	ha	400,000	
Water and Accessibility			
Water Supply Coverage (JMP)	%	100	
Water Supply Coverage (Sector Ministry)	%	N/A	
Urban Water Supply Coverage (JMP)	%	100	
Urban Water Supply Coverage (Sector Ministry)	%	N/A	
Rural Water Supply Coverage (JMP)	%	100	
Rural Water Supply Coverage (Sector Ministry)	%	N/A	
Sanitation Coverage (JMP)	%	87	
Sanitation Coverage (Sector Ministry)	%	N/A	
Urban Sanitation Coverage (JMP)	%	100	
Urban Sanitation Coverage (Sector Ministry)	%	N/A	
Rural Sanitation Coverage (JMP)	%	-	
Rural Sanitation Coverage (Sector Ministry)	%	N/A	
Length of water supply pipe networks	Km	N/A	
Length of Sewage pipe networks	Km	N/A	
Length of Irrigation Networks	Km	N/A	
Length of Drainage Network	Km	N/A	
Total drinking water treatment plant capacity	BCM/Year	N/A	
Dam Capacity (Installed)	BCM/Year	0.23	
Desalination Capacity	BCM/Year	N/A	
Electricity Generated Using Hydropower	GWh/Year	750	
Water and Demographics			
Total Population	1000 inhabitants	4,140	
Internal Renewable Water Resources per Capita	CM/capita	1,763	
Total Renewable Blue Water Resources per Capita	CM/capita	780	
Total Renewable Water Resources per Capita	CM/capita	1,091	
Blue Water Withdrawal per Capita	CM/capita	342	
Green Water Consumption per Capita	CM/capita	310	
Total Available Water Resources per Capita	CM/capita	1,228	
Total Water Consumption per Capita	CM/capita	652	
Agricultural Water Withdrawal per Capita	CM/capita	203	
Industrial Water Withdrawal per Capita	CM/capita	39	
Domestic Water Withdrawal per Capita	CM/capita	99	
Population Without Improved Water Supply	1000 inhabitants	0	

Population Without Adequate Sanitation	1000 inhabitants	538.20	
Water and Quality			
Average Total Dissolved Solids	mg/l	N/A	
Diarrhea Reported Cases	% of children under 5	19.30	
Dracunculiasis Reported Cases	Number	0	
Cholera Reported cases	Number	N/A	
Open Defecation Practice	%	-	
Water and Climate			
Flood Events in the Last Two Decades.	Number	4	
Flood Events 1989-2000	Number	2	
Flood Events 2000-2011	Number	2	
Water and Economics			
National Climate Change Adaptation Plan	Yes/No	N/A	
Industrial Water Productivity (GDP/Water Use)	$/CM	52.86	
Employment in Agriculture	Jobs/MCM	29.64	
Agricultural Water Productivity (GDP/Water Use)	$/CM	0.17	
Water and Sanitation Charges as % of the lowest Household Income Groups	%	N/A	
Subsidy (Domestic-Industrial-Agricultural)	%	N/A	
Public Expenditure on Water Related Projects	Million US$	7,257	
Foreign Development Assistance for Water (Total 2009-2012)	Million US$	93.68	
Foreign Development Assistance for Water (average yearly)	Million US$	31.23	
Virtual Water Imports related to Trade in the Agricultural Sector	BCM/Year	5.57	
Virtual Water Exports related to Trade in the Agricultural Sector	BCM/Year	0.43	
Virtual-Water net Flow Related to Trade in the Agricultural Sector	BCM/Year	5.14	
Water and Political Affairs			
IWRM Plan in Place	Yes/No	N/A	
Water Rights/year	Number	N/A	
Well Permits/year	Number	N/A	
Irrigation related complaints	Number/Year	N/A	
Water Supply and Sanitation related complaints	Number/Year	N/A	
Transboundary Water Bodies Dependency Ratio	%	2	
Standpoint in the 1997 UN Convention	Ratification/ Voting	Ratified	

*All data and estimates are for 2012 unless otherwise mentioned

Libya

Libya

The average annual rainfall is about 46 mm/ year with only 5% of the total area subjected to 100 mm/y of rain or more. The areas suitable for rain-fed agriculture are very limited; however there are vast areas of natural pasture, therefore, the annual volume of Green Water amounts to 22.73 BCM/y. Precipitation mainly occurs in winter, it accounts for 46 BCM/y 0.63 BCM/Year of internal renewable water resources. Surface runoff generated by rain flow is estimated at 0.2 BCM/y out of which 0.1 BCM/y contributes to evaporation losses and ground water recharge. Rechargeable ground water aquifers exist only along the north eastern zone where a considerable part is lost to the sea and through evaporation. The actual Renewable Blue Water Resources, as of 2008, is 0.6 BCM/y where the total population was 6.2 million inhabitant, thus generating an annual per capita share of Blue Water of only 97 m3/y 84.8 CM/capita.

The total Blue Water withdrawal is estimated at 4.3 BCM/y as of 2000, 83% of which is diverted to agriculture, 14% to domestic sector, and 3% to industry. Blue Water is mainly supplied through the extraction of fossil water from the Paleozoic and Mesozoic sand stone formations south of the 29 th parallel. Annual unconventional water sources include 0.007 BCM/ Year of desalinated water (directed towards domestic and industrial usage) and 0.04 BCM/y of reused treated water. The total withdrawals sources are distributed as:

- 95.6% from groundwater,
- 2.3% from surface runoff,
- 0.7% from desalination, and
- 1.4% from waste water reuse.

The irrigation potential based on Blue Water Resources is estimated at 47,000 ha located in the coastal areas. The water supply coverage is estimated as 100% in urban communities and 95% of rural population as of 2011, while the sanitation coverage is 60% in urban areas and 40% in rural areas.

Politically driven actions/reactions, isolation attempts, and the international embargo supported by the western communities have previously imposed serious constrains which hindered the effective development of the country's various sectors, despite the availability of financial resources. Major changes during the last 20 years include the establishment of sixteen dams with a total dam capacity of 0.387 BCM/y to manage surface runoff. The great man made river is a gigantic project aiming at conveying 2 BCM/y of fossil-extracted water through the desert to the northern regions to serve irrigation purposes.

Extensive extraction of groundwater from the coastal zones led to a considerable deterioration of the water quality due the reduction of groundwater level and the inland advancing of the salt water interface at a rate of 100 to 250 m/yr. The total area salinized by irrigation amounted to 190,000 ha in 1998.

Libya's GDP was estimated at $ 121 billion in 2010. The gross agriculture share was to $ 7.2 billion whereas the industry share (including oil and gas) was estimated at 60.5 % of total GDP. The Gross National Income per capita based on purchasing power parity in 2011 was estimated at $ 3370. According to the bilateral commitments between Development Assistance Committee (DAC) countries of the Organization for Economic Cooperation and Development (OECD), Djibouti has received in the water sector and sanitation Official Development Aid (ODA) of $ 22.51 million in 2011.

The total capital investment needed during the period 2010-2015 to reach the

sanitation universal coverage target is estimated at 2 billion $, whereas for the capital investment needed for MDG sanitation coverage $ 966 million are required. As for the water supply sector, Iraq still requires $ 1.5 billion to achieve MDG coverage, and $ 2 billion to achieve universal water supply coverage.

Agriculture is the largest water consumer. The gross agriculture production in 2010 reached $ 7 billion, the total food imports in the same year were estimated at $ 1174.31 million. In 2010, Iraq exported 0.68 thousand tons of cereals with $ 0.14 million, and imported 275.12 thousand tons of cereals at the value of $ 362.61 million. In 2010, Iraq's total agriculture imports of virtual water were estimated at 3.5 billion CM with the products valued at $ 1 billion. The total agriculture exports to Iraq in 2010 were estimated at 10.59 million $ which translates to about 23.21 MCM of virtual water exports.

The technically feasible hydropower potential is estimated at 90,000, whereas the economically feasible hydropower potential 67,000 Gigawatt hour per year and the installed hydro capacity is 2,273 Megawatt hour. The hydro power generation in 2008 represents 13 % of the total power production in Egypt..

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Libya Water Indicators

Water Related Indicators	Units	Libya	Notes
Water Availability			
Annual Average Precipitaion Depth	MM/Year	46	
Annual Average Precipitation Volume	BCM/Year	75	
Internal Renewable Surface Water (IRSW)	BCM/Year	0.03	
Internal Renewable Groundwater (IRG)	BCM/Year	0.60	
Total Internal Renewable Blue Water Resources (TIRBWR)=(IRSW+IRG)	BCM/Year	0.63	
External Surface Water Inflow (ESWI)	BCM/Year	0	
External Surface Water Outflow (ESWO)	BCM/Year	0	
External Groundwater Inflow (EGI)	BCM/Year	0	
External Groundwater Outflow (EGO)	BCM/Year	0	
Total External Renewable Blue Water Resources (TERBWR)=(ESWI+EGI)	BCM/Year	0	
Total Renewable Blue Surface Water (TRBSW)=(IRSW)+(ESWI)-(ESWO)	BCM/Year	0.03	
Total Renewable Blue Groundwater (TRBG)=(IRG)+(EGI)-(EGO)	BCM/Year	0.60	
Overlap Between Surface Water and Groundwater (OSW)	BCM/Year	0.10	
Total Renewable Blue Water Resources (TRBWR)=(TRBSW)+(TRBG)-(OSW)	BCM/Year	0.53	
Total Rainfed Agriculture Abstractions	BCM/Year	2.35	
Total Natural Pasture Abstractions	BCM/Year	20.12	
Total Forest Abstractions	BCM/Year	0.26	
Total Renewable Green Water Resources (TRGWR)	BCM/Year	22.73	
Total Renewable Water Resources (TRWR)=(TRBWR+TRGWR)	BCM/Year	23.26	
Produced Municipal and Industrial Wastewater (PMW)	BCM/Year	0.55	
Treated Municipal and Industrial Wastewater	BCM/Year	0.04	
Reused Treated and Industrial Municipal Wastewater	BCM/Year	0.04	
Produced Agricultural Drainage (PAD)	BCM/Year	0.0896	
Reused Agricultural Drainage	BCM/Year	0	
Produced Desalinated Water (PDW)	BCM/Year	0.0070	
Total Non-Conventional Water Resources (TNCWR)=(PMW)+(PAD)+(PDW)	BCM/Year	0.64	
Total Non Renewable Groundwater Resources (TNRGR)	BCM/Year	1.79	
Total Conventional Water Resources (TCWR)=(TRWR)+(TNRGR)	BCM/Year	25.05	
Total Available Water Resources (TAWR)=(TCWR)+(TNCWR)	BCM/Year	25.69	
Water Withdrawals and Consumption			
Annual Total Water Withdrawal	BCM/Year	4.33	
Withdrawals by the Domestic Sector	BCM/Year	0.61	
Withdrawals by the Industrial Sector	BCM/Year	0.13	
Withdrawals by the Irrigated Agriculture Sector (Blue Water+Non-conventional Water)	BCM/Year	3.58	
Agricultural Consumption from Green Water	BCM/Year	2.35	
Total Agricultural Withdrawals	BCM/Year	5.94	
Withdrawals From Blue Surface Water	BCM/Year	0	
Withdrawals From Blue Groundwater	BCM/Year	4.61	
Withdrawals from Non-Renewable Groundwater	BCM/Year	4	

Withdrawals From Non-Conventional Resources	BCM/Year	0.05	
Overall Water Use Efficiency	%	86.25	
Water Sustainability Index	%	127.93	
Wastewater and Drainage Outflows	BCM/Year	0.60	
Water and Land Use Change			
Total Irrigated Agricultural Land	ha	470,000	
Total rain-Fed Agricultural Land	ha	1,580,000	
Total Forest Land	ha	176,000	
Total Natural Pasture Land	ha	13,500,000	
Water and Accessibility			
Water Supply Coverage (JMP)	%	71	
Water Supply Coverage (Sector Ministry)	%	N/A	
Urban Water Supply Coverage (JMP)	%	–	
Urban Water Supply Coverage (Sector Ministry)	%	N/A	
Rural Water Supply Coverage (JMP)	%	–	
Rural Water Supply Coverage (Sector Ministry)	%	N/A	
Sanitation Coverage (JMP)	%	97	
Sanitation Coverage (Sector Ministry)	%	N/A	
Urban Sanitation Coverage (JMP)	%	97	
Urban Sanitation Coverage (Sector Ministry)	%	N/A	
Rural Sanitation Coverage (JMP)	%	96	
Rural Sanitation Coverage (Sector Ministry)	%	N/A	
Length of water supply pipe networks	Km	N/A	
Length of Sewage pipe networks	Km	N/A	
Length of Irrigation Networks	Km	N/A	
Length of Drainage Network	Km	N/A	
Total drinking water treatment plant capacity	BCM/Year	N/A	
Dam Capacity (Installed)	BCM/Year	0.38	
Desalination Capacity	BCM/Year	N/A	
Electricity Generated Using Hydropower	GWh/Year	0	
Water and Demographics			
Total Population	1000 inhabitants	6,200	
Internal Renewable Water Resources per Capita	CM/capita	100	
Total Renewable Blue Water Resources per Capita	CM/capita	84	
Total Renewable Water Resources per Capita	CM/capita	3,751	
Blue Water Withdrawal per Capita	CM/capita	697	
Green Water Consumption per Capita	CM/capita	3,666	
Total Available Water Resources per Capita	CM/capita	4,143	
Total Water Consumption per Capita	CM/capita	4,364	
Agricultural Water Withdrawal per Capita	CM/capita	578	
Industrial Water Withdrawal per Capita	CM/capita	21	
Domestic Water Withdrawal per Capita	CM/capita	98	
Population Without Improved Water Supply	1000 inhabitants	1,798	

Population Without Adequate Sanitation	1000 inhabitants	186	
Water and Quality			
Average Total Dissolved Solids	mg/l	N/A	
Diarrhea Reported Cases	% of children under 5	16.90	
Dracunculiasis Reported Cases	Number	0	
Cholera Reported cases	Number	N/A	
Open Defecation Practice	%	-	
Water and Climate			
Flood Events in the Last Two Decades.	Number	N/A	
Flood Events 1989-2000	Number	0	
Flood Events 2000-2011	Number	0	
Water and Economics			
National Climate Change Adaptation Plan	Yes/No	N/A	
Industrial Water Productivity (GDP/Water Use)	$/CM	369.48	
Employment in Agriculture	Jobs/MCM	14.62	
Agricultural Water Productivity (GDP/Water Use)	$/CM	0.33	
Water and Sanitation Charges as % of the lowest Household Income Groups	%	N/A	
Subsidy (Domestic-Industrial-Agricultural)	%	N/A	
Public Expenditure on Water Related Projects	Million US$	N/A	
Foreign Development Assistance for Water (Total 2009-2012)	Million US$	0.06	
Foreign Development Assistance for Water (average yearly)	Million US$	0.02	
Virtual Water Imports related to Trade in the Agricultural Sector	BCM/Year	8.10	
Virtual Water Exports related to Trade in the Agricultural Sector	BCM/Year	0.04	
Virtual-Water net Flow Related to Trade in the Agricultural Sector	BCM/Year	8.07	
Water and Political Affairs			
IWRM Plan in Place	Yes/No	N/A	
Water Rights/year	Number	N/A	
Well Permits/year	Number	N/A	
Irrigation related complaints	Number/Year	N/A	
Water Supply and Sanitation related complaints	Number/Year	N/A	
Transboundary Water Bodies Dependency Ratio	%	0	
Standpoint in the 1997 UN Convention	Ratification/ Voting	Ratified	

*All data and estimates are for 2012 unless otherwise mentioned

Mauritania

Mauritania

The average annual rainfall is about 92 mm varying considerably from less than 20 mm in the north to more than 500 mm in the south east. Precipitation mainly occurs for three months on the average and generates an annual volume of 95 BCM/y (AQUASTAT, FAO). The Green Water consumption is estimated at 4.077 BCM/y. Internal Renewable Blue Water Resources are estimated at 0.4 BCM/y of which 0.1 BCM/y are attributed to surface runoff and 0.3 BCM/y are due to ground water. The Senegal River runs along the southern border presenting, along with its tributaries on the right bank, the dominating hydrographic system of Mauritania. The Total Renewable Blue Water Resources are 11.4 BCM/y as of 2012 where the total population is projected to be 3.359 million inhabitant, thus generating a per capita share of 3394 CM/y. The total dam capacity is 0.50 BCM/Year in 1994.

Unconventional water resources formerly included 0.03 BCM/Year of desalinated sea water produced in a plant near the capital Nouakchott, some reports indicate that this plant has been abandoned after a short operation period. There is currently one wastewater treatment plant with an annual capacity of 730,000 CM. The treated wastewater is used mainly in garden irrigation. The total annual freshwater withdrawal is 1.6 BCM/y (923 CM/y /cap/y) as of 1985 and divided as follows:

- 80% agriculture,
- 15% domestic uses
- 4% industrial uses
- 1% tourism

The irrigation potential based on ARWR is estimated at 220,000 ha out of which 5,000 ha are oasis where irrigation is supplied through manual extraction from shallow wells. The water supply coverage (2008) is assessed as 52% in urban communities and 47% of rural population. It is estimated that 50% of the urban population have access to sanitation as of 2008. It has been reported that Mauritania loses 41 million USD annually due to poor sanitation, which is equivalent to 12.2 USD per citizen per year. Moreover, 0.7 Million Mauritanians use latrines or share it in an unhealthy way, and 1.7 million don't have latrines and defecate in the open air. According to the Water and Sanitation Program (WSP), outdoor defecation costs Mauritania 30.4 million dollar. However, the elimination of this practice would necessitate the construction and use of less than 350,000 latrines.

300,000 Mauritanian citizens benefit from a robust legal and institutional framework called "Organisation pour la Mise en Valeur du Fleuve Sénégal" (OMVS) which has been jointly developed two of the remaining three Senegal Basin riparians to deliver electricity to consumers in the three countries through a 200 megawatt hydroelectric plant at the foot of the Manantali dam in Mali and a 1,000 kilometre long system of 225 kilovolt transmission lines. The portion of the Mauritanian Population served by the framework amounts to 20% of the total basin population served.

The annual demographic growth at a rate of 2.3 % along with escalating demand for food, and requirements for fulfilling the national development plans are reflected in serious attempts for better management of water resources. High costs of irrigation development, weak support to the private sector, and inadequate organization of the operation of irrigation schemes are the main restraining factors. Insufficient and irregular rainfall and surface flows in the wades along with inconvenient accessibility to river water are also identified as main problems facing water resource management. Major changes during the last ten years include the inception

of effective exploitation of the countries rich fisheries, where the average annual freshwater fish catch is estimated at 5300 tons as of 1992 which is nearly half the estimate of 1973. Very high evaporation estimated at 3500 mm/y contributes to a major loss of water resources.

Mauritania's GDP was estimated at 3.6 billion $ in 2010. The agriculture share was up to 16 % of the total GDP whereas the industry share (including oil and gas) was estimated at 46.2 % of GDP. The Gross National Income per Capita based on purchasing power parity in 2009 was estimated at 1960 $. According to the bilateral commitments between Development Assistance Committee (DAC) countries of the Organization for Economic Cooperation and Development (OECD), Mauritania has received in the water sector and sanitation Official Development Aid estimated at 1.68 million $ in 2011 when Mauritania obtained in 2010 an amount of aid up to 14.95 million $. Regarding Arab Aid, Mauritania has received 55.84 million $ in the water and sanitation sector in 2011.

The total capital investment needed during the period 2010-2015 to reach the sanitation universal coverage target is estimated at $ 185 million and 1,671 thousand people to be covered, the capital investment for MDG in sanitation coverage is at the value of $ 111 million translated to about 1,173 thousand people. As for the water supply sector, Mauritania requires $ 78 million to achieve the MDG target and 576 thousand people to be covered. Regarding the universal coverage, Mauritania requires $ 222 million to reach the MDG coverage in the value of 1,485 thousand person to be covered.

Agriculture is the major water use sector. The gross agriculture production in 2010 reached $ 575 million. Mauritania virtual water imports in agriculture were estimated at 2640.931 MCM which had a product value of $ 351.47 million. Exports of virtual water in agriculture were estimated at 0 MCM but had in products monetary value the amount of $ 119.6 million of exports.

The installed hydro capacity is estimated at about 30 Megawatt hour. The hydro power generation in 2008 reached 1318 Gigawatt hour which represents 6.6 % of the total power production in Mauritania..

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Mauritania Water Indicators

Water Related Indicators	Units	Mauritania	Notes
Water Availability			
Annual Average Precipitaion Depth	MM/Year	224	
Annual Average Precipitation Volume	BCM/Year	94.82	
Internal Renewable Surface Water (IRSW)	BCM/Year	0.10	
Internal Renewable Groundwater (IRG)	BCM/Year	0.30	
Total Internal Renewable Blue Water Resources (TIRBWR)=(IRSW+IRG)	BCM/Year	0.40	
External Surface Water Inflow (ESWI)	BCM/Year	11	
External Surface Water Outflow (ESWO)	BCM/Year	0	
External Groundwater Inflow (EGI)	BCM/Year	0	
External Groundwater Outflow (EGO)	BCM/Year	0	
Total External Renewable Blue Water Resources (TERBWR)=(ESWI+EGI)	BCM/Year	11	
Total Renewable Blue Surface Water (TRBSW)=(IRSW)+(ESWI)-(ESWO)	BCM/Year	11.10	
Total Renewable Blue Groundwater (TRBG)=(IRG)+(EGI)-(EGO)	BCM/Year	0.30	
Overlap Between Surface Water and Groundwater (OSW)	BCM/Year	0.00	
Total Renewable Blue Water Resources (TRBWR)=(TRBSW)+(TRBG)-(OSW)	BCM/Year	11.40	
Total Rainfed Agriculture Abstractions	BCM/Year	0.04	
Total Natural Pasture Abstractions	BCM/Year	3.94	
Total Forest Abstractions	BCM/Year	0.02	
Total Renewable Green Water Resources (TRGWR)	BCM/Year	4.00	
Total Renewable Water Resources (TRWR)=(TRBWR+TRGWR)	BCM/Year	15.40	
Produced Municipal and Industrial Wastewater (PMW)	BCM/Year	0.08	
Treated Municipal and Industrial Wastewater	BCM/Year	0.000700	
Reused Treated and Industrial Municipal Wastewater	BCM/Year	0.0007	
Produced Agricultural Drainage (PAD)	BCM/Year	0.3750	
Reused Agricultural Drainage	BCM/Year	N/A	
Produced Desalinated Water (PDW)	BCM/Year	0.03	
Total Non-Conventional Water Resources (TNCWR)=(PMW)+(PAD)+(PDW)	BCM/Year	0.48	
Total Non Renewable Groundwater Resources (TNRGR)	BCM/Year	N/A	
Total Conventional Water Resources (TCWR)=(TRWR)+(TNRGR)	BCM/Year	15.40	
Total Available Water Resources (TAWR)=(TCWR)+(TNCWR)	BCM/Year	15.88	
Water Withdrawals and Consumption			
Annual Total Water Withdrawal	BCM/Year	1.62	
Withdrawals by the Domestic Sector	BCM/Year	0.10	
Withdrawals by the Industrial Sector	BCM/Year	0.03	
Withdrawals by the Irrigated Agriculture Sector (Blue Water+Non-conventional Water)	BCM/Year	1.50	
Agricultural Consumption from Green Water	BCM/Year	0.04	
Total Agricultural Withdrawals	BCM/Year	1.54	
Withdrawals From Blue Surface Water	BCM/Year	N/A	
Withdrawals From Blue Groundwater	BCM/Year	N/A	
Withdrawals from Non-Renewable Groundwater	BCM/Year	0	

Withdrawals From Non-Conventional Resources	BCM/Year	0.03	
Overall Water Use Efficiency	%	72.58	
Water Sustainability Index	%	26.54	
Wastewater and Drainage Outflows	BCM/Year	0.45	
Water and Land Use Change			
Total Irrigated Agricultural Land	ha	49,200	
Total rain-Fed Agricultural Land	ha	356,000	
Total Forest Land	ha	206,200	
Total Natural Pasture Land	ha	39,250,000	
Water and Accessibility			
Water Supply Coverage (JMP)	%	50	
Water Supply Coverage (Sector Ministry)	%	N/A	
Urban Water Supply Coverage (JMP)	%	52	
Urban Water Supply Coverage (Sector Ministry)	%	N/A	
Rural Water Supply Coverage (JMP)	%	48	
Rural Water Supply Coverage (Sector Ministry)	%	N/A	
Sanitation Coverage (JMP)	%	26	
Sanitation Coverage (Sector Ministry)	%	N/A	
Urban Sanitation Coverage (JMP)	%	51	
Urban Sanitation Coverage (Sector Ministry)	%	N/A	
Rural Sanitation Coverage (JMP)	%	9	
Rural Sanitation Coverage (Sector Ministry)	%	N/A	
Length of water supply pipe networks	Km	N/A	
Length of Sewage pipe networks	Km	N/A	
Length of Irrigation Networks	Km	N/A	
Length of Drainage Network	Km	N/A	
Total drinking water treatment plant capacity	BCM/Year	N/A	
Dam Capacity (Installed)	BCM/Year	0.50	
Desalination Capacity	BCM/Year	N/A	
Electricity Generated Using Hydropower	GWh/Year	120	
Water and Demographics			
Total Population	1000 inhabitants	3,359	
Internal Renewable Water Resources per Capita	CM/capita	119	
Total Renewable Blue Water Resources per Capita	CM/capita	3,393	
Total Renewable Water Resources per Capita	CM/capita	4,584	
Blue Water Withdrawal per Capita	CM/capita	482	
Green Water Consumption per Capita	CM/capita	1,190	
Total Available Water Resources per Capita	CM/capita	4,726	
Total Water Consumption per Capita	CM/capita	1,673	
Agricultural Water Withdrawal per Capita	CM/capita	446	
Industrial Water Withdrawal per Capita	CM/capita	7.53	
Domestic Water Withdrawal per Capita	CM/capita	28.40	
Population Without Improved Water Supply	1000 inhabitants	1,679	

Population Without Adequate Sanitation	1000 inhabitants	2,485	
Water and Quality			
Average Total Dissolved Solids	mg/l	N/A	
Diarrhea Reported Cases	% of children under 5	18.30	
Dracunculiasis Reported Cases	Number	0	
Cholera Reported cases	Number	2,047	
Open Defecation Practice	%	54	
Water and Climate			
Flood Events in the Last Two Decades.	Number	6	
Flood Events 1989-2000	Number	0	
Flood Events 2000-2011	Number	6	
Water and Economics			
National Climate Change Adaptation Plan	Yes/No	N/A	
Industrial Water Productivity (GDP/Water Use)	$/CM	74.44	
Employment in Agriculture	Jobs/MCM	285.85	
Agricultural Water Productivity (GDP/Water Use)	$/CM	1.06	
Water and Sanitation Charges as % of the lowest Household Income Groups	%	N/A	
Subsidy (Domestic-Industrial-Agricultural)	%	N/A	
Public Expenditure on Water Related Projects	Million US$	N/A	
Foreign Development Assistance for Water (Total 2009-2012)	Million US$	93.97	
Foreign Development Assistance for Water (average yearly)	Million US$	31.32	
Virtual Water Imports related to Trade in the Agricultural Sector	BCM/Year	2.64	
Virtual Water Exports related to Trade in the Agricultural Sector	BCM/Year	0	
Virtual-Water net Flow Related to Trade in the Agricultural Sector	BCM/Year	2.64	
Water and Political Affairs			
IWRM Plan in Place	Yes/No	N/A	
Water Rights/year	Number	N/A	
Well Permits/year	Number	N/A	
Irrigation related complaints	Number/Year	N/A	
Water Supply and Sanitation related complaints	Number/Year	N/A	
Transboundary Water Bodies Dependency Ratio	%	96	
Standpoint in the 1997 UN Convention	Ratification/ Voting	N/A	

*All data and estimates are for 2012 unless otherwise mentioned

Morocco

Morocco

The average annual rainfall is about 346 mm varying from more than 450 mm in the north to less than 150 mm in the southeast, and generating an annual precipitation volume of 154 BCM. More than 50% of the rainfall occur over 15 % of the country's area. The total greenwater consumption is estimated at 46 BCM/y. Transboundary outgoing surface flow to Algeria is estimated at 0.23 BCM/y. Internal Renewable Blue Water Resources are estimated at 29 BCM/y 32 BCM/Year. The Total Renewable Blue Water Resources (TRBWR) is considered also 29 BCM/y as of 2012 where the total population is 32 million inhabitant, thus generating a per capita share of TRBWR of 908.5 CM/y. The total dam capacity in 2012 is about 17 BCM corresponding to 130 operating dams. The total annual freshwater withdrawal is 12.6 BCM (400 CM /cap/y)13.89 BCM/Year as of 2012, and divided as follows:

- 87% agriculture,
- 10% domestic uses, and
- 3% industrial uses

The total irrigated area in 2000 was 1.05 million ha representing only 10% of the cultivated area. The hydroelectric production in 2004 is measured as 1000 Million KWh contributing to 16% of the national energy production. The water supply coverage (2008) is assessed as 98% in urban communities and 60% of rural population. As of 2008, the sanitation coverage was 83% in urban areas and 52% in rural areas.

Population growth at a rate of about 1.054 %, and increased demand for food, drinking, industrial, and agricultural purposes are persisting factors pushing for better management water resource. Although the national water demand is satisfied, specific areas already suffer from water scarcity, especially during the dry season. The general national policy for increasing water availability is based on two lines of actions, namely achieving more control of surface water and surface storage through dam regulation, and increasing groundwater extraction. Major emphasis has been put on the construction of regulating dams and development of large irrigation schemes since the early 1960s.

Since 1995 a new Water Law has been effective. The Law decentralized management of water resources to involve basin-level agencies and introduced a consultative process through which more stakeholders are involved in water use, development, and distribution plans.

Placing water availability on the top of the national priorities list has came with a bill that was mostly paid by the environment, as the over-extraction of both surface and groundwater has caused vast areas of wetlands to disappear. Pollution of surface water due to municipal and industrial waste discharges has been magnified during the drought periods of 1979 - 1984, and 1991 - 1995. Water quality deterioration is currently confronted by the National Master Plan of Liquid Sanitation which, however, faces many financing problems.

Morocco's GDP was estimated at $ 91 billion in 2010. The agriculture share was up to 15 % of the total GDP whereas the industry share (including oil and gas) was estimated at 29.9 % of GDP. The Gross National Income per Capita based on purchasing power parity in 2011 was estimated at $ 4600. According to the bilateral commitments between Development Assistance Committee (DAC) countries of the Organization for Economic Cooperation and Development (OECD), Morocco has received in the water sector and

sanitation Official Development Aid estimated at $ 306.59 million in 2011. This amount states the second highest amount of aid disbursed to Arab recipient countries after Jordan in the water supply and sanitation sector in 2011. As for the actual government budget for the fiscal year 2013, Morocco has planned to invest in drinking water through the National Initiative for Human Development to spend on the Water Supply and Sanitation sector about $ 87.07 million

The total capital investment needed during the period 2010-2015 to reach the sanitation universal coverage target is estimated at $ 1.6 billion and 8,655 thousand people to be covered, the capital investment for MDG in sanitation coverage is at the value of $ 638 million translated to 3,141 thousand people. Regarding the water supply, Morocco needs to invest the amount of $ 426 million and to cover 2,337 thousand people to reach the MDG target. As for the universal coverage, Morocco needs to invest the amount of $ 1.7 billion and to cover 5,443 thousand people.

Agriculture is the major water use sector. The gross agriculture production in 2010 reached $ 12.6 billion. Morocco virtual water imports in agriculture were estimated at 21766.82 MCM which had a product value of $ 30.5 billion. Exports of virtual water in agriculture were estimated at 3325.301 MCM which is translated in products value at about $ 3 billion.

The technically feasible hydropower potential is estimated at 5,203 GigaWatthour per year and the installed hydro capacity is around 1,265 Megawatt hour. The hydro power generation in 2008 reached 1,318 Gigawatt hour which represents 6.6 % of the total power production in Morocco..

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Morocco Water Indicators

Water Related Indicators	Units	Morocco	Notes
Water Availability			
Annual Average Precipitaion Depth	MM/Year	346	
Annual Average Precipitation Volume	BCM/Year	154.50	
Internal Renewable Surface Water (IRSW)	BCM/Year	22	
Internal Renewable Groundwater (IRG)	BCM/Year	10	
Total Internal Renewable Blue Water Resources (TIRBWR)=(IRSW+IRG)	BCM/Year	32	
External Surface Water Inflow (ESWI)	BCM/Year	0	
External Surface Water Outflow (ESWO)	BCM/Year	0.23	
External Groundwater Inflow (EGI)	BCM/Year	0	
External Groundwater Outflow (EGO)	BCM/Year	0.03	
Total External Renewable Blue Water Resources (TERBWR)=(ESWI+EGI)	BCM/Year	0	
Total Renewable Blue Surface Water (TRBSW)=(IRSW)+(ESWI)-(ESWO)	BCM/Year	21.77	
Total Renewable Blue Groundwater (TRBG)=(IRG)+(EGI)-(EGO)	BCM/Year	9.97	
Overlap Between Surface Water and Groundwater (OSW)	BCM/Year	3	
Total Renewable Blue Water Resources (TRBWR)=(TRBSW)+(TRBG)-(OSW)	BCM/Year	28.74	
Total Rainfed Agriculture Abstractions	BCM/Year	10.74	
Total Natural Pasture Abstractions	BCM/Year	29.68	
Total Forest Abstractions	BCM/Year	6.18	
Total Renewable Green Water Resources (TRGWR)	BCM/Year	46.59	
Total Renewable Water Resources (TRWR)=(TRBWR+TRGWR)	BCM/Year	75.33	
Produced Municipal and Industrial Wastewater (PMW)	BCM/Year	0.65	
Treated Municipal and Industrial Wastewater	BCM/Year	0.04	
Reused Treated and Industrial Municipal Wastewater	BCM/Year	0	
Produced Agricultural Drainage (PAD)	BCM/Year	2.9523	
Reused Agricultural Drainage	BCM/Year	N/A	
Produced Desalinated Water (PDW)	BCM/Year	0.01	
Total Non-Conventional Water Resources (TNCWR)=(PMW)+(PAD)+(PDW)	BCM/Year	3.61	
Total Non Renewable Groundwater Resources (TNRGR)	BCM/Year	N/A	
Total Conventional Water Resources (TCWR)=(TRWR)+(TNRGR)	BCM/Year	75.33	
Total Available Water Resources (TAWR)=(TCWR)+(TNCWR)	BCM/Year	78.94	
Water Withdrawals and Consumption			
Annual Total Water Withdrawal	BCM/Year	13.89	
Withdrawals by the Domestic Sector	BCM/Year	1.61	
Withdrawals by the Industrial Sector	BCM/Year	0.47	
Withdrawals by the Irrigated Agriculture Sector (Blue Water+Non-conventional Water)	BCM/Year	11.81	
Agricultural Consumption from Green Water	BCM/Year	10.74	
Total Agricultural Withdrawals	BCM/Year	22.55	
Withdrawals From Blue Surface Water	BCM/Year	10.12	
Withdrawals From Blue Groundwater	BCM/Year	3.40	
Withdrawals from Non-Renewable Groundwater	BCM/Year	0	

Withdrawals From Non-Conventional Resources	BCM/Year	0.01	
Overall Water Use Efficiency	%	73.36	
Water Sustainability Index	%	94.06	
Wastewater and Drainage Outflows	BCM/Year	3.60	
Water and Land Use Change			
Total Irrigated Agricultural Land	ha	1,258,200	
Total rain-Fed Agricultural Land	ha	7,598,000	
Total Forest Land	ha	4,370,800	
Total Natural Pasture Land	ha	21,000,000	
Water and Accessibility			
Water Supply Coverage (JMP)	%	83	
Water Supply Coverage (Sector Ministry)	%	80	
Urban Water Supply Coverage (JMP)	%	98	
Urban Water Supply Coverage (Sector Ministry)	%	N/A	
Rural Water Supply Coverage (JMP)	%	61	
Rural Water Supply Coverage (Sector Ministry)	%	80	
Sanitation Coverage (JMP)	%	70	
Sanitation Coverage (Sector Ministry)	%	70	
Urban Sanitation Coverage (JMP)	%	83	
Urban Sanitation Coverage (Sector Ministry)	%	N/A	
Rural Sanitation Coverage (JMP)	%	52	
Rural Sanitation Coverage (Sector Ministry)	%	N/A	
Length of water supply pipe networks	Km	N/A	
Length of Sewage pipe networks	Km	N/A	
Length of Irrigation Networks	Km	N/A	
Length of Drainage Network	Km	N/A	
Total drinking water treatment plant capacity	BCM/Year	N/A	
Dam Capacity (Installed)	BCM/Year	16.90	
Desalination Capacity	BCM/Year	N/A	
Electricity Generated Using Hydropower	GWh/Year	1,318	
Water and Demographics			
Total Population	1000 inhabitants	31,635	
Internal Renewable Water Resources per Capita	CM/capita	1,011	
Total Renewable Blue Water Resources per Capita	CM/capita	908	
Total Renewable Water Resources per Capita	CM/capita	2,381	
Blue Water Withdrawal per Capita	CM/capita	438	
Green Water Consumption per Capita	CM/capita	1,472	
Total Available Water Resources per Capita	CM/capita	2,495	
Total Water Consumption per Capita	CM/capita	1,911	
Agricultural Water Withdrawal per Capita	CM/capita	373	
Industrial Water Withdrawal per Capita	CM/capita	14.87	
Domestic Water Withdrawal per Capita	CM/capita	50.81	
Population Without Improved Water Supply	1000 inhabitants	5,377	

Population Without Adequate Sanitation	1000 inhabitants	9,490	
Water and Quality			
Average Total Dissolved Solids	mg/l	N/A	
Diarrhea Reported Cases	% of children under 5	10.40	
Dracunculiasis Reported Cases	Number	0	
Cholera Reported cases	Number	N/A	
Open Defecation Practice	%	16	
Water and Climate			
Flood Events in the Last Two Decades.	Number	15	
Flood Events 1989-2000	Number	5	
Flood Events 2000-2011	Number	10	
Water and Economics			
National Climate Change Adaptation Plan	Yes/No	N/A	
Industrial Water Productivity (GDP/Water Use)	$/CM	63.69	
Employment in Agriculture	Jobs/MCM	191.37	
Agricultural Water Productivity (GDP/Water Use)	$/CM	0.03	
Water and Sanitation Charges as % of the lowest Household Income Groups	%	N/A	
Subsidy (Domestic-Industrial-Agricultural)	%	N/A	
Public Expenditure on Water Related Projects	Million US$	87.07	
Foreign Development Assistance for Water (Total 2009-2012)	Million US$	954.54	
Foreign Development Assistance for Water (average yearly)	Million US$	318.18	
Virtual Water Imports related to Trade in the Agricultural Sector	BCM/Year	21.77	
Virtual Water Exports related to Trade in the Agricultural Sector	BCM/Year	3.33	
Virtual-Water net Flow Related to Trade in the Agricultural Sector	BCM/Year	18.44	
Water and Political Affairs			
IWRM Plan in Place	Yes/No	N/A	
Water Rights/year	Number	N/A	
Well Permits/year	Number	N/A	
Irrigation related complaints	Number/Year	N/A	
Water Supply and Sanitation related complaints	Number/Year	N/A	
Transboundary Water Bodies Dependency Ratio	%	0	
Standpoint in the 1997 UN Convention	Ratification/ Voting	Ratified	

*All data and estimates are for 2012 unless otherwise mentioned

Oman

Oman

The average annual rainfall is about 100 mm varying from more than 350 mm in the mountain areas to less than 50 mm in the internal desert regions. Due to the high summer temperatures, the annual evaporation ranges from 1660 to 2200 mm. The rainfall occurs during the winter (November-April) in the north part, while seasonal summer storms (June-September) accrue in the south part and some internal parts. The total annual precipitation volume is 27 BCM, 5 of which are directly consumed by rainfed agriculture, pasture areas, and forest areas, in what is known as Green Water. Groundwater recharge is estimated at 1.3 BCM/y. The Total Annual Blue Water withdrawal is 1.43 BCM/Year as of 2011, and divided as follows:

- 78% agriculture,
- 12% domestic uses
- 6% industrial and commercial uses
- 1% grazing
- 3% for environmental purposes

The total annual water withdrawal reflects a deficit of 378 Million cubic meters which is compensated by non-conventional and/or non-renewable resources.

Of the 0.09 BCM/y of produced wastewater, only 0.03 BCM/y was treated in 2006. In addition desalinated water was estimated at 0.109 BCM/y as of 2006. In Oman, all agriculture is irrigated. The equipped area is estimated at 136,000 ha.

Oman's aflaj system (Fig (99)) is an ancient but effective method of water management. Individual falajs (water channels) collectively form the aflaj network, extending from the mountain tops and wadis to areas of interest and population. Oman's aflaj are dug in a way that ensures that the water is carried by the earth's gravity and the natural incline of the land over long distances without using pumps or any other mechanical means. There are 4,112 aflaj in the Sultanate, 3,017 of which are currently in operation. The maintenance of these structures is undertaken by the govermment according to an annual timetable which constantly adjusts its priorities (Omanet.com).

Figure 99. An Omani Falaj (Omannet.com)

Oman's GDP was estimated at $ 63 billion in 2010. The agriculture share was up to 1.30% which is at the value of $ 857.00 million whereas the industry share (including oil and gas) was estimated at 55.1 of total GDP. The Gross National Income per Capita based on purchasing power parity in 2008 was estimated at $ 25200. According to the bilateral commitments between Development Assistance Committee (DAC) countries of the Organization for Economic Cooperation and Development (OECD) and Arab countries, Oman didn't receive any aids for the year 2011. Previously under the same bilateral commitments, Oman used to receive ODA from 2005 till 2007. As of the actual government budget of 2012, Oman has allocated for the Ministry of Regional Municipalities and Water Resources,

Public Authority of Water and Electricity, Development Budget for the Ministry of Regional Municipalities and Water Resources in addition to the development budget for water sector and water resources and irrigation the total amount of $ 3.4 billion.

The total capital investment needed during the period 2010-2015 to reach the sanitation universal coverage target is estimated at $ 124 million , whereas for the capital investment needed for MDG sanitation coverage is about $ 37 million. As for the water supply sector, Oman requires $ 13 million to achieve the MDG target and still requires $ 216 million to achieve universal water supply coverage.

Agriculture is the major water use sector. Oman virtual water imports in agriculture were estimated at 4 billion CM which had a product value of $ 595.30 million. Exports of virtual water in agriculture were estimated at 12 million CM which is translated in products value of $ 1.3 billion.

The technically feasible hydropower potential is estimated at 0 Gigawatt hour per year and the installed hydro capacity is 0 Megawatt hour. The hydro power generation in 2008 reached 0 Gigawatt hour which represents 0 of the total power production in Oman.

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Oman Water Indicators

Water Related Indicators	Units	Oman	Notes
Water Availability			
Annual Average Precipitaion Depth	MM/Year	100	
Annual Average Precipitation Volume	BCM/Year	27.42	
Internal Renewable Surface Water (IRSW)	BCM/Year	0.21	
Internal Renewable Groundwater (IRG)	BCM/Year	0.85	
Total Internal Renewable Blue Water Resources (TIRBWR)=(IRSW+IRG)	BCM/Year	1.06	
External Surface Water Inflow (ESWI)	BCM/Year	0	
External Surface Water Outflow (ESWO)	BCM/Year	0	
External Groundwater Inflow (EGI)	BCM/Year	0	
External Groundwater Outflow (EGO)	BCM/Year	0	
Total External Renewable Blue Water Resources (TERBWR)=(ESWI+EGI)	BCM/Year	0	
Total Renewable Blue Surface Water (TRBSW)=(IRSW)+(ESWI)-(ESWO)	BCM/Year	0.22	
Total Renewable Blue Groundwater (TRBG)=(IRG)+(EGI)-(EGO)	BCM/Year	0.85	
Overlap Between Surface Water and Groundwater (OSW)	BCM/Year	0.95	
Total Renewable Blue Water Resources (TRBWR)=(TRBSW)+(TRBG)-(OSW)	BCM/Year	0.11	
Total Rainfed Agriculture Abstractions	BCM/Year	0.25	
Total Natural Pasture Abstractions	BCM/Year	5.55	
Total Forest Abstractions	BCM/Year	0.00	
Total Renewable Green Water Resources (TRGWR)	BCM/Year	5.81	
Total Renewable Water Resources (TRWR)=(TRBWR+TRGWR)	BCM/Year	5.92	
Produced Municipal and Industrial Wastewater (PMW)	BCM/Year	0.04	
Treated Municipal and Industrial Wastewater	BCM/Year	0.04	
Reused Treated and Industrial Municipal Wastewater	BCM/Year	0.0370	
Produced Agricultural Drainage (PAD)	BCM/Year	0.2824	
Reused Agricultural Drainage	BCM/Year	N/A	
Produced Desalinated Water (PDW)	BCM/Year	0.20	
Total Non-Conventional Water Resources (TNCWR)=(PMW)+(PAD)+(PDW)	BCM/Year	0.52	
Total Non Renewable Groundwater Resources (TNRGR)	BCM/Year	N/A	
Total Conventional Water Resources (TCWR)=(TRWR)+(TNRGR)	BCM/Year	5.92	
Total Available Water Resources (TAWR)=(TCWR)+(TNCWR)	BCM/Year	6.44	
Water Withdrawals and Consumption			
Annual Total Water Withdrawal	BCM/Year	1.43	
Withdrawals by the Domestic Sector	BCM/Year	0.06	
Withdrawals by the Industrial Sector	BCM/Year	0.04	
Withdrawals by the Irrigated Agriculture Sector (Blue Water+Non-conventional Water)	BCM/Year	1.13	
Agricultural Consumption from Green Water	BCM/Year	0.25	
Total Agricultural Withdrawals	BCM/Year	1.38	
Withdrawals From Blue Surface Water	BCM/Year	0.11	
Withdrawals From Blue Groundwater	BCM/Year	1.32	
Withdrawals from Non-Renewable Groundwater	BCM/Year	0.32	

Withdrawals From Non-Conventional Resources	BCM/Year	0.23	
Overall Water Use Efficiency	%	80.06	
Water Sustainability Index	%	133.78	
Wastewater and Drainage Outflows	BCM/Year	0.29	
Water and Land Use Change			
Total Irrigated Agricultural Land	ha	79,000	
Total rain-Fed Agricultural Land	ha	77,000	
Total Forest Land	ha	0	
Total Natural Pasture Land	ha	1,700,000	
Water and Accessibility			
Water Supply Coverage (JMP)	%	89	
Water Supply Coverage (Sector Ministry)	%	0.95	
Urban Water Supply Coverage (JMP)	%	93	
Urban Water Supply Coverage (Sector Ministry)	%	0.80	
Rural Water Supply Coverage (JMP)	%	78	
Rural Water Supply Coverage (Sector Ministry)	%	67	
Sanitation Coverage (JMP)	%	99	
Sanitation Coverage (Sector Ministry)	%	88	
Urban Sanitation Coverage (JMP)	%	100	
Urban Sanitation Coverage (Sector Ministry)	%	97	
Rural Sanitation Coverage (JMP)	%	95	
Rural Sanitation Coverage (Sector Ministry)	%	80	
Length of water supply pipe networks	Km	N/A	
Length of Sewage pipe networks	Km	N/A	
Length of Irrigation Networks	Km	N/A	
Length of Drainage Network	Km	N/A	
Total drinking water treatment plant capacity	BCM/Year	N/A	
Dam Capacity (Installed)	BCM/Year	0.12	
Desalination Capacity	BCM/Year	0.20	
Electricity Generated Using Hydropower	GWh/Year	0	
Water and Demographics			
Total Population	1000 inhabitants	2,712	
Internal Renewable Water Resources per Capita	CM/capita	390	
Total Renewable Blue Water Resources per Capita	CM/capita	41.7	
Total Renewable Water Resources per Capita	CM/capita	2,182	
Blue Water Withdrawal per Capita	CM/capita	527	
Green Water Consumption per Capita	CM/capita	2,140	
Total Available Water Resources per Capita	CM/capita	2,374	
Total Water Consumption per Capita	CM/capita	2,667	
Agricultural Water Withdrawal per Capita	CM/capita	416	
Industrial Water Withdrawal per Capita	CM/capita	14.24	
Domestic Water Withdrawal per Capita	CM/capita	21.76	
Population Without Improved Water Supply	1000 inhabitants	2,686	

Population Without Adequate Sanitation	1000 inhabitants	325.44	
Water and Quality			
Average Total Dissolved Solids	mg/l	N/A	
Diarrhea Reported Cases	% of children under 5	6.70	
Dracunculiasis Reported Cases	Number	0	
Cholera Reported cases	Number	N/A	
Open Defecation Practice	%	–	
Water and Climate			
Flood Events in the Last Two Decades.	Number	6	
Flood Events 1989-2000	Number	2	
Flood Events 2000-2011	Number	5	
Water and Economics			
National Climate Change Adaptation Plan	Yes/No	N/A	
Industrial Water Productivity (GDP/Water Use)	$/CM	1,024	
Employment in Agriculture	Jobs/MCM	177.93	
Agricultural Water Productivity (GDP/Water Use)	$/CM	9.15	
Water and Sanitation Charges as % of the lowest Household Income Groups	%	0.02	
Subsidy (Domestic-Industrial-Agricultural)	%	50% domestic only	
Public Expenditure on Water Related Projects	Million US$	6,940	
Foreign Development Assistance for Water (Total 2009-2012)	Million US$	N/A	
Foreign Development Assistance for Water (average yearly)	Million US$	N/A	
Virtual Water Imports related to Trade in the Agricultural Sector	BCM/Year	12.62	
Virtual Water Exports related to Trade in the Agricultural Sector	BCM/Year	4.84	
Virtual-Water net Flow Related to Trade in the Agricultural Sector	BCM/Year	7.78	
Water and Political Affairs			
IWRM Plan in Place	Yes/No	yes	
Water Rights/year	Number	4,175	
Well Permits/year	Number	83	
Irrigation related complaints	Number/Year	N/A	
Water Supply and Sanitation related complaints	Number/Year	N/A	
Transboundary Water Bodies Dependency Ratio	%	0	
Standpoint in the 1997 UN Convention	Ratification/ Voting	Voted in Favor	

*All data and estimates are for 2012 unless otherwise mentioned

Palestine

Palestine

Population is the main factor affecting water deterioration in the Gaza Strip and West Bank. In 2011, the population reached 1.59 millions in the Gaza Strip and about 2.58 millions in West Bank. The temperature and precipitation vary with altitude. In the West Bank the Altitude range from -400 below sea level to 1000 above sea level. The annual rainfall is 340 mm which corresponds to an annual volume of 2.04 BCM / year.

Groundwater is the main resource of water in the Gaza Strip and the west bank. The annual groundwater abstraction from the Mountain Aquifer in the West Bank and the coastal Aquifer in Gaza is recorded at 173 Million Cubic Meters (MCM), which accounts to 10% of all groundwater shared with Israel. This number does not include the over pumpage portion from the Gaza Coastal Aquifer.

The main Gaza Aquifer is a continuation of the shallow sandy/sandstone coastal aquifers of Israel. About 2200 wells tap this aquifer with depths mostly ranging between 25 and 30 meters. Its annual safe yield is 60 – 65 MCM; however the aquifer is continuously over pumped by a rate of 90-100 MCM/Y in order to meet Israeli settlers and Palestinian water needs. The Mountain Aquifer in the West Bank is mostly recharged from rainfall on the west Bank Mountains of heights greater than 500 meters above mean Sea level. The annual renewable freshwater of this aquifer ranges from 600 MCM according to different Israeli and Palestinian sources.

Average precipitation for Upper Jordan and Lake Tiberias averages 1,600 mm and 800 mm respectively. Lower basin, around the Dead sea has a desert climate characterized by scarce rainfall. The Jordan River is progressively more saline and less usable towards the Dead sea. The Jordan River system satisfies about 50% of Israel's and Jordan's water demand; Lebanon and Syria are minor users, meeting 5% of their combined demands via the Jordan. The Natural annual discharge of the River Jordan amounts to 1400 MCM, 580 MCM of which are diverted unilaterally by Israel to its center and Southern Desert.

One of the major impediments to developing a sound Palestinian water policy has been Israeli control over the water resources in Palestine which has affected adversely the development of a consistent supply, maintenance of quality, and improvements in systems. The Israeli overall consumption including agriculture is at least seven times higher than the Palestinian consumption. Regional and International efforts are strongly needed so that Palestine can acquire an equitable and reasonable share of water according to the customary International law, which was not significantly considered in the 1995 Oslo agreement that supposedly called for interim allocations and a joint water committeewhich was designed for 5 years period.

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Palestine Water Indicators

Water Related Indicators	Units	Palestine	Notes
Water Availability			
Annual Average Precipitaion Depth	MM/Year	340	
Annual Average Precipitation Volume	BCM/Year	2.04	
Internal Renewable Surface Water (IRSW)	BCM/Year	0.80	
Internal Renewable Groundwater (IRG)	BCM/Year	0.74	
Total Internal Renewable Blue Water Resources (TIRBWR)=(IRSW+IRG)	BCM/Year	1.54	
External Surface Water Inflow (ESWI)	BCM/Year	0.02	
External Surface Water Outflow (ESWO)	BCM/Year	0.13	
External Groundwater Inflow (EGI)	BCM/Year	0.18	
External Groundwater Outflow (EGO)	BCM/Year	0.87	
Total External Renewable Blue Water Resources (TERBWR)=(ESWI+EGI)	BCM/Year	0.20	
Total Renewable Blue Surface Water (TRBSW)=(IRSW)+(ESWI)-(ESWO)	BCM/Year	0.68	
Total Renewable Blue Groundwater (TRBG)=(IRG)+(EGI)-(EGO)	BCM/Year	0.05	
Overlap Between Surface Water and Groundwater (OSW)	BCM/Year	0.00	
Total Renewable Blue Water Resources (TRBWR)=(TRBSW)+(TRBG)-(OSW)	BCM/Year	0.74	
Total Rainfed Agriculture Abstractions	BCM/Year	0.19	
Total Natural Pasture Abstractions	BCM/Year	0.40	
Total Forest Abstractions	BCM/Year	0.02	
Total Renewable Green Water Resources (TRGWR)	BCM/Year	0.61	
Total Renewable Water Resources (TRWR)=(TRBWR+TRGWR)	BCM/Year	1.35	
Produced Municipal and Industrial Wastewater (PMW)	BCM/Year	0.52	
Treated Municipal and Industrial Wastewater	BCM/Year	0.32	
Reused Treated and Industrial Municipal Wastewater	BCM/Year	0	
Produced Agricultural Drainage (PAD)	BCM/Year	0.0344	
Reused Agricultural Drainage	BCM/Year	N/A	
Produced Desalinated Water (PDW)	BCM/Year	0.01	
Total Non-Conventional Water Resources (TNCWR)=(PMW)+(PAD)+(PDW)	BCM/Year	0.56	
Total Non Renewable Groundwater Resources (TNRGR)	BCM/Year	N/A	
Total Conventional Water Resources (TCWR)=(TRWR)+(TNRGR)	BCM/Year	1.35	
Total Available Water Resources (TAWR)=(TCWR)+(TNCWR)	BCM/Year	1.91	
Water Withdrawals and Consumption			
Annual Total Water Withdrawal	BCM/Year	0.33	
Withdrawals by the Domestic Sector	BCM/Year	0.17	
Withdrawals by the Industrial Sector	BCM/Year	0.02	
Withdrawals by the Irrigated Agriculture Sector (Blue Water+Non-conventional Water)	BCM/Year	0.14	
Agricultural Consumption from Green Water	BCM/Year	0.19	
Total Agricultural Withdrawals	BCM/Year	0.33	
Withdrawals From Blue Surface Water	BCM/Year	N/A	
Withdrawals From Blue Groundwater	BCM/Year	N/A	
Withdrawals from Non-Renewable Groundwater	BCM/Year	0	

Withdrawals From Non-Conventional Resources	BCM/Year	0.01	
Overall Water Use Efficiency	%	-66.50	
Water Sustainability Index	%	60.38	
Wastewater and Drainage Outflows	BCM/Year	0.55	
Water and Land Use Change			
Total Irrigated Agricultural Land	ha	12,443	
Total rain-Fed Agricultural Land	ha	71,300	
Total Forest Land	ha	0	
Total Natural Pasture Land	ha	0	
Water and Accessibility			
Water Supply Coverage (JMP)	%	N/A	
Water Supply Coverage (Sector Ministry)	%	95	
Urban Water Supply Coverage (JMP)	%	N/A	
Urban Water Supply Coverage (Sector Ministry)	%	100	
Rural Water Supply Coverage (JMP)	%	N/A	
Rural Water Supply Coverage (Sector Ministry)	%	95	
Sanitation Coverage (JMP)	%	N/A	
Sanitation Coverage (Sector Ministry)	%	N/A	
Urban Sanitation Coverage (JMP)	%	N/A	
Urban Sanitation Coverage (Sector Ministry)	%	N/A	
Rural Sanitation Coverage (JMP)	%	N/A	
Rural Sanitation Coverage (Sector Ministry)	%	N/A	
Length of water supply pipe networks	Km	N/A	
Length of Sewage pipe networks	Km	N/A	
Length of Irrigation Networks	Km	N/A	
Length of Drainage Network	Km	N/A	
Total drinking water treatment plant capacity	BCM/Year	N/A	
Dam Capacity (Installed)	BCM/Year	N/A	
Desalination Capacity	BCM/Year	N/A	
Electricity Generated Using Hydropower	GWh/Year	N/A	
Water and Demographics			
Total Population	1000 inhabitants	3,981	
Internal Renewable Water Resources per Capita	CM/capita	386	
Total Renewable Blue Water Resources per Capita	CM/capita	185	
Total Renewable Water Resources per Capita	CM/capita	339	
Blue Water Withdrawal per Capita	CM/capita	82.39	
Green Water Consumption per Capita	CM/capita	154	
Total Available Water Resources per Capita	CM/capita	479	
Total Water Consumption per Capita	CM/capita	236	
Agricultural Water Withdrawal per Capita	CM/capita	34.60	
Industrial Water Withdrawal per Capita	CM/capita	5.77	
Domestic Water Withdrawal per Capita	CM/capita	42.02	
Population Without Improved Water Supply	1000 inhabitants	199	

Population Without Adequate Sanitation	1000 inhabitants	NA	
Water and Quality			
Average Total Dissolved Solids	mg/l	N/A	
Diarrhea Reported Cases	% of children under 5	N/A	
Dracunculiasis Reported Cases	Number	0	
Cholera Reported cases	Number	N/A	
Open Defecation Practice	%	N/A	
Water and Climate			
Flood Events in the Last Two Decades.	Number	N/A	
Flood Events 1989-2000	Number	0	
Flood Events 2000-2011	Number	0	
Water and Economics			
National Climate Change Adaptation Plan	Yes/No	yes	
Industrial Water Productivity (GDP/Water Use)	$/CM	0	
Employment in Agriculture	Jobs/MCM	241.07	
Agricultural Water Productivity (GDP/Water Use)	$/CM	2.59	
Water and Sanitation Charges as % of the lowest Household Income Groups	%	N/A	
Subsidy (Domestic-Industrial-Agricultural)	%	N/A	
Public Expenditure on Water Related Projects	Million US$	N/A	
Foreign Development Assistance for Water (Total 2009-2012)	Million US$	N/A	
Foreign Development Assistance for Water (average yearly)	Million US$	N/A	
Virtual Water Imports related to Trade in the Agricultural Sector	BCM/Year	1.42	
Virtual Water Exports related to Trade in the Agricultural Sector	BCM/Year	0.11	
Virtual-Water net Flow Related to Trade in the Agricultural Sector	BCM/Year	1.31	
Water and Political Affairs			
IWRM Plan in Place	Yes/No	yes	
Water Rights/year	Number	N/A	
Well Permits/year	Number	N/A	
Irrigation related complaints	Number/Year	N/A	
Water Supply and Sanitation related complaints	Number/Year	N/A	
Transboundary Water Bodies Dependency Ratio	%	4	
Standpoint in the 1997 UN Convention	Ratification/ Voting	N/A	

*All data and estimates are for 2012 unless otherwise mentioned

Qatar

Qatar

The average annual rainfall is about 130 mm. Precipitation mainly occurs in winter from November to April , the annual precipitation volume is 0.8 BCM/y The total renewable water resources is considered 0.06 BCM/Year as of 2012 where the total population is 1.85 million inhabitant, thus generating a per capita share of Renewable Blue Water Resources of 36.30 CM/ capita. The actual per capita consumption amounts to 277.85 CM/capita, which is one of the world's highest consumption. The totaL greenwater consumed by rainfed areas, pasture areas, and forest areas is 0.154 BCM/y.

Non-conventional water sources accounted for almost 82 % of the total water withdrawal in 2011. The total quantity of desalinated water used in 2011 was 401 million CM/y. About 193 million CM/y of wastewater were treated in 2011.

Fossil groundwater is one of the main sources of agricultural water in Qatar. There are 2 main Reverse Osmosis treatment plants as shown in fig (100). The water production from the 2 RO(s) in 2011 was 0.242 MCM.

The total annual freshwater withdrawal as of 2011 is divided as follows:

- 0.027 km3/y for agriculture,
- 0.016 km3/y as an emergency municipal reserve.

The Water supply coverage and the Sanitation coverage are both 100%, the total length of the water supply network is 6400 Km and the total number of supply plants is 7.

Desalinated water is the main source of Qatar's drinking water. The irrigation potential based on ARWR is estimated as 12000 ha as of 2008.

With no significant surface water flow, transboundary flow is limited to 0.002 BCM/y of groundwater entering Qatar's border annually; nevertheless, the state was among the first contracting states to the 1997 UN Convention for the Non-Navigational uses of International Water Courses.

One of the main highlights of the Arab sessions in the sixth World Water Forum was the strong future commitment made by the government of Qatar, as their delegation expressed the state's intent to achieve food security and independence through sea water desalination.

Figure 100. Reverse Osmosis Groundwater Treatment Plants in Qatar

Qatar's GDP was estimated at $ 128.5 billion in 2010. The industry share (including oil and gas) was estimated at

67% of GDP. According to the bilateral commitments between Development Assistance Committee (DAC) countries of the Organization for Economic Cooperation and Development (OECD) and the Arab countries, Qatar was not one of the recipient countries.

The total capital investment needed during the period 2010-2015 to reach the sanitation universal coverage target is estimated at $ 45 million and 122 thousand people to be covered, as for the capital investment for MDG in sanitation coverage is already covered in Qatar. Regarding the water supply coverage, Qatar needs to invest the amount of $ 70 million and to cover 122 thousand people to reach the MDG target. The MDG target is actually achieved.

Agriculture is the major water use sector. The gross agriculture production in 2010 reached 92 million $. Qatar virtual water imports in agriculture were estimated at 3 billion CM which had a product value of $ 1 billion. Exports of virtual water in agriculture were estimated at 39 MCM which is translated in products value at about $ 16.78 million.

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Qatar Water Indicators

Water Related Indicators	Units	Qatar	Notes
Water Availability			
Annual Average Precipitaion Depth	MM/Year	130	
Annual Average Precipitation Volume	BCM/Year	0.86	
Internal Renewable Surface Water (IRSW)	BCM/Year	0	
Internal Renewable Groundwater (IRG)	BCM/Year	0.06	
Total Internal Renewable Blue Water Resources (TIRBWR)=(IRSW+IRG)	BCM/Year	0.06	
External Surface Water Inflow (ESWI)	BCM/Year	0	
External Surface Water Outflow (ESWO)	BCM/Year	0	
External Groundwater Inflow (EGI)	BCM/Year	0	
External Groundwater Outflow (EGO)	BCM/Year	0	
Total External Renewable Blue Water Resources (TERBWR)=(ESWI+EGI)	BCM/Year	0	
Total Renewable Blue Surface Water (TRBSW)=(IRSW)+(ESWI)-(ESWO)	BCM/Year	0	
Total Renewable Blue Groundwater (TRBG)=(IRG)+(EGI)-(EGO)	BCM/Year	0.06	
Overlap Between Surface Water and Groundwater (OSW)	BCM/Year	0	
Total Renewable Blue Water Resources (TRBWR)=(TRBSW)+(TRBG)-(OSW)	BCM/Year	0.06	
Total Rainfed Agriculture Abstractions	BCM/Year	0	
Total Natural Pasture Abstractions	BCM/Year	0	
Total Forest Abstractions	BCM/Year	0	
Total Renewable Green Water Resources (TRGWR)	BCM/Year	0	
Total Renewable Water Resources (TRWR)=(TRBWR+TRGWR)	BCM/Year	0.06	
Produced Municipal and Industrial Wastewater (PMW)	BCM/Year	0.06	
Treated Municipal and Industrial Wastewater	BCM/Year	0.05	
Reused Treated and Industrial Municipal Wastewater	BCM/Year	0.0430	
Produced Agricultural Drainage (PAD)	BCM/Year	0.0655	
Reused Agricultural Drainage	BCM/Year	N/A	
Produced Desalinated Water (PDW)	BCM/Year	0.18	
Total Non-Conventional Water Resources (TNCWR)=(PMW)+(PAD)+(PDW)	BCM/Year	0.30	
Total Non Renewable Groundwater Resources (TNRGR)	BCM/Year	N/A	
Total Conventional Water Resources (TCWR)=(TRWR)+(TNRGR)	BCM/Year	0.06	
Total Available Water Resources (TAWR)=(TCWR)+(TNCWR)	BCM/Year	0.36	
Water Withdrawals and Consumption			
Annual Total Water Withdrawal	BCM/Year	0.44	
Withdrawals by the Domestic Sector	BCM/Year	0.17	
Withdrawals by the Industrial Sector	BCM/Year	0.01	
Withdrawals by the Irrigated Agriculture Sector (Blue Water+Non-conventional Water)	BCM/Year	0.26	
Agricultural Consumption from Green Water	BCM/Year	0	
Total Agricultural Withdrawals	BCM/Year	0.26	
Withdrawals From Blue Surface Water	BCM/Year	0	
Withdrawals From Blue Groundwater	BCM/Year	0.60	
Withdrawals from Non-Renewable Groundwater	BCM/Year	0.60	

Withdrawals From Non-Conventional Resources	BCM/Year	0.22	
Overall Water Use Efficiency	%	84.10	
Water Sustainability Index	%	1,724	
Wastewater and Drainage Outflows	BCM/Year	0.08	
Water and Land Use Change			
Total Irrigated Agricultural Land	ha	0	
Total rain-Fed Agricultural Land	ha	199,000	
Total Forest Land	ha	9,000	
Total Natural Pasture Land	ha	150,000	
Water and Accessibility			
Water Supply Coverage (JMP)	%	100	
Water Supply Coverage (Sector Ministry)	%	N/A	
Urban Water Supply Coverage (JMP)	%	100	
Urban Water Supply Coverage (Sector Ministry)	%	N/A	
Rural Water Supply Coverage (JMP)	%	100	
Rural Water Supply Coverage (Sector Ministry)	%	N/A	
Sanitation Coverage (JMP)	%	100	
Sanitation Coverage (Sector Ministry)	%	N/A	
Urban Sanitation Coverage (JMP)	%	100	
Urban Sanitation Coverage (Sector Ministry)	%	N/A	
Rural Sanitation Coverage (JMP)	%	100	
Rural Sanitation Coverage (Sector Ministry)	%	N/A	
Length of water supply pipe networks	Km	N/A	
Length of Sewage pipe networks	Km	N/A	
Length of Irrigation Networks	Km	N/A	
Length of Drainage Network	Km	N/A	
Total drinking water treatment plant capacity	BCM/Year	N/A	
Dam Capacity (Installed)	BCM/Year	N/A	
Desalination Capacity	BCM/Year	0.34	
Electricity Generated Using Hydropower	GWh/Year	N/A	
Water and Demographics			
Total Population	1000 inhabitants	1,598	
Internal Renewable Water Resources per Capita	CM/capita	35.04	
Total Renewable Blue Water Resources per Capita	CM/capita	36.3	
Total Renewable Water Resources per Capita	CM/capita	36.30	
Blue Water Withdrawal per Capita	CM/capita	277	
Green Water Consumption per Capita	CM/capita	0	
Total Available Water Resources per Capita	CM/capita	226	
Total Water Consumption per Capita	CM/capita	277	
Agricultural Water Withdrawal per Capita	CM/capita	163	
Industrial Water Withdrawal per Capita	CM/capita	5.01	
Domestic Water Withdrawal per Capita	CM/capita	108	
Population Without Improved Water Supply	1000 inhabitants	0	

Population Without Adequate Sanitation	1000 inhabitants	0	
Water and Quality			
Average Total Dissolved Solids	mg/l	N/A	
Diarrhea Reported Cases	% of children under 5	8.80	
Dracunculiasis Reported Cases	Number	0	
Cholera Reported cases	Number	N/A	
Open Defecation Practice	%	0	
Water and Climate			
Flood Events in the Last Two Decades.	Number	N/A	
Flood Events 1989-2000	Number	0	
Flood Events 2000-2011	Number	0	
Water and Economics			
National Climate Change Adaptation Plan	Yes/No	N/A	
Industrial Water Productivity (GDP/Water Use)	$/CM	14,485	
Employment in Agriculture	Jobs/MCM	75.49	
Agricultural Water Productivity (GDP/Water Use)	$/CM	1.20	
Water and Sanitation Charges as % of the lowest Household Income Groups	%	1.72	
Subsidy (Domestic-Industrial-Agricultural)	%	N/A	
Public Expenditure on Water Related Projects	Million US$	N/A	
Foreign Development Assistance for Water (Total 2009-2012)	Million US$	N/A	
Foreign Development Assistance for Water (average yearly)	Million US$	N/A	
Virtual Water Imports related to Trade in the Agricultural Sector	BCM/Year	3.43	
Virtual Water Exports related to Trade in the Agricultural Sector	BCM/Year	0.04	
Virtual-Water net Flow Related to Trade in the Agricultural Sector	BCM/Year	3.39	
Water and Political Affairs			
IWRM Plan in Place	Yes/No	N/A	
Water Rights/year	Number	N/A	
Well Permits/year	Number	N/A	
Irrigation related complaints	Number/Year	N/A	
Water Supply and Sanitation related complaints	Number/Year	N/A	
Transboundary Water Bodies Dependency Ratio	%	4	
Standpoint in the 1997 UN Convention	Ratification/ Voting	Ratified	

*All data and estimates are for 2012 unless otherwise mentioned

Saudi Arabia

Saudi Arabia

Saudi Arabia occupies the bulk of the Arabian Peninsula with a total area of 2.25 km^2 situated in south west Asia. The coast line in the Red Sea and the Arabian Gulf is about 2,640 km long. The total population as of July 2012 is about 26 millions, about 6 million of which are of foreign nationalities. The population density is about 12 inhabitants/ km^2 and the population growth rate is1.523%.

The climate in Saudi Arabia is generally harsh as it is mostly dry desert. The annual rainfall ranges from 90 to 500 mm/year, and the annual precipitation volume is 126 BCM . The annual Green Water consumption which comprises the direct beneficial uses by pasture and forest areas is 0.405 BCM .Flash floods occur in many parts of Saudi Arabia due to heavy rain in short periods. The average annual surface runoff for the whole country is 2 billion cubic meters. More than 223 dams have been constructed for various purposes (i.e. flood control, irrigation, water supply and groundwater recharge) the total storage capacity of these dams is 835 million cubic meters. The biggest two dams are Najran dam which stores 86 MCM and Jezan dam with a storage of 51 MCM.

The total volumes of available renewable water resources from surface water and groundwater recharge are about 6,188 MCM. The average per capita water share from renewable resources is about 281 cubic meters, which is considered extreme water poverty.

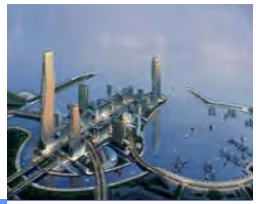
The non-renewable water consumption is about 15.5 BCM/year which comes from 9 primary aquifers and 13 secondary aquifers (Figure (102)). The most significant primary non-renewable groundwater aquifers are Wajid aquifer with a proven reserve of 30,000 MCM, Saq aquifer with a proven reserve of 65,000 MCM, and Wasia Biyadah aquifer with a proven reserve of 120,000 MCM.

Agriculture consumes about 85% of the total water consumption in the country while municipal and industrial water demand uses the remaining 15%.

Saudi Arabia has been the world's largest user of sea water desalination technology since 1970. Desalinated water is used for domestic purposes only. There are currently 21 desalination plants in the western province and 6 in the eastern province. 76% of plants adopt the multistage flash systems technology, while the rest are operated by the reverse osmosis methodology. The average desalination cost is 4 Saudi Riyals per cubic meter (1.06 US dollars). The average annual amount of desalinated water is 1.05 BCM.

Saudi Arabia is implementing a plan to reclaim most of the treated wastewater to be used for agriculture, industry and landscaping, the annually treated wastewater is about 240 MCM.

Saudi Arabia's GDP was estimated at $ 44.7 billion in 2010. The agriculture share was up to 2% of the total GDP in 2010 whereas the industry share (including oil and gas) was estimated at 59.8% of GDP. The Gross National Income per Capita based on purchasing power parity in 2010 was estimated at $ 22,800. According to the bilateral commitments between Development Assistance Committee (DAC) countries of the Organization for Economic Cooperation and Development (OECD) and Arab countries, Saudi Arabia has received in the water sector and sanitation Official Development Aid estimated at $ 0.57 million in 2011. This amount is one of the least amounts of aid disbursed to Arab countries. As for the actual government



budget for the fiscal year 2011, Jordan has planned to spend on the water, industry and agriculture sector the total amount of $ 13.5 billion.

Saudi Arabia virtual water imports in agriculture were estimated at 38 billion CM which had a product value of $ 8 billion. Whereas exports of virtual water

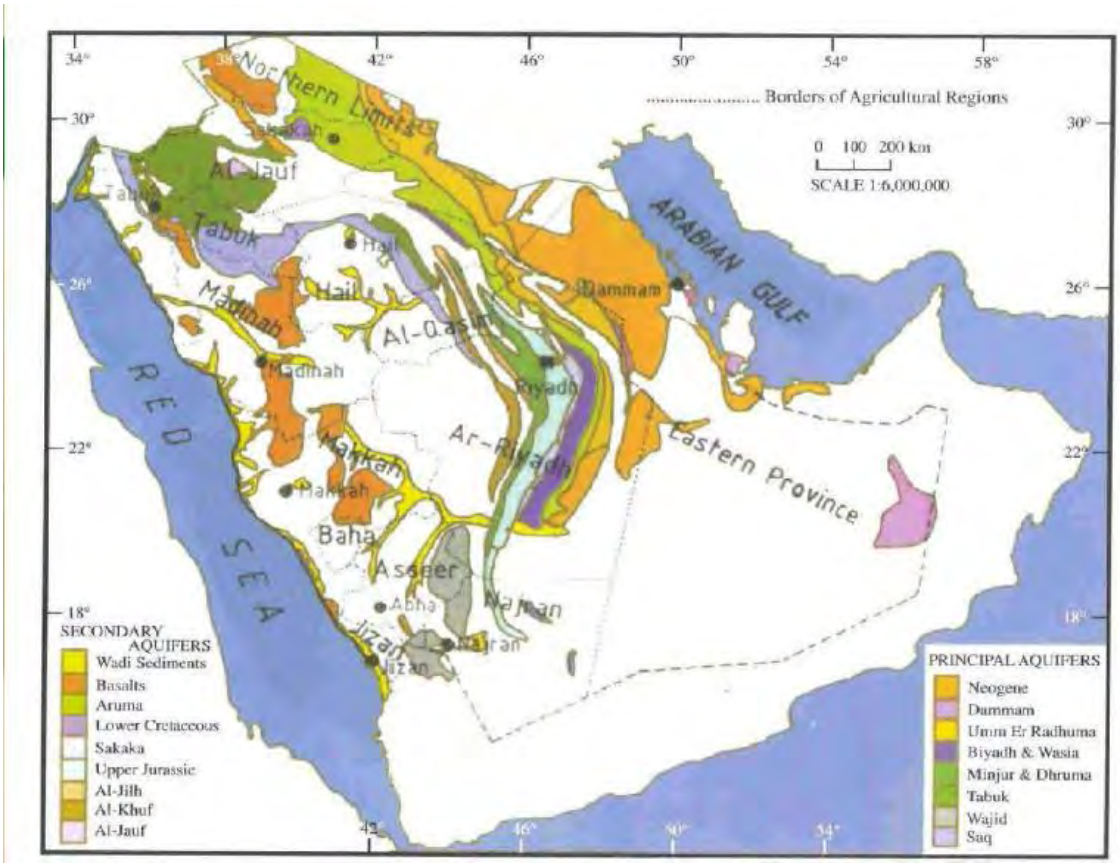


Figure 101. Groundwater Aquifers of Saudi Arabia

The total capital investment needed during the period 2010-2015 to reach the sanitation universal coverage target is estimated at $ 717 million and 2,687 thousand people to be covered, when the MDG target is actually achieved. Regarding the water supply coverage, Saudi Arabia needs to invest the amount of $ 472 million and to cover 1,263 thousand people to reach the MDG target. For the universal coverage, $ 1.9 billion of investment are required to cover 3,811 thousand people.

Agriculture is the major water use sector. The gross agriculture production in 2010 reached $ 11 billion. in agriculture were estimated at 5 billion CM which is translated a products monetary value of about $ 1 billion.

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Saudi Arabia Water Indicators

Water Related Indicators	Units	Saudi Arabia	Notes
Water Availability			
Annual Average Precipitaion Depth	MM/Year	59	
Annual Average Precipitation Volume	BCM/Year	126.80	
Internal Renewable Surface Water (IRSW)	BCM/Year	2.20	
Internal Renewable Groundwater (IRG)	BCM/Year	2.20	
Total Internal Renewable Blue Water Resources (TIRBWR)=(IRSW+IRG)	BCM/Year	4.40	
External Surface Water Inflow (ESWI)	BCM/Year	0	
External Surface Water Outflow (ESWO)	BCM/Year	0	
External Groundwater Inflow (EGI)	BCM/Year	0	
External Groundwater Outflow (EGO)	BCM/Year	0.39	
Total External Renewable Blue Water Resources (TERBWR)=(ESWI+EGI)	BCM/Year	0	
Total Renewable Blue Surface Water (TRBSW)=(IRSW)+(ESWI)-(ESWO)	BCM/Year	2.20	
Total Renewable Blue Groundwater (TRBG)=(IRG)+(EGI)-(EGO)	BCM/Year	1.81	
Overlap Between Surface Water and Groundwater (OSW)	BCM/Year	2	
Total Renewable Blue Water Resources (TRBWR)=(TRBSW)+(TRBG)-(OSW)	BCM/Year	2.01	
Total Rainfed Agriculture Abstractions	BCM/Year	0	
Total Natural Pasture Abstractions	BCM/Year	0	
Total Forest Abstractions	BCM/Year	0	
Total Renewable Green Water Resources (TRGWR)	BCM/Year	0	
Total Renewable Water Resources (TRWR)=(TRBWR+TRGWR)	BCM/Year	2.01	
Produced Municipal and Industrial Wastewater (PMW)	BCM/Year	0.73	
Treated Municipal and Industrial Wastewater	BCM/Year	0.24	
Reused Treated and Industrial Municipal Wastewater	BCM/Year	0.1660	
Produced Agricultural Drainage (PAD)	BCM/Year	0.5000	
Reused Agricultural Drainage	BCM/Year	N/A	
Produced Desalinated Water (PDW)	BCM/Year	1.03	
Total Non-Conventional Water Resources (TNCWR)=(PMW)+(PAD)+(PDW)	BCM/Year	2.26	
Total Non Renewable Groundwater Resources (TNRGR)	BCM/Year	15.50	
Total Conventional Water Resources (TCWR)=(TRWR)+(TNRGR)	BCM/Year	19.90	
Total Available Water Resources (TAWR)=(TCWR)+(TNCWR)	BCM/Year	22.16	
Water Withdrawals and Consumption			
Annual Total Water Withdrawal	BCM/Year	23.24	
Withdrawals by the Domestic Sector	BCM/Year	2.09	
Withdrawals by the Industrial Sector	BCM/Year	0.70	
Withdrawals by the Irrigated Agriculture Sector (Blue Water+Non-conventional Water)	BCM/Year	20.46	
Agricultural Consumption from Green Water	BCM/Year	0.00	
Total Agricultural Withdrawals	BCM/Year	20.46	
Withdrawals From Blue Surface Water	BCM/Year	1.08	
Withdrawals From Blue Groundwater	BCM/Year	21.15	
Withdrawals from Non-Renewable Groundwater	BCM/Year	21.15	

Withdrawals From Non-Conventional Resources	BCM/Year	1.20	
Overall Water Use Efficiency	%	94.71	
Water Sustainability Index	%	556.03	
Wastewater and Drainage Outflows	BCM/Year	1.06	
Water and Land Use Change			
Total Irrigated Agricultural Land	ha	1,608,000	
Total rain-Fed Agricultural Land	ha	1,704,000	
Total Forest Land	ha	2,800,000	
Total Natural Pasture Land	ha	170,000,000	
Water and Accessibility			
Water Supply Coverage (JMP)	%	–	
Water Supply Coverage (Sector Ministry)	%	89	
Urban Water Supply Coverage (JMP)	%	97	
Urban Water Supply Coverage (Sector Ministry)	%	N/A	
Rural Water Supply Coverage (JMP)	%	–	
Rural Water Supply Coverage (Sector Ministry)	%	N/A	
Sanitation Coverage (JMP)	%	–	
Sanitation Coverage (Sector Ministry)	%	46	
Urban Sanitation Coverage (JMP)	%	100	
Urban Sanitation Coverage (Sector Ministry)	%	N/A	
Rural Sanitation Coverage (JMP)	%	–	
Rural Sanitation Coverage (Sector Ministry)	%	N/A	
Length of water supply pipe networks	Km	N/A	
Length of Sewage pipe networks	Km	N/A	
Length of Irrigation Networks	Km	N/A	
Length of Drainage Network	Km	N/A	
Total drinking water treatment plant capacity	BCM/Year	N/A	
Dam Capacity (Installed)	BCM/Year	1	
Desalination Capacity	BCM/Year	1.22	
Electricity Generated Using Hydropower	GWh/Year	0	
Water and Demographics			
Total Population	1000 inhabitants	26,809	
Internal Renewable Water Resources per Capita	CM/capita	164.12	
Total Renewable Blue Water Resources per Capita	CM/capita	74.8	
Total Renewable Water Resources per Capita	CM/capita	164.12	
Blue Water Withdrawal per Capita	CM/capita	867	
Green Water Consumption per Capita	CM/capita	0	
Total Available Water Resources per Capita	CM/capita	826	
Total Water Consumption per Capita	CM/capita	867	
Agricultural Water Withdrawal per Capita	CM/capita	763	
Industrial Water Withdrawal per Capita	CM/capita	26.01	
Domestic Water Withdrawal per Capita	CM/capita	78.02	
Population Without Improved Water Supply	1000 inhabitants	2,948	

Population Without Adequate Sanitation	1000 inhabitants	14,476.86	
Water and Quality			
Average Total Dissolved Solids	mg/l	N/A	
Diarrhea Reported Cases	% of children under 5	9.10	
Dracunculiasis Reported Cases	Number	0	
Cholera Reported cases	Number	N/A	
Open Defecation Practice	%	–	
Water and Climate			
Flood Events in the Last Two Decades.	Number	15	
Flood Events 1989-2000	Number	3	
Flood Events 2000-2011	Number	12	
Water and Economics			
National Climate Change Adaptation Plan	Yes/No	N/A	
Industrial Water Productivity (GDP/Water Use)	$/CM	494.72	
Employment in Agriculture	Jobs/MCM	24.08	
Agricultural Water Productivity (GDP/Water Use)	$/CM	0	
Water and Sanitation Charges as % of the lowest Household Income Groups	%	0.11	
Subsidy (Domestic-Industrial-Agricultural)	%	N/A	
Public Expenditure on Water Related Projects	Million US$	13,545	
Foreign Development Assistance for Water (Total 2009-2012)	Million US$	0.57	
Foreign Development Assistance for Water (average yearly)	Million US$	0.19	
Virtual Water Imports related to Trade in the Agricultural Sector	BCM/Year	38.99	
Virtual Water Exports related to Trade in the Agricultural Sector	BCM/Year	5.28	
Virtual-Water net Flow Related to Trade in the Agricultural Sector	BCM/Year	33.71	
Water and Political Affairs			
IWRM Plan in Place	Yes/No	N/A	
Water Rights/year	Number	N/A	
Well Permits/year	Number	N/A	
Irrigation related complaints	Number/Year	N/A	
Water Supply and Sanitation related complaints	Number/Year	N/A	
Transboundary Water Bodies Dependency Ratio	%	0	
Standpoint in the 1997 UN Convention	Ratification/ Voting	Voted in Favor	

*All data and estimates are for 2012 unless otherwise mentioned

Somalia

Somalia

The average annual rainfall is about 282 mm varying between less than 250 mm in the north to about 400 mm in the south and 700 mm in the southwest. The rainfall distribution is bi-modal and occurs mostly between mid April to June, and again between October to December, the total annual precipitation volume is 161 BCM/y, 70 of which are directly and beneficially abstracted by rainfed agriculture, forest areas, and natural pasture areas, which is globally known as Green Water. Somalia, however, exhibits regular periods of drought. Trans-boundary incoming surface flow from Ethiopia is estimated at 8.74 BCM/y. The Internal Renewable Blue Water Resources are estimated at 9 BCM/year. The Total Renewable Blue Water Resources is 14.74 BCM/y as of 2012 where the total population is 10.085 million inhabitant, thus generating a per capita share of annual Renewable Blue Water Resources of 1461 CM/y.

The Shebelli and Juba rivers, originating and extracting more than 90% of their discharge from Ethiopia while draining in the south-east towards the Indian Ocean, constitute the main surface water conveyers in Somalia. The rivers are poorly managed and they lose most of their carrying capacity as a result of percolation, overbank spillage due to limited conveyance capacity and water abstraction. Availability of groundwater is very limited due to limited potential for recharge except for few locations in the northern region wadis. A 200 million CM off-stream storage exists at Johar.

The total annual Blue Water withdrawal is 3.3 BCM/y as of 2003, and divided as follows:

- 99% agriculture,
- 1% domestic uses

The irrigation potential is estimated at 240,000 ha as of the year 2000. In 1984 the total water managed area was only 200,000 ha, out of which only 50,000 ha had controlled irrigation. The water supply coverage in 2006 was 29% while the sanitation coverage was 23% in the same year.

Along the Juba and Shebelli alluvial plains that are also known as the riverine area), floods are the most prevalent type of natural disaster, whereas flash floods are common occurrences along the intermittent wadis in the north of the country. Both phenomena cause high numbers of casualties. Figure (103) shows the 2006 flood extent map of Somalia.

The most recent flash floods were on the 28th of September 2012, in the central town of Beledweyne, the provincial capital of Hiiraan region. The city has received heavy rainfall that raged on for at least 10 hours on Thursday and Friday, causing the Shebelli River to burst its banks and made floods into the town.

Somalia's GDP was estimated at $ 1.3 billion in 2010. The agriculture share was up to 63% of the GDP which is at the value of $ 820 million. According to the bilateral commitments between Development Assistance Committee (DAC) countries of the Organization for Economic Cooperation and Development (OECD) and Arab countries, Somalia has received in the water sector and sanitation Official Development Aid estimated at $ 2.33 million in 2011.

The total capital investment needed during the period 2010-2015 to reach the sanitation universal coverage target is estimated at $ 362 million , and the capital investment needed for MDG in sanitation coverage is estimated at $ 242 million as well as Somalia needs to cover 4,033 thousand people to reach the sanitation MDG and 4,525 thousand people to achieve the universal

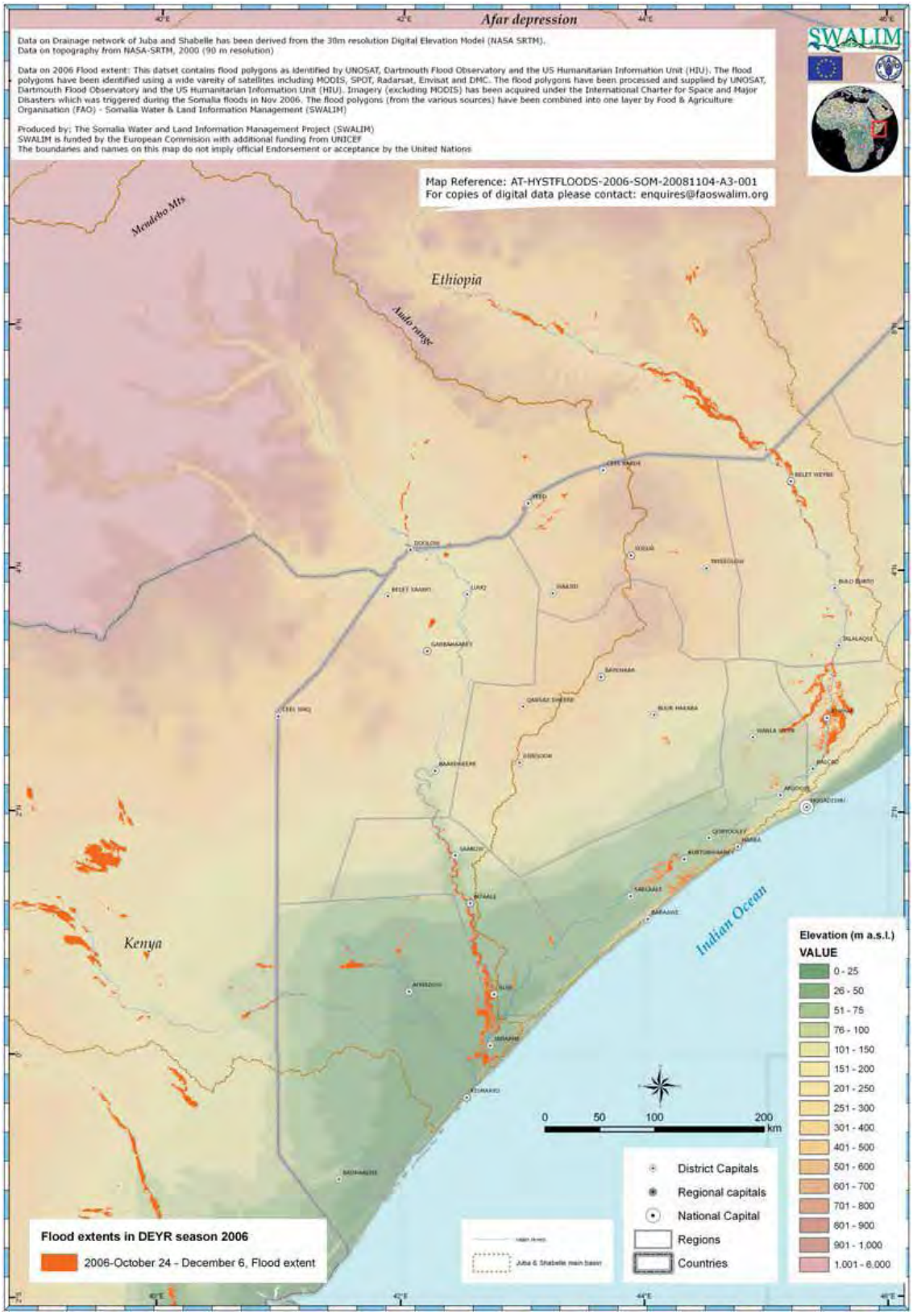

Figure 102. Flood Extent in Somalia in 2006 (Atlas of Somali Water and Land Resources, 2006)

coverage. Somalia needs to invest $ 242 million to achieved the MDG target in the water supply sector and still requires $ 334 million to achieve universal water supply coverage. This is translated to 4,525 thousand people that need to be covered to reach water supply MDG and 4,115 thousand people to reach the universal coverage.

Agriculture is the major water use sector. Somalia virtual water exports in agriculture were estimated at 343.3034 MCM which had a product value of $ 16.85 million. Somalia's imports of virtual water in agriculture were estimated at 38.9 billion CM which is translated in products value at about $ 280.8 million.

The technically feasible hydropower potential is estimated at 600 Gigawatt hour per year in Somalia.

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Somalia Water Indicators

Water Related Indicators	Units	Somalia	Notes
Water Availability			
Annual Average Precipitaion Depth	MM/Year	282	
Annual Average Precipitation Volume	BCM/Year	161	
Internal Renewable Surface Water (IRSW)	BCM/Year	5.70	
Internal Renewable Groundwater (IRG)	BCM/Year	3.30	
Total Internal Renewable Blue Water Resources (TIRBWR)=(IRSW+IRG)	BCM/Year	9	
External Surface Water Inflow (ESWI)	BCM/Year	8.70	
External Surface Water Outflow (ESWO)	BCM/Year	0	
External Groundwater Inflow (EGI)	BCM/Year	0	
External Groundwater Outflow (EGO)	BCM/Year	0	
Total External Renewable Blue Water Resources (TERBWR)=(ESWI+EGI)	BCM/Year	8.70	
Total Renewable Blue Surface Water (TRBSW)=(IRSW)+(ESWI)-(ESWO)	BCM/Year	14.40	
Total Renewable Blue Groundwater (TRBG)=(IRG)+(EGI)-(EGO)	BCM/Year	3.30	
Overlap Between Surface Water and Groundwater (OSW)	BCM/Year	3	
Total Renewable Blue Water Resources (TRBWR)=(TRBSW)+(TRBG)-(OSW)	BCM/Year	14.70	
Total Rainfed Agriculture Abstractions	BCM/Year	1.14	
Total Natural Pasture Abstractions	BCM/Year	59.15	
Total Forest Abstractions	BCM/Year	9.57	
Total Renewable Green Water Resources (TRGWR)	BCM/Year	69.86	
Total Renewable Water Resources (TRWR)=(TRBWR+TRGWR)	BCM/Year	84.56	
Produced Municipal and Industrial Wastewater (PMW)	BCM/Year	0.02	
Treated Municipal and Industrial Wastewater	BCM/Year	0	
Reused Treated and Industrial Municipal Wastewater	BCM/Year	0	
Produced Agricultural Drainage (PAD)	BCM/Year	1.0308	
Reused Agricultural Drainage	BCM/Year	N/A	
Produced Desalinated Water (PDW)	BCM/Year	0	
Total Non-Conventional Water Resources (TNCWR)=(PMW)+(PAD)+(PDW)	BCM/Year	1.05	
Total Non Renewable Groundwater Resources (TNRGR)	BCM/Year	N/A	
Total Conventional Water Resources (TCWR)=(TRWR)+(TNRGR)	BCM/Year	84.56	
Total Available Water Resources (TAWR)=(TCWR)+(TNCWR)	BCM/Year	85.60	
Water Withdrawals and Consumption			
Annual Total Water Withdrawal	BCM/Year	4.14	
Withdrawals by the Domestic Sector	BCM/Year	0.02	
Withdrawals by the Industrial Sector	BCM/Year	0	
Withdrawals by the Irrigated Agriculture Sector (Blue Water+Non-conventional Water)	BCM/Year	4.12	
Agricultural Consumption from Green Water	BCM/Year	1.14	
Total Agricultural Withdrawals	BCM/Year	5.26	
Withdrawals From Blue Surface Water	BCM/Year	4.13	
Withdrawals From Blue Groundwater	BCM/Year	0.02	
Withdrawals from Non-Renewable Groundwater	BCM/Year	0	

Withdrawals From Non-Conventional Resources	BCM/Year	0	
Overall Water Use Efficiency	%	74.77	
Water Sustainability Index	%	0.06	
Wastewater and Drainage Outflows	BCM/Year	1.05	
Water and Land Use Change			
Total Irrigated Agricultural Land	ha	200,000	
Total rain-Fed Agricultural Land	ha	828,000	
Total Forest Land	ha	6,959,700	
Total Natural Pasture Land	ha	43,000,000	
Water and Accessibility			
Water Supply Coverage (JMP)	%	29	
Water Supply Coverage (Sector Ministry)	%	N/A	
Urban Water Supply Coverage (JMP)	%	66	
Urban Water Supply Coverage (Sector Ministry)	%	N/A	
Rural Water Supply Coverage (JMP)	%	7	
Rural Water Supply Coverage (Sector Ministry)	%	N/A	
Sanitation Coverage (JMP)	%	23	
Sanitation Coverage (Sector Ministry)	%	N/A	
Urban Sanitation Coverage (JMP)	%	52	
Urban Sanitation Coverage (Sector Ministry)	%	N/A	
Rural Sanitation Coverage (JMP)	%	6	
Rural Sanitation Coverage (Sector Ministry)	%	N/A	
Length of water supply pipe networks	Km	N/A	
Length of Sewage pipe networks	Km	N/A	
Length of Irrigation Networks	Km	N/A	
Length of Drainage Network	Km	N/A	
Total drinking water treatment plant capacity	BCM/Year	N/A	
Dam Capacity (Installed)	BCM/Year	0	
Desalination Capacity	BCM/Year	N/A	
Electricity Generated Using Hydropower	GWh/Year	N/A	
Water and Demographics			
Total Population	1000 inhabitants	10,085	
Internal Renewable Water Resources per Capita	CM/capita	892	
Total Renewable Blue Water Resources per Capita	CM/capita	1,457	
Total Renewable Water Resources per Capita	CM/capita	8,384	
Blue Water Withdrawal per Capita	CM/capita	410	
Green Water Consumption per Capita	CM/capita	6,926	
Total Available Water Resources per Capita	CM/capita	8,488	
Total Water Consumption per Capita	CM/capita	7,337	
Agricultural Water Withdrawal per Capita	CM/capita	408	
Industrial Water Withdrawal per Capita	CM/capita	0.25	
Domestic Water Withdrawal per Capita	CM/capita	1.87	
Population Without Improved Water Supply	1000 inhabitants	7,160	

Population Without Adequate Sanitation	1000 inhabitants	7,765.45	
Water and Quality			
Average Total Dissolved Solids	mg/l	N/A	
Diarrhea Reported Cases	% of children under 5	23.40	
Dracunculiasis Reported Cases	Number	0	
Cholera Reported cases	Number	3,510	
Open Defecation Practice	%	53	
Water and Climate			
Flood Events in the Last Two Decades.	Number	31	
Flood Events 1989-2000	Number	16	
Flood Events 2000-2011	Number	15	
Water and Economics			
National Climate Change Adaptation Plan	Yes/No	N/A	
Industrial Water Productivity (GDP/Water Use)	$/CM	0	
Employment in Agriculture	Jobs/MCM	687.75	
Agricultural Water Productivity (GDP/Water Use)	$/CM	0.16	
Water and Sanitation Charges as % of the lowest Household Income Groups	%	N/A	
Subsidy (Domestic-Industrial-Agricultural)	%	N/A	
Public Expenditure on Water Related Projects	Million US$	N/A	
Foreign Development Assistance for Water (Total 2009-2012)	Million US$	7.13	
Foreign Development Assistance for Water (average yearly)	Million US$	2.38	
Virtual Water Imports related to Trade in the Agricultural Sector	BCM/Year	1.13	
Virtual Water Exports related to Trade in the Agricultural Sector	BCM/Year	0.34	
Virtual-Water net Flow Related to Trade in the Agricultural Sector	BCM/Year	0.78	
Water and Political Affairs			
IWRM Plan in Place	Yes/No	N/A	
Water Rights/year	Number	N/A	
Well Permits/year	Number	N/A	
Irrigation related complaints	Number/Year	N/A	
Water Supply and Sanitation related complaints	Number/Year	N/A	
Transboundary Water Bodies Dependency Ratio	%	59	
Standpoint in the 1997 UN Convention	Ratification/ Voting	N/A	

*All data and estimates are for 2012 unless otherwise mentioned

Sudan

Sudan

The official split of Sudan into North and South in 2011 was not accompanied by necessary change in official figures and statistics. While, the data and numbers shown hereafter reflect on the state of the water in the northern part, the total separation of information in terms of hydrology and transboundary flows between both parts will take rigorous efforts and a considerable amount of time. The average annual rainfall is about 186 mm. The total annual precipitation volume is 320 BCM/Year, 150 of which are directly abstracted by rainfed areas, natural pasture areas, and forest, in what is known as Green Water. The Internal Renewable Blue Water Resources are estimated at only 13 BCM/Year (0.05% of total precipitation)

Of the 108 BCM/y of Nilotic in-flow entering the formerly unified Sudan, 78 BCM/y are estimated to be drained from Ethiopia and 30 BCM/y are originating from the equatorial lakes. The average annual Nile flow at Aswan, on the Sudano-Egyptian border, is about 84 BCM/y, out of which more than 80% is occurring between August and October. According to the Nile water agreement of 1959, a share of 18.5 BCM/y is attributed to Sudan and a share of 55.5 BCM/y is assigned to Egypt.

The origins of the Nile in the Sudan spring out of two major sources: the Equitorial Lakes Plateau, and the Ethiopian Plateau. The Equatorial Lakes Plateau comprises a number of great lakes, namely:

- Basin of Lakes Victoria and Kioga supplying the Victoria Nile,
- Basin of Lakes George & Edward and the Semiliki River connecting Lake Edward to Lake Albert, and
- Basin of Lake Albert out of which the Albert Nile originates and is joined by torrential streams to form what is known as Bahr El Gabal river which enters Sudan.

The basin of the Ethiopian Plateau which is includes:

- Basin of Sobat River
- Basin of the Blue Nile, and
- Basin of Atbara River

Bahr El-Gabal crossing the southern borders of Sudan flows through the swampy areas known as the Sudd where it confluences with Bahr El-Gazal River from the west then Sobat River from the east. The formed water way known as the White Nile, is joined by the Blue Nile further north at the Sudan's capitol Khartoum. At a distance of 1550 Km to the south of the Sudano-Egyptian boundaries, the Atbara River Joins the Nile supplying about 12 BCM/y.

The seasonal rivers of Gash and Baraka in eastern Sudan have a violent water flow in the rainy period from July to September and the flow is divided between canals that form a fertile delta area (spate irrigation).

The total annual water withdrawal is 27.22 BCM/Year as of 2012, 92% of which is utilized by agriculture, 6% by domestic sector and 2% consumed by industry.

The sanitation coverage for the unified Sudan was only 30% in 2006, while the water supply coverage was 70% in the same year.

In semi-arid zones such as West region, safe drinking water is rare. In particular, areas in the states of North Darfur and South Kordofan rely on groundwater supply (wells) or water storage methods called hafir (small lakes constructed in low lying areas to allow water to be stored during rainfall events) , or earth dams for their water supply (Mohamed-Ali, 2009)

Sudan's GDP was estimated at $ 72.5 billion in 2010. The agriculture share was up

to which is at the value of $ 22.7 billion whereas the industry share (including oil and gas) was estimated at 39.8 % of total GDP. The Gross National Income per Capita based on purchasing power parity in 2011 was estimated at $ 2030. According to the bilateral commitments between Development Assistance Committee (DAC) countries of the Organization for Economic Cooperation and Development (OECD) and Arab countries, Sudan has received in the water sector and sanitation Official Development Aid estimated at $ 33 million in 2011. Regarding Arab Aid, Sudan has received the total of $ 1,682.85 million in the water and sanitation sector from Arab aid banks and funds.

The total capital investment needed during the period 2010-2015 to reach the sanitation universal coverage target is estimated at $ 3.5 billion and 15.5 million people to be covered, as for the capital investment needed for MDG in sanitation coverage is estimated by $ 3,710 million and 20,316 thousand person to be covered. As for the water supply sector, Sudan requires $ 1,445 million to achieve the MDG target which is translated into the number of 12,534 thousand people to be covered also 9 million person needs to achieve universal water supply coverage in the value of $ 926 million.

Agriculture is the major water use sector. Sudan virtual water exports in agriculture were estimated at 1.7 billion CM which had a product value of $ 4.50 million. The imports of virtual water in agriculture were estimated at 5 billion CM which is translated in products value at about $ 765 million.

Economically feasible hydropower potential was estimated at 19000 GigaWatt hour per year in 2008. The installed hydrocapacity is at the value of 575 MegaWatt hour. The hydro power generation in 2008 reached 4,333 Gigawatt hour which represents 55% of the total power production in Sudan.

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Sudan Water Indicators

Water Related Indicators	Units	Sudan (North)	Notes
Water Availability			
Annual Average Precipitaion Depth	MM/Year	186	
Annual Average Precipitation Volume	BCM/Year	320	
Internal Renewable Surface Water (IRSW)	BCM/Year	6	
Internal Renewable Groundwater (IRG)	BCM/Year	7	
Total Internal Renewable Blue Water Resources (TIRBWR)=(IRSW+IRG)	BCM/Year	13	
External Surface Water Inflow (ESWI)	BCM/Year	84	
External Surface Water Outflow (ESWO)	BCM/Year	65.50	
External Groundwater Inflow (EGI)	BCM/Year	0	
External Groundwater Outflow (EGO)	BCM/Year	1.00	
Total External Renewable Blue Water Resources (TERBWR)=(ESWI+EGI)	BCM/Year	84	
Total Renewable Blue Surface Water (TRBSW)=(IRSW)+(ESWI)-(ESWO)	BCM/Year	24.50	
Total Renewable Blue Groundwater (TRBG)=(IRG)+(EGI)-(EGO)	BCM/Year	6	
Overlap Between Surface Water and Groundwater (OSW)	BCM/Year	2	
Total Renewable Blue Water Resources (TRBWR)=(TRBSW)+(TRBG)-(OSW)	BCM/Year	28.50	
Total Rainfed Agriculture Abstractions	BCM/Year	13.76	
Total Natural Pasture Abstractions	BCM/Year	87.02	
Total Forest Abstractions	BCM/Year	49.23	
Total Renewable Green Water Resources (TRGWR)	BCM/Year	150	
Total Renewable Water Resources (TRWR)=(TRBWR+TRGWR)	BCM/Year	178.50	
Produced Municipal and Industrial Wastewater (PMW)	BCM/Year	4.80	
Treated Municipal and Industrial Wastewater	BCM/Year	N/A	
Reused Treated and Industrial Municipal Wastewater	BCM/Year	0	
Produced Agricultural Drainage (PAD)	BCM/Year	5.1911	
Reused Agricultural Drainage	BCM/Year	N/A	
Produced Desalinated Water (PDW)	BCM/Year	0	
Total Non-Conventional Water Resources (TNCWR)=(PMW)+(PAD)+(PDW)	BCM/Year	9.99	
Total Non Renewable Groundwater Resources (TNRGR)	BCM/Year	N/A	
Total Conventional Water Resources (TCWR)=(TRWR)+(TNRGR)	BCM/Year	178.50	
Total Available Water Resources (TAWR)=(TCWR)+(TNCWR)	BCM/Year	188.49	
Water Withdrawals and Consumption			
Annual Total Water Withdrawal	BCM/Year	27.22	
Withdrawals by the Domestic Sector	BCM/Year	6	
Withdrawals by the Industrial Sector	BCM/Year	0.45	
Withdrawals by the Irrigated Agriculture Sector (Blue Water+Non-conventional Water)	BCM/Year	20.76	
Agricultural Consumption from Green Water	BCM/Year	13.76	
Total Agricultural Withdrawals	BCM/Year	34.52	
Withdrawals From Blue Surface Water	BCM/Year	N/A	
Withdrawals From Blue Groundwater	BCM/Year	N/A	
Withdrawals from Non-Renewable Groundwater	BCM/Year	N/A	

Withdrawals From Non-Conventional Resources	BCM/Year	0	
Overall Water Use Efficiency	%	63.29	
Water Sustainability Index	%	0.23	
Wastewater and Drainage Outflows	BCM/Year	9.99	
Water and Land Use			
Total Irrigated Agricultural Land	ha	1,946,200	
Total rain-Fed Agricultural Land	ha	18,528,000	
Total Forest Land	ha	66,290,400	
Total Natural Pasture Land	ha	117,180,000	
Water and Accessibility			
Water Supply Coverage (JMP)	%	58	
Water Supply Coverage (Sector Ministry)	%	N/A	
Urban Water Supply Coverage (JMP)	%	67	
Urban Water Supply Coverage (Sector Ministry)	%	N/A	
Rural Water Supply Coverage (JMP)	%	52	
Rural Water Supply Coverage (Sector Ministry)	%	N/A	
Sanitation Coverage (JMP)	%	26	
Sanitation Coverage (Sector Ministry)	%	N/A	
Urban Sanitation Coverage (JMP)	%	44	
Urban Sanitation Coverage (Sector Ministry)	%	N/A	
Rural Sanitation Coverage (JMP)	%	14	
Rural Sanitation Coverage (Sector Ministry)	%	N/A	
Length of water supply pipe networks	Km	N/A	
Length of Sewage pipe networks	Km	N/A	
Length of Irrigation Networks	Km	N/A	
Length of Drainage Network	Km	N/A	
Total drinking water treatment plant capacity	BCM/Year	N/A	
Dam Capacity (Installed)	BCM/Year	N/A	
Desalination Capacity	BCM/Year	N/A	
Electricity Generated Using Hydropower	GWh/Year	4,333	
Water and Demographics			
Total Population	1000 inhabitants	24,620	
Internal Renewable Water Resources per Capita	CM/capita	528	
Total Renewable Blue Water Resources per Capita	CM/capita	1,157	
Total Renewable Water Resources per Capita	CM/capita	7,250	
Blue Water Withdrawal per Capita	CM/capita	1,105	
Green Water Consumption per Capita	CM/capita	6,092	
Total Available Water Resources per Capita	CM/capita	7,656	
Total Water Consumption per Capita	CM/capita	7,198	
Agricultural Water Withdrawal per Capita	CM/capita	843	
Industrial Water Withdrawal per Capita	CM/capita	18.33	
Domestic Water Withdrawal per Capita	CM/capita	243	
Population Without Improved Water Supply	1000 inhabitants	10,340	

Population Without Adequate Sanitation	1000 inhabitants	18,218	
Water and Quality			
Average Total Dissolved Solids	mg/l	N/A	
Diarrhea Reported Cases	% of children under 5	29.40	
Dracunculiasis Reported Cases	Number	1,686	
Cholera Reported cases	Number	N/A	
Open Defecation Practice	%	43	
Water and Climate			
Flood Events in the Last Two Decades.	Number	21	
Flood Events 1989-2000	Number	10	
Flood Events 2000-2011	Number	11	
Water and Economics			
National Climate Change Adaptation Plan	Yes/No	N/A	
Industrial Water Productivity (GDP/Water Use)	$/CM	0	
Employment in Agriculture	Jobs/MCM	188.57	
Agricultural Water Productivity (GDP/Water Use)	$/CM	0.66	
Water and Sanitation Charges as % of the lowest Household Income Groups	%	N/A	
Subsidy (Domestic-Industrial-Agricultural)	%	N/A	
Public Expenditure on Water Related Projects	Million US$	N/A	
Foreign Development Assistance for Water (Total 2009-2012)	Million US$	1,885	
Foreign Development Assistance for Water (average yearly)	Million US$	628	
Virtual Water Imports related to Trade in the Agricultural Sector	BCM/Year	5.06	
Virtual Water Exports related to Trade in the Agricultural Sector	BCM/Year	1.75	
Virtual-Water net Flow Related to Trade in the Agricultural Sector	BCM/Year	3.31	
Water and Political Affairs			
IWRM Plan in Place	Yes/No	N/A	
Water Rights/year	Number	N/A	
Well Permits/year	Number	N/A	
Irrigation related complaints	Number/Year	N/A	
Water Supply and Sanitation related complaints	Number/Year	N/A	
Transboundary Water Bodies Dependency Ratio	%	80	
Standpoint in the 1997 UN Convention	Ratification/ Voting	Voted in Favor	

*All data and estimates are for 2012 unless otherwise mentioned

Syria

Syria

The overall climate is coastal Mediterranean, with mild, wet winters and dry, hot summers. The annual rainfall ranges from 100 to 150 mm the north-west, 150 to 200 mm from the south towards the central and east-central areas, 300 to 600 mm in the plains and along the foothills in the west, and 800 to 1000 mm along the coast, increasing to 1400 mm in the mountains. The Average annual rainfall in Syria is 252 mm which translates to a total annual volume of 46.6 BCM, 4.28 are transformed to surface runoff, 4.88 are transformed to groundwater, and 30 are consumed as Green Water. The transboundary surface flow entering Syria and secured through treaties is 16.09 BCM (Natural annual flow is 28 BCM), while the annual actual incoming groundwater is 1.33 BCM which is at least ten times less than the annual natural flow. The total population of Syria is estimated at 22.5 million (2012), of which 49% live in rural areas, the actual population growth as of 2011 is -0.97%. The Water supply coverage was 89% as of 2006 while the sanitation coverage reached 92% in the same year.

The total annual Blue Water withdrawal is 21.35 BCM/Year as of 1990, and divided as follows:

- 88% agriculture,
- 8% domestic uses, and
- 4% industrial uses

Groundwater recharge is about 4.88 BCM/y , of which 2 BCM/y discharges into rivers as spring water. Total groundwater inflow has been estimated at 1.35 BCM/y , of which 1.2 BCM from Turkey and 0.15 BCM from Lebanon.

There are at least 141 dams in Syria with a total storage capacity of 19.65 BCM. Al-Assad lake is one of the main reservoirs in Syria, with a storage capacity of 11.2 BCM.

There are also five lakes in Syria, the largest being lake Jabboul near Alepo with a surface area of about 239 km^2. Lake Qattineh near Homs is the main perennial lake in Syria.

Water Resources management in Syria is confronted by various obstacles, but on top of them is the fact that most of Syria's water is transboundary, The Barada river (fig (104)) is the only river in Syria that is totally contained within the Syrian territory. Syria depends to a large extent on the inflow of water from Turkey through the Euphrates and its tributaries. While Syria has signed written agreements with its neighbors on Transboundary Rivers, some argue that none of these agreements could be considered as an international treaty that is recognized by respective Parliaments, these agreements are still regarded as memorandum of understandings reflecting the political wills and future water related intentions of the signing countries.

Since 1962, Syria, Iraq and Turkey have been meeting on a regular basis to discuss water developments in the Euphrates and Tigris basins. The multipurpose Protocol of 1987 marked the first bilateral agreement between Syria and Turkey. According to that protocol, Turkey is committed to release a minimum of 500 m3 per second over the Syrian border.

In 1989, the two downstream countries of the Eupharates and Tigris came to a water-sharing agreement in which 58 percent of the waters were allocated to Iraq and 42 percent to Syria. However, a spark was ignited in early 1990, when Turkey proceeded to drastically cut the Euphrates flow in order to fill the Atatürk Dam for a full month and Syria and Turkey came close to war.

Since the early 2000s, Turkey has shifted its discourse

over transboundary waters. Instead of focusing on sovereignty, they have supported benefit-sharing on a bilateral basis with Syria, which has led to the organisation of a series of meetings, research projects and training programmes. The third bilateral agreement of 2001 between Syria and Turkey opened a new chapter, although it failed to address volumetric allocations, the pending issue of agricultural pollution from Turkey , and the status of the third co-riparian Iraq.

There is an agreement between Lebanon and Syria over the Orontes signed in 1994, which stipulates that Lebanon receives 80 million cubic meters of water per year "if the river flow inside Lebanon is 400 million cubic meters per year or more". This means that the risk of drought is borne by Lebanon. No new wells were allowed to be drilled in the Lebanese portion of the Orontes basin since the signature of the agreement. There is no similar agreement on the Orontes between Syria and Turkey.

In 1987 Syria and Jordan signed an agreement about the sharing of the Yarmouk River's water and have subsequently built the Unity Dam, on their common border.

Figure 103. Barada River

Syria's GDP was estimated at 59 billion $ in 2010. The agriculture share was up to 23 % of the total GDP in 2008 whereas the industry share (including oil and gas) was estimated at 30.6% of GDP. The Gross National Income per Capita based on purchasing power parity in 2011 was estimated at $ 5120. According to the bilateral commitments between Development Assistance Committee (DAC) countries of the Organization for Economic Cooperation and Development (OECD) and Arab countries, Syria has received in the water sector and sanitation Official Development Aid estimated at $ 6.09 million in 2011. This amount is the least amount of aid that Syria received since 2005. Regarding Arab Aid, Syria has received $ 300 thousand in the water and sanitation sector from the Kuwait fund for Economic Development in 2009.

The total capital investment needed during the period 2010-2015 to reach the sanitation universal coverage target is estimated at $ 831 million and 3,055 thousand people to be covered, the capital investment for MDG in sanitation coverage is at the value of $ 52 million translated to 139 thousand people. Regarding the water supply coverage, Syria needs to invest the amount of $ 391 million and to cover 854 thousand people to reach the MDG target. For the universal coverage, $ 1.4 billion of investment are required to cover 3,421 thousand people.

Agriculture is the major water use sector. The gross agriculture production in 2010 reached $ 12 billion. Syria virtual water imports in agriculture were estimated at 15 billion CM which had a product value of $ 2.6 billion. Whereas exports of virtual water in agriculture were estimated at 4.6 billion CM which is translated a products monetary value of about $ 1.4 billion.

The installed hydro capacity is 1,505 Megawatt hour. The hydro power generation in 2008 reached around 8000 Gigawatt hour which represents 15 % of the total

power production in Syria.

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Syria Water Indicators

Water Related Indicators	Units	Syria	Notes
Water Availability			
Annual Average Precipitaion Depth	MM/Year	252	
Annual Average Precipitation Volume	BCM/Year	46.67	
Internal Renewable Surface Water (IRSW)	BCM/Year	4.29	
Internal Renewable Groundwater (IRG)	BCM/Year	4.84	
Total Internal Renewable Blue Water Resources (TIRBWR)=(IRSW+IRG)	BCM/Year	9.13	
External Surface Water Inflow (ESWI)	BCM/Year	37.52	
External Surface Water Outflow (ESWO)	BCM/Year	31.73	
External Groundwater Inflow (EGI)	BCM/Year	11.13	
External Groundwater Outflow (EGO)	BCM/Year	0.34	
Total External Renewable Blue Water Resources (TERBWR)=(ESWI+EGI)	BCM/Year	48.65	
Total Renewable Blue Surface Water (TRBSW)=(IRSW)+(ESWI)-(ESWO)	BCM/Year	10.08	
Total Renewable Blue Groundwater (TRBG)=(IRG)+(EGI)-(EGO)	BCM/Year	15.63	
Overlap Between Surface Water and Groundwater (OSW)	BCM/Year	2	
Total Renewable Blue Water Resources (TRBWR)=(TRBSW)+(TRBG)-(OSW)	BCM/Year	23.71	
Total Rainfed Agriculture Abstractions	BCM/Year	10.08	
Total Natural Pasture Abstractions	BCM/Year	19.26	
Total Forest Abstractions	BCM/Year	1.12	
Total Renewable Green Water Resources (TRGWR)	BCM/Year	30.46	
Total Renewable Water Resources (TRWR)=(TRBWR+TRGWR)	BCM/Year	86.24	
Produced Municipal and Industrial Wastewater (PMW)	BCM/Year	1.36	
Treated Municipal and Industrial Wastewater	BCM/Year	0.55	
Reused Treated and Industrial Municipal Wastewater	BCM/Year	0.5500	
Produced Agricultural Drainage (PAD)	BCM/Year	4.6988	
Reused Agricultural Drainage	BCM/Year	N/A	
Produced Desalinated Water (PDW)	BCM/Year	0.005	
Total Non-Conventional Water Resources (TNCWR)=(PMW)+(PAD)+(PDW)	BCM/Year	6.06	
Total Non Renewable Groundwater Resources (TNRGR)	BCM/Year	N/A	
Total Conventional Water Resources (TCWR)=(TRWR)+(TNRGR)	BCM/Year	86.24	
Total Available Water Resources (TAWR)=(TCWR)+(TNCWR)	BCM/Year	92.30	
Water Withdrawals and Consumption			
Annual Total Water Withdrawal	BCM/Year	21.35	
Withdrawals by the Domestic Sector	BCM/Year	1.80	
Withdrawals by the Industrial Sector	BCM/Year	0.75	
Withdrawals by the Irrigated Agriculture Sector (Blue Water+Non-conventional Water)	BCM/Year	18.80	
Agricultural Consumption from Green Water	BCM/Year	10.08	
Total Agricultural Withdrawals	BCM/Year	28.88	
Withdrawals From Blue Surface Water	BCM/Year		
Withdrawals From Blue Groundwater	BCM/Year		
Withdrawals from Non-Renewable Groundwater	BCM/Year	N/A	

Withdrawals From Non-Conventional Resources	BCM/Year	0.55	
Overall Water Use Efficiency	%	71.60	
Water Sustainability Index	%	0.36	
Wastewater and Drainage Outflows	BCM/Year	5.51	
Water and Land Use Change			
Total Irrigated Agricultural Land	ha	1,013,000	
Total rain-Fed Agricultural Land	ha	4,308,000	
Total Forest Land	ha	478,400	
Total Natural Pasture Land	ha	8,232,000	
Water and Accessibility			
Water Supply Coverage (JMP)	%	90	
Water Supply Coverage (Sector Ministry)	%	N/A	
Urban Water Supply Coverage (JMP)	%	93	
Urban Water Supply Coverage (Sector Ministry)	%	N/A	
Rural Water Supply Coverage (JMP)	%	86	
Rural Water Supply Coverage (Sector Ministry)	%	N/A	
Sanitation Coverage (JMP)	%	95	
Sanitation Coverage (Sector Ministry)	%	N/A	
Urban Sanitation Coverage (JMP)	%	96	
Urban Sanitation Coverage (Sector Ministry)	%	N/A	
Rural Sanitation Coverage (JMP)	%	93	
Rural Sanitation Coverage (Sector Ministry)	%	N/A	
Length of water supply pipe networks	Km	N/A	
Length of Sewage pipe networks	Km	N/A	
Length of Irrigation Networks	Km	N/A	
Length of Drainage Network	Km	N/A	
Total drinking water treatment plant capacity	BCM/Year	N/A	
Dam Capacity (Installed)	BCM/Year	19.65	
Desalination Capacity	BCM/Year	0.005	
Electricity Generated Using Hydropower	GWh/Year	~8000	
Water and Demographics			
Total Population	1000 inhabitants	22,554	
Internal Renewable Water Resources per Capita	CM/capita	404	
Total Renewable Blue Water Resources per Capita	CM/capita	1,051	
Total Renewable Water Resources per Capita	CM/capita	3,823	
Blue Water Withdrawal per Capita	CM/capita	946	
Green Water Consumption per Capita	CM/capita	1,350	
Total Available Water Resources per Capita	CM/capita	4,092	
Total Water Consumption per Capita	CM/capita	2,297	
Agricultural Water Withdrawal per Capita	CM/capita	833	
Industrial Water Withdrawal Per Capita	CM/capita	33.32	
Domestic Water Withdrawal Per Capita	CM/capita	79.87	
Population Without Improved Water Supply	1000 inhabitants	2,255.40	

Population Without Adequate Sanitation	1000 inhabitants	1,127.70	
Water and Quality			
Average Total Dissolved Solids	mg/l	N/A	
Diarrhea Reported Cases	% of children under 5	8.60	
Dracunculiasis Reported Cases	Number	0	
Cholera Reported cases	Number	N/A	
Open Defecation Practice	%	0	
Water and Climate			
Flood Events in the Last Two Decades.	Number	4	
Flood Events 1989-2000	Number	1	
Flood Events 2000-2011	Number	3	
Water and Economics			
National Climate Change Adaptation Plan	Yes/No	N/A	
Industrial Water Productivity (GDP/Water Use)	$/CM	24.08	
Employment in Agriculture	Jobs/MCM	24.97	
Agricultural Water Productivity (GDP/Water Use)	$/CM	0.42	
Water and Sanitation Charges as % of the lowest Household Income Groups	%	N/A	
Subsidy (Domestic-Industrial-Agricultural)	%	N/A	
Public Expenditure on Water Related Projects	Million US$	N/A	
Foreign Development Assistance for Water (Total 2009-2012)	Million US$	32.38	
Foreign Development Assistance for Water (average yearly)	Million US$	10.79	
Virtual Water Imports related to Trade in the Agricultural Sector	BCM/Year	15.18	
Virtual Water Exports related to Trade in the Agricultural Sector	BCM/Year	4.68	
Virtual-Water net Flow Related to Trade in the Agricultural Sector	BCM/Year	10.49	
Water and Political Affairs			
IWRM Plan in Place	Yes/No	N/A	
Water Rights/year	Number	N/A	
Well Permits/year	Number	N/A	
Irrigation related complaints	Number/Year	N/A	
Water Supply and Sanitation related complaints	Number/Year	N/A	
Transboundary Water Bodies Dependency Ratio	%	88	
Standpoint in the 1997 UN Convention	Ratification/ Voting	Ratified	

*All data and estimates are for 2012 unless otherwise mentioned

Tunisia

Tunisia

The average annual rainfall is about 153 mm varying from more than 1500 mm in the north to less than 100 mm in about 50% of the country. More than 80% of the rainfall occurs between October and March, the total annual precipitation volume amounts to, 23.70 BCM/Year 12.8 of which are directly abstracted by rain fed agriculture, natural pasture areas, and forest areas, in what is known as Green Water. The total Transboundary incoming flow from Algeria is estimated at 0.6 BCM/y. Internal Renewable Blue Water Resources are estimated at 4.20 BCM/Year of which 2.7 BCM/y is attributed to surface water, and 0.96 BCM/y to ground water. The available surface water resources being exploited as of 2010 are estimated at 2.2 BCM/y. The ground water resources are estimated as 0.745 BCM/y extracted from phreatic aquifer of depth below 50 m, and 0.82 BCM/y extracted from renewable deep aquifers of depths exceeding 50 m. Potential for extraction of fossil water is estimated at 0.62 BCM/y. The total dam capacity in 1991 was about 1.51 BCM corresponding to a total of 257 dams.

The total annual Blue Water withdrawal is 2.64 BCM/Year (412 CM/cap/y) as of 2011, and is divided as follows:

- 75% agriculture,
- 18% domestic uses
- 6% industrial uses, and
- 1% tourism

However, the amount of water withdrawn is a direct function of the rainfall intensity and distribution. The total water managed area in 2007 is 0.56 million ha, 39% of which is under full or partial control irrigation schemes. The average annual growth of irrigation development is about 2%. The water supply coverage is assessed as 99% in urban communities and 84% of rural population. It is estimated that 96% of the total population have access to sanitation.

Limited water resources, stressed per capita share, and hazards of future water scarcity along with continual growth of population and extended demand for food, drinking, industrial, agricultural and development plans in general are driving forces for preserving existing resources and optimizing the benefits through integrated management of water resource. Since gaining its dependence in the 1950s, Tunisia has expanded considerable effort for establishing an industrial and agricultural-led infrastructure. In the 1990s, the national development programs have been closely coupled with environmental protection programs.

Since the beginning of the 1980s, reuse of treated wastewater has been adopted to provide additional potential water resources. In 2011, 240 million cubic meters of waste water has been treated, out of which 38 million cubic meters are adopted for reuse. Non-conventional water resources also include 373,000 CM of desalinated water. Conjunctive use of surface water and groundwater has been successfully adopted in pilot areas in wadis.

Increasing the storage potential through groundwater recharge is also being practiced. The current Groundwater recharge is estimated to be 33 Million CM. The general national policy for increasing water availability is based on development of irrigation schemes, adaptation of water saving techniques, and encouraging the reuse of waste water. A monitoring system has been set for all irrigation schemes of potential salinisation effects where the salinity of irrigation water is between 1.5 and 4.0 g/l.

Tunisia's GDP was estimated at $ 44 billion in 2010. The agriculture share was up to 8 % of the total GDP whereas the industry share (including oil and gas) was estimated at 29.9 % of GDP. The Gross National Income per Capita based on purchasing power parity in 2011 was estimated at $ 9060. According to the bilateral commitments between Development Assistance Committee (DAC) countries of the Organization for Economic Cooperation and Development (OECD), Tunisia has received in the water sector and sanitation Official Development Aid estimated at $ 108.1 million in 2011. As for the actual government budget during 2007-2011, Tunisia has planned to invest in water sector about $ 1.8 billion.

The total capital investment needed during the period 2010-2015 to reach the sanitation universal coverage target is estimated at $ 190 million and 1,628 thousand people to be covered, the capital investment needed to achieve the MDG in sanitation coverage is at the value of $ 29 million to cover 247 thousand people. Regarding the water supply, Tunisia has achieved the MDG target. As for the universal coverage, Tunisia needs to invest the amount of $ 378 million to cover 953 thousand people with water supply.

Agriculture is the major water use sector. The gross agriculture production in 2010 reached $ 3 billion. Tunisia virtual water imports in agriculture were estimated at 13 billion CM which had a product value of $ 1 billion. Exports of virtual water in agriculture were estimated at 4 billion CM which was translated in products value of about $ 995 million.

The technically feasible hydropower potential is estimated at 250 GigaWatthour per year and the installed hydro capacity is around 70 Megawatt hour. The hydro power generation in 2008 reached 160 Gigawatt hour which represents 3 % of the total power production in Tunisia.

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Tunisia Water Indicators

Water Related Indicators	Units	Tunisia	Notes
Water Availability			
Annual Average Precipitaion Depth	MM/Year	153	
Annual Average Precipitation Volume	BCM/Year	23.70	
Internal Renewable Surface Water (IRSW)	BCM/Year	2.70	
Internal Renewable Groundwater (IRG)	BCM/Year	1.50	
Total Internal Renewable Blue Water Resources (TIRBWR)=(IRSW+IRG)	BCM/Year	4.20	
External Surface Water Inflow (ESWI)	BCM/Year	0.30	
External Surface Water Outflow (ESWO)	BCM/Year	0.19	
External Groundwater Inflow (EGI)	BCM/Year	0.10	
External Groundwater Outflow (EGO)	BCM/Year	0.10	
Total External Renewable Blue Water Resources (TERBWR)=(ESWI+EGI)	BCM/Year	0.40	
Total Renewable Blue Surface Water (TRBSW)=(IRSW)+(ESWI)-(ESWO)	BCM/Year	2.81	
Total Renewable Blue Groundwater (TRBG)=(IRG)+(EGI)-(EGO)	BCM/Year	1.50	
Overlap Between Surface Water and Groundwater (OSW)	BCM/Year	0.40	
Total Renewable Blue Water Resources (TRBWR)=(TRBSW)+(TRBG)-(OSW)	BCM/Year	3.91	
Total Rainfed Agriculture Abstractions	BCM/Year	5.52	
Total Natural Pasture Abstractions	BCM/Year	5.95	
Total Forest Abstractions	BCM/Year	1.33	
Total Renewable Green Water Resources (TRGWR)	BCM/Year	12.81	
Total Renewable Water Resources (TRWR)=(TRBWR+TRGWR)	BCM/Year	17.41	
Produced Municipal and Industrial Wastewater (PMW)	BCM/Year	0.29	
Treated Municipal and Industrial Wastewater	BCM/Year	0.25	
Reused Treated and Industrial Municipal Wastewater	BCM/Year	0.02	
Produced Agricultural Drainage (PAD)	BCM/Year	0.14	
Reused Agricultural Drainage	BCM/Year	N/A	
Produced Desalinated Water (PDW)	BCM/Year	0.03	
Total Non-Conventional Water Resources (TNCWR)=(PMW)+(PAD)+(PDW)	BCM/Year	0.46	
Total Non Renewable Groundwater Resources (TNRGR)	BCM/Year	0.65	
Total Conventional Water Resources (TCWR)=(TRWR)+(TNRGR)	BCM/Year	18.06	
Total Available Water Resources (TAWR)=(TCWR)+(TNCWR)	BCM/Year	18.52	
Water Withdrawals and Consumption			
Annual Total Water Withdrawal	BCM/Year	2.64	
Withdrawals by the Domestic Sector	BCM/Year	0.37	
Withdrawals by the Industrial Sector	BCM/Year	0.11	
Withdrawals by the Irrigated Agriculture Sector (Blue Water+Non-conventional Water)	BCM/Year	2.16	
Agricultural Consumption from Green Water	BCM/Year	5.52	
Total Agricultural Withdrawals	BCM/Year	7.69	
Withdrawals From Blue Surface Water	BCM/Year	1.50	
Withdrawals From Blue Groundwater	BCM/Year	1.14	
Withdrawals from Non-Renewable Groundwater	BCM/Year	0	

Withdrawals From Non-Conventional Resources	BCM/Year	0.05	
Overall Water Use Efficiency	%	83.78	
Water Sustainability Index	%	120.97	
Wastewater and Drainage Outflows	BCM/Year	0.41	
Water and Land Use Change			
Total Irrigated Agricultural Land	ha	385,000	
Total rain-Fed Agricultural Land	ha	4,491,000	
Total Forest Land	ha	1,085,000	
Total Natural Pasture Land	ha	4,840,000	
Water and Accessibility			
Water Supply Coverage (JMP)	%	99	
Water Supply Coverage (Sector Ministry)	%	N/A	
Urban Water Supply Coverage (JMP)	%	N/A	
Urban Water Supply Coverage (Sector Ministry)	%	N/A	
Rural Water Supply Coverage (JMP)	%	–	
Rural Water Supply Coverage (Sector Ministry)	%	N/A	
Sanitation Coverage (JMP)	%	96	
Sanitation Coverage (Sector Ministry)	%	N/A	
Urban Sanitation Coverage (JMP)	%	N/A	
Urban Sanitation Coverage (Sector Ministry)	%	N/A	
Rural Sanitation Coverage (JMP)	%	–	
Rural Sanitation Coverage (Sector Ministry)	%	N/A	
Length of water supply pipe networks	Km	N/A	
Length of Sewage pipe networks	Km	N/A	
Length of Irrigation Networks	Km	N/A	
Length of Drainage Network	Km	N/A	
Total drinking water treatment plant capacity	BCM/Year	N/A	
Dam Capacity (Installed)	BCM/Year	2.66	
Desalination Capacity	BCM/Year	N/A	
Electricity Generated Using Hydropower	GWh/Year	160	
Water and Demographics			
Total Population	1000 inhabitants	10,365	
Internal Renewable Water Resources per Capita	CM/capita	404	
Total Renewable Blue Water Resources per Capita	CM/capita	376	
Total Renewable Water Resources per Capita	CM/capita	1,679	
Blue Water Withdrawal per Capita	CM/capita	254	
Green Water Consumption per Capita	CM/capita	1,236	
Total Available Water Resources per Capita	CM/capita	1,786	
Total Water Consumption per Capita	CM/capita	1,490	
Agricultural Water Withdrawal per Capita	CM/capita	208	
Industrial Water Withdrawal per Capita	CM/capita	10.61	
Domestic Water Withdrawal per Capita	CM/capita	35.21	
Population Without Improved Water Supply	1000 inhabitants	103.65	

Population Without Adequate Sanitation	1000 inhabitants	414.60	
Water and Quality			
Average Total Dissolved Solids	mg/l	4,000	
Diarrhea Reported Cases	% of children under 5	5.80	
Dracunculiasis Reported Cases	Number	0	
Cholera Reported cases	Number	N/A	
Open Defecation Practice	%	–	
Water and Climate			
Flood Events in the Last Two Decades.	Number	7	
Flood Events 1989-2000	Number	2	
Flood Events 2000-2011	Number	5	
Water and Economics			
National Climate Change Adaptation Plan	Yes/No		
Industrial Water Productivity (GDP/Water Use)	$/CM	138.83	
Employment in Agriculture	Jobs/MCM	97.46	
Agricultural Water Productivity (GDP/Water Use)	$/CM	0.41	
Water and Sanitation Charges as % of the lowest Household Income Groups	%	0.01	
Subsidy (Domestic-Industrial-Agricultural)	%	N/A	
Public Expenditure on Water Related Projects	Million US$	1,863	
Foreign Development Assistance for Water (Total 2009-2012)	Million US$	318.94	
Foreign Development Assistance for Water (average yearly)	Million US$	106.31	
Virtual Water Imports related to Trade in the Agricultural Sector	BCM/Year	13.01	
Virtual Water Exports related to Trade in the Agricultural Sector	BCM/Year	4.78	
Virtual-Water net Flow Related to Trade in the Agricultural Sector	BCM/Year	8.23	
Water and Political Affairs			
IWRM Plan in Place	Yes/No	N/A	
Water Rights/year	Number	N/A	
Well Permits/year	Number	N/A	
Irrigation related complaints	Number/Year	N/A	
Water Supply and Sanitation related complaints	Number/Year	N/A	
Transboundary Water Bodies Dependency Ratio	%	8	
Standpoint in the 1997 UN Convention	Ratification/ Voting	Ratified	

*All data and estimates are for 2012 unless otherwise mentioned

United Arab Emirates

United Arab Emirates

The average annual rainfall is about 120 mm varying from less than 40 mm in southern desert to about 160 mm in the north-eastern mountains. Most of the rainfall occurs between October and March. The areas suitable for rain-fed agriculture are very limited, thus the total Green Water consumed as beneficial abstractions from these areas, along with pasture areas and forests amount to 2.4 BCM . Precipitation, which varies over space and time, accounts for 6.52 BCM/y of Internal renewable water resources. The average annual groundwater recharge is about 0.12 BCM. Rechargeable ground water aquifers occur mainly from infiltration from the ephemeral river beds. In the year 2010 the total groundwater abstraction is estimated at 2.157 BCM, which means that the groundwater depletion was almost 2BCM. The over-extraction of groundwater resources has led to a lowering of the water table by more than one meter on average during the last two decades, while sea water intrusion is increasing in the coastal areas. The groundwater quality distribution is shown in fig (105). The actual renewable water resources, as of 2010, is estimated at 0.15 BCM/y where the total population is 8.26 million inhabitant (including all temporary workers), thus generating a per capita share of only 21.6 CM/capita.

Rainfall, along with the terrain characteristics dictates Wadi runoff in the UAE. The potential average annual surface flow ranges from 23 to 138 MCM. There are 60 recognized catchments in the UAE (Fig (106)).

The total freshwater withdrawal is estimated at 8.29 BCM/Year, 60 % of which is diverted to agriculture, 39% to domestic sector, 1% to industry. The total freshwater withdrawals sources are distributed as:

- 51% from groundwater,
- 40% from desalination, and
- 9% from treated wastewater reuse.

There are about 118 dams and embankments of various dimensions. They are mainly built for recharge purposes and to provide protection against damage caused by flash floods. The total storage capacity of these dams is estimated at 0.06 BCM/Year.

The Water supply coverage in the UAE is 100%, and the sanitation coverage is also 100%.

U.A.E.'s GDP was estimated at 297 billion $ in 2010. The agriculture share was about 1 % of the total GDP whereas the industry share (including oil and gas) was estimated at 55.52% of GDP. The Gross National Income per Capita based on purchasing power parity in 2009 was estimated at $ 50,600. According to the bilateral commitments between Development Assistance Committee (DAC) countries of the Organization for Economic Cooperation and Development (OECD) and the Arab countries, U.A.E. wasn't one of the recipient countries. As for the actual government budget for 2010, U.A.E. has planned to spend on water, environment, public work, energy, trade and economy the amount of about $ 6.6 billion which is estimated at about 4% of the budget.

The total capital investment needed during the period 2010-2015 to reach the sanitation universal coverage target is estimated at $ 408 million and 543 thousand people to be covered, the capital investment for MDG in sanitation coverage is at the value of $ 44 million translated to 68 thousand people. Regarding the water supply coverage, U.A.E. needs to invest the amount of $ 64 million and to cover 134 thousand people to reach the universal coverage, and the amount of $ 1 billion and 486 thousand people to be covered. The MDG target in water sector is already achieved in U.A.E.

Agriculture is the major water use sector. The gross agriculture production in 2010 reached $ 2.6 billion. U.A.E. virtual water imports in agriculture were estimated at 27 billion CM which had a product value of $ 7.8 billion. Exports of virtual water in agriculture were estimated at 6.8 billion CM which is translated in products value at about $ 2 billion.

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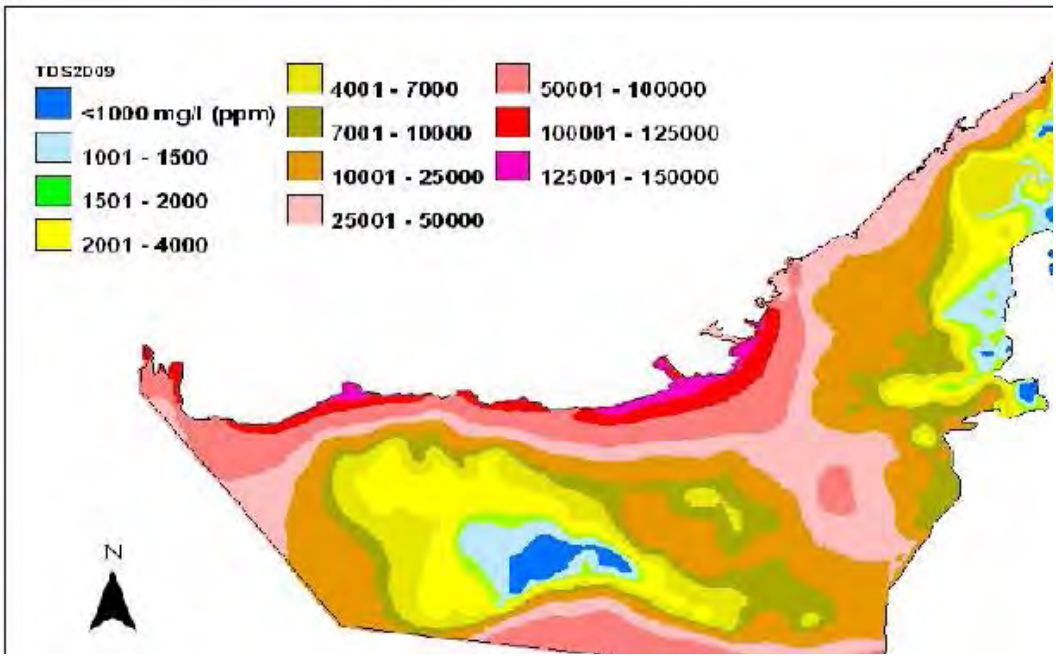

Figure 104. Groundwater Quality Distribution in the UAE (UAE Ministry of Environment and Water, 2011)

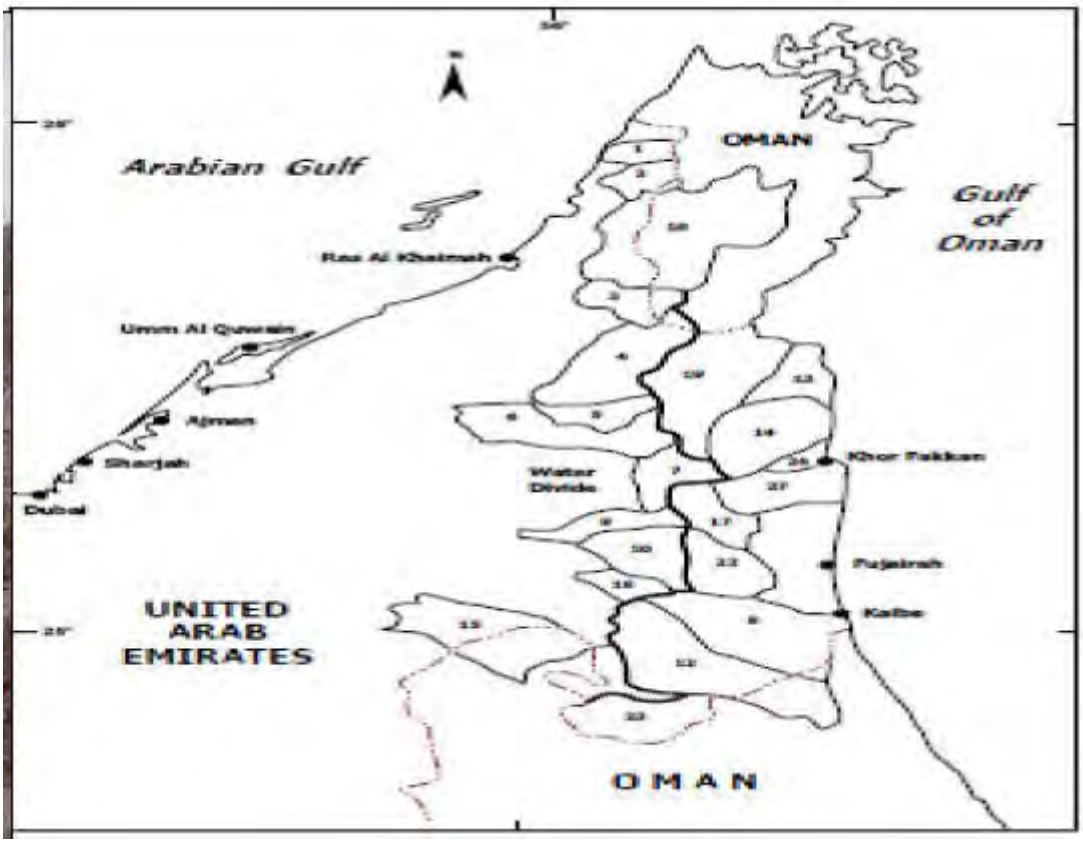

Figure 105. Surface Water Catchments in UAE (UAE Ministry of Environment and Water, 2011)

United Arab Emirates Water Indicators

Water Related Indicators	Units	UAE	Notes
Water Availability			
Annual Average Precipitaion Depth	MM/Year	120	
Annual Average Precipitation Volume	BCM/Year	6.52	
Internal Renewable Surface Water (IRSW)	BCM/Year	0.15	
Internal Renewable Groundwater (IRG)	BCM/Year	0.12	
Total Internal Renewable Blue Water Resources (TIRBWR)=(IRSW+IRG)	BCM/Year	0.17	
External Surface Water Inflow (ESWI)	BCM/Year	0.	
External Surface Water Outflow (ESWO)	BCM/Year	0	
External Groundwater Inflow (EGI)	BCM/Year	0	
External Groundwater Outflow (EGO)	BCM/Year	0	
Total External Renewable Blue Water Resources (TERBWR)=(ESWI+EGI)	BCM/Year	0	
Total Renewable Blue Surface Water (TRBSW)=(IRSW)+(ESWI)-(ESWO)	BCM/Year	0.15	
Total Renewable Blue Groundwater (TRBG)=(IRG)+(EGI)-(EGO)	BCM/Year	0.12	
Overlap Between Surface Water and Groundwater (OSW)	BCM/Year	0.12	
Total Renewable Blue Water Resources (TRBWR)=(TRBSW)+(TRBG)-(OSW)	BCM/Year	0.15	
Total Rainfed Agriculture Abstractions	BCM/Year	0.13	
Total Natural Pasture Abstractions	BCM/Year	1.13	
Total Forest Abstractions	BCM/Year	1.15	
Total Renewable Green Water Resources (TRGWR)	BCM/Year	2.41	
Total Renewable Water Resources (TRWR)=(TRBWR+TRGWR)	BCM/Year	2.56	
Produced Municipal and Industrial Wastewater (PMW)	BCM/Year	1.02	
Treated Municipal and Industrial Wastewater	BCM/Year	0.29	
Reused Treated and Industrial Municipal Wastewater	BCM/Year	0.29	
Produced Agricultural Drainage (PAD)	BCM/Year	1.72	
Reused Agricultural Drainage	BCM/Year	N/A	
Produced Desalinated Water (PDW)	BCM/Year	0.95	
Total Non-Conventional Water Resources (TNCWR)=(PMW)+(PAD)+(PDW)	BCM/Year	3.69	
Total Non Renewable Groundwater Resources (TNRGR)	BCM/Year	N/A	
Total Conventional Water Resources (TCWR)=(TRWR)+(TNRGR)	BCM/Year	2.56	
Total Available Water Resources (TAWR)=(TCWR)+(TNCWR)	BCM/Year	6.25	
Water Withdrawals and Consumption			
Annual Total Water Withdrawal	BCM/Year	8.29	
Withdrawals by the Domestic Sector	BCM/Year	1.28	
Withdrawals by the Industrial Sector	BCM/Year	0.14	
Withdrawals by the Irrigated Agriculture Sector (Blue Water+Non-conventional Water)	BCM/Year	6.87	
Agricultural Consumption from Green Water	BCM/Year	0.13	
Total Agricultural Withdrawals	BCM/Year	6.99	
Withdrawals From Blue Surface Water	BCM/Year	0	
Withdrawals From Blue Groundwater	BCM/Year	6.32	
Withdrawals from Non-Renewable Groundwater	BCM/Year	6.32	

Withdrawals From Non-Conventional Resources	BCM/Year	1.24	
Overall Water Use Efficiency	%	70.34	
Water Sustainability Index	%	431.85	
Wastewater and Drainage Outflows	BCM/Year	2.45	
Water and Land Use Change			
Total Irrigated Agricultural Land	ha	66,700	
Total rain-Fed Agricultural Land	ha	34,000	
Total Forest Land	ha	310,800	
Total Natural Pasture Land	ha	305,000	
Water and Accessibility			
Water Supply Coverage (JMP)	%	100	
Water Supply Coverage (Sector Ministry)	%	N/A	
Urban Water Supply Coverage (JMP)	%	100	
Urban Water Supply Coverage (Sector Ministry)	%	N/A	
Rural Water Supply Coverage (JMP)	%	100	
Rural Water Supply Coverage (Sector Ministry)	%	N/A	
Sanitation Coverage (JMP)	%	98	
Sanitation Coverage (Sector Ministry)	%	N/A	
Urban Sanitation Coverage (JMP)	%	98	
Urban Sanitation Coverage (Sector Ministry)	%	N/A	
Rural Sanitation Coverage (JMP)	%	95	
Rural Sanitation Coverage (Sector Ministry)	%	N/A	
Length of water supply pipe networks	Km	N/A	
Length of Sewage pipe networks	Km	N/A	
Length of Irrigation Networks	Km	N/A	
Length of Drainage Network	Km	N/A	
Total drinking water treatment plant capacity	BCM/Year	N/A	
Dam Capacity (Installed)	BCM/Year	0.06	
Desalination Capacity	BCM/Year	1.78	
Electricity Generated Using Hydropower	GWh/Year	N/A	
Water and Demographics			
Total Population	1000 inhabitants	6,939	
Internal Renewable Water Resources per Capita	CM/capita	21.62	
Total Renewable Blue Water Resources per Capita	CM/capita	21.6	
Total Renewable Water Resources per Capita	CM/capita	368	
Blue Water Withdrawal per Capita	CM/capita	1,194	
Green Water Consumption per Capita	CM/capita	346	
Total Available Water Resources per Capita	CM/capita	900	
Total Water Consumption per Capita	CM/capita	1,541	
Agricultural Water Withdrawal per Capita	CM/capita	989	
Industrial Water Withdrawal per Capita	CM/capita	20.62	
Domestic Water Withdrawal per Capita	CM/capita	184	
Population Without Improved Water Supply	1000 inhabitants	0	

Population Without Adequate Sanitation	1000 inhabitants	138.78	
Water and Quality			
Average Total Dissolved Solids	mg/l	N/A	
Diarrhea Reported Cases	% of children under 5	8.80	
Dracunculiasis Reported Cases	Number	0	
Cholera Reported cases	Number	N/A	
Open Defecation Practice	%	0	
Water and Climate			
Flood Events in the Last Two Decades.	Number	1	
Flood Events 1989-2000	Number	0	
Flood Events 2000-2011	Number	1	
Water and Economics			
National Climate Change Adaptation Plan	Yes/No	N/A	
Industrial Water Productivity (GDP/Water Use)	$/CM	1,398	
Employment in Agriculture	Jobs/MCM	24.35	
Agricultural Water Productivity (GDP/Water Use)	$/CM	0.50	
Water and Sanitation Charges as % of the lowest Household Income Groups	%	3.36	
Subsidy (Domestic-Industrial-Agricultural)	%	N/A	
Public Expenditure on Water Related Projects	Million US$	N/A	
Foreign Development Assistance for Water (Total 2009-2012)	Million US$	N/A	
Foreign Development Assistance for Water (average yearly)	Million US$	N/A	
Virtual Water Imports related to Trade in the Agricultural Sector	BCM/Year	27.06	
Virtual Water Exports related to Trade in the Agricultural Sector	BCM/Year	6.86	
Virtual-Water net Flow Related to Trade in the Agricultural Sector	BCM/Year	20.20	
Water and Political Affairs			
IWRM Plan in Place	Yes/No	N/A	
Water Rights/year	Number	N/A	
Well Permits/year	Number	N/A	
Irrigation related complaints	Number/Year	N/A	
Water Supply and Sanitation related complaints	Number/Year	N/A	
Transboundary Water Bodies Dependency Ratio	%	0	
Standpoint in the 1997 UN Convention	Ratification/ Voting	Voted in Favor	

*All data and estimates are for 2012 unless otherwise mentioned

Yemen

Yemen

The average annual rainfall is about 232 mm, varying between 500-800mm at western high lands, and less than 50mm at coasts of red sea and Gulf of Aden. Rainfall occurs mainly during the spring (March – April) and summer (July –September) months. The annual precipitation volume is 89 BCM, while the annual beneficial abstractions by rainfed areas, pasture areas, and forests, known as Green Water, is estimated at 4 BCM .

There are four major drainage areas in Yemen, namely the Red Sea, the Gulf of Aden, the Arabian Sea, and the Rub Al-Khali which despite being one of the biggest sand sea in the world, has historical imprints of inflowing streams and rivers, Fig (101) shows a branching pattern that could only have been caused by flowing water.

The total renewable water resources is estimated at 2.1 BCM/y in 2009 , which translates into a per capita share of only 90.02 CM/yr.

The actual fresh water withdrawal is estimated at 3.54 BCM/y in 2006, resulting in an annual deficit of 1.44 BCM/y. This deficit is largely satisfied from fossil groundwater aquifers. With very rare discharge, ground water aquifers decline 1-7 meters annually, which raises the cost of pumping and causes a deterioration of ground water quality including sea water intrusion in the coastal plain areas. Water use in Yemen is allocated as follows::

- 90% agriculture
- 8 % domestic
- 2% industry

0.05 BCM/Year is treated annually in Yemen, which is about 55% of the treatment capacity of the 12 treatment stations in the country. The quality of the treated water is different from one station to another, with the best quality in Hajah and the worst in Taiz. The overall quality is not acceptable to farmers who refrain from using treated wastewater in any type of agriculture.

Desalination is one of the future alternatives in Yemen. It is currently faced by many obstacles including the high altitude of some areas as well as the cost recovery of the unit price of water.

The water supply coverage in Yemen is 62% while the sanitation coverage is 52%.

Figure 106. Traces of Streams in the Rub Elkhali (US Lunar and Planetary Institute)

Yemen's GDP was estimated at $ 29 billion in 2010. The agriculture share was up to 8% of the total GDP whereas the industry share (including oil and gas) was estimated at 29.4 % of GDP. The Gross National Income per Capita based on

purchasing power parity in 2009 was estimated at $ 2370. According to the bilateral commitments between Development Assistance Committee (DAC) countries of the Organization for Economic Cooperation and Development (OECD), Yemen has received in the water sector and sanitation Official Development Aid estimated at $ 28.36 million in 2011. Regarding Arab Aid, Yemen has received $ 21.0 million in the water and sanitation sector from the Islamic Development Bank. As for the actual government budget for the fiscal year 2008, Yemen has planned to spend on the Water and Sanitation sector about $ 112 million.

The total capital investment needed during the period 2010-2015 to reach the sanitation universal coverage target is estimated at $ 1.9 billion and 11 million people to be covered, the capital investment for MDG in sanitation coverage is at the value of $ 200 million translated to 3,441 thousand people. As for the water supply sector, Yemen requires $ 64 million to achieve the MDG target and 134 thousand people to be covered. Regarding the universal coverage, Yemen requires $ 1,700 million to reach the MDG coverage in the value of 564 thousand person to be covered.

Agriculture is the major water use sector. The gross agriculture production in 2010 reached $ 3492 million. Yemen virtual water imports in agriculture were estimated at 13 billion CM which had a product value of $ 2 billion. When exports of virtual water in agriculture were estimated at 1463.071 MCM which is translated in products value at about $ 281.17 million.

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Yemen Water Indicators

Water Related Indicators	Units	Yemen	Notes
Water Availability			
Annual Average Precipitaion Depth	MM/Year	232	
Annual Average Precipitation Volume	BCM/Year	88.17	
Internal Renewable Surface Water (IRSW)	BCM/Year	2	
Internal Renewable Groundwater (IRG)	BCM/Year	1.50	
Total Internal Renewable Blue Water Resources (TIRBWR)=(IRSW+IRG)	BCM/Year	3.50	
External Surface Water Inflow (ESWI)	BCM/Year	0	
External Surface Water Outflow (ESWO)	BCM/Year	0	
External Groundwater Inflow (EGI)	BCM/Year	0	
External Groundwater Outflow (EGO)	BCM/Year	0	
Total External Renewable Blue Water Resources (TERBWR)=(ESWI+EGI)	BCM/Year	0	
Total Renewable Blue Surface Water (TRBSW)=(IRSW)+(ESWI)-(ESWO)	BCM/Year	2	
Total Renewable Blue Groundwater (TRBG)=(IRG)+(EGI)-(EGO)	BCM/Year	1.50	
Overlap Between Surface Water and Groundwater (OSW)	BCM/Year	1.40	
Total Renewable Blue Water Resources (TRBWR)=(TRBSW)+(TRBG)-(OSW)	BCM/Year	2.10	
Total Rainfed Agriculture Abstractions	BCM/Year	0.88	
Total Natural Pasture Abstractions	BCM/Year	2.51	
Total Forest Abstractions	BCM/Year	0.60	
Total Renewable Green Water Resources (TRGWR)	BCM/Year	4.00	
Total Renewable Water Resources (TRWR)=(TRBWR+TRGWR)	BCM/Year	6.10	
Produced Municipal and Industrial Wastewater (PMW)	BCM/Year	0.07	
Treated Municipal and Industrial Wastewater	BCM/Year	0.05	
Reused Treated and Industrial Municipal Wastewater	BCM/Year	0.0060	
Produced Agricultural Drainage (PAD)	BCM/Year	0.9666	
Reused Agricultural Drainage	BCM/Year	N/A	
Produced Desalinated Water (PDW)	BCM/Year	0.03	
Total Non-Conventional Water Resources (TNCWR)=(PMW)+(PAD)+(PDW)	BCM/Year	1.07	
Total Non Renewable Groundwater Resources (TNRGR)	BCM/Year	N/A	
Total Conventional Water Resources (TCWR)=(TRWR)+(TNRGR)	BCM/Year	9.60	
Total Available Water Resources (TAWR)=(TCWR)+(TNCWR)	BCM/Year	10.67	
Water Withdrawals and Consumption			
Annual Total Water Withdrawal	BCM/Year	4.26	
Withdrawals by the Domestic Sector	BCM/Year	0.32	
Withdrawals by the Industrial Sector	BCM/Year	0.08	
Withdrawals by the Irrigated Agriculture Sector (Blue Water+Non-conventional Water)	BCM/Year	3.87	
Agricultural Consumption from Green Water	BCM/Year	0.88	
Total Agricultural Withdrawals	BCM/Year	4.75	
Withdrawals From Blue Surface Water	BCM/Year	N/A	
Withdrawals From Blue Groundwater	BCM/Year	N/A	
Withdrawals from Non-Renewable Groundwater	BCM/Year	N/A	

Withdrawals From Non-Conventional Resources	BCM/Year	0.03	
Overall Water Use Efficiency	%	75.72	
Water Sustainability Index	%	0.54	
Wastewater and Drainage Outflows	BCM/Year	1.03	
Water and Land Use Change			
Total Irrigated Agricultural Land	ha	481,500	
Total rain-Fed Agricultural Land	ha	772,000	
Total Forest Land	ha	528,000	
Total Natural Pasture Land	ha	2,200,000	
Water and Accessibility			
Water Supply Coverage (JMP)	%	55	
Water Supply Coverage (Sector Ministry)	%	N/A	
Urban Water Supply Coverage (JMP)	%	72	
Urban Water Supply Coverage (Sector Ministry)	%	N/A	
Rural Water Supply Coverage (JMP)	%	47	
Rural Water Supply Coverage (Sector Ministry)	%	N/A	
Sanitation Coverage (JMP)	%	53	
Sanitation Coverage (Sector Ministry)	%	N/A	
Urban Sanitation Coverage (JMP)	%	93	
Urban Sanitation Coverage (Sector Ministry)	%	N/A	
Rural Sanitation Coverage (JMP)	%	34	
Rural Sanitation Coverage (Sector Ministry)	%	N/A	
Length of water supply pipe networks	Km	N/A	
Length of Sewage pipe networks	Km	N/A	
Length of Irrigation Networks	Km	N/A	
Length of Drainage Network	Km	N/A	
Total drinking water treatment plant capacity	BCM/Year	N/A	
Dam Capacity (Installed)	BCM/Year	0.46	
Desalination Capacity	BCM/Year	N/A	
Electricity Generated Using Hydropower	GWh/Year	N/A	
Water and Demographics			
Total Population	1000 inhabitants	23,328	
Internal Renewable Water Resources per Capita	CM/capita	150	
Total Renewable Blue Water Resources per Capita	CM/capita	90.0	
Total Renewable Water Resources per Capita	CM/capita	411	
Blue Water Withdrawal per Capita	CM/capita	182	
Green Water Consumption per Capita	CM/capita	171	
Total Available Water Resources per Capita	CM/capita	457	
Total Water Consumption per Capita	CM/capita	354	
Agricultural Water Withdrawal per Capita	CM/capita	165	
Industrial Water Withdrawal per Capita	CM/capita	3.33	
Domestic Water Withdrawal per Capita	CM/capita	13.58	
Population Without Improved Water Supply	1000 inhabitants	10,497	

Population Without Adequate Sanitation	1000 inhabitants	10,964	
Water and Quality			
Average Total Dissolved Solids	mg/l	N/A	
Diarrhea Reported Cases	% of children under 5	27.50	
Dracunculiasis Reported Cases	Number	0	
Cholera Reported cases	Number	300	
Open Defecation Practice	%	22	
Water and Climate			
Flood Events in the Last Two Decades.	Number	21	
Flood Events 1989-2000	Number	6	
Flood Events 2000-2011	Number	15	
Water and Economics			
National Climate Change Adaptation Plan	Yes/No		
Industrial Water Productivity (GDP/Water Use)	$/CM	127.76	
Employment in Agriculture	Jobs/MCM	265.34	
Agricultural Water Productivity (GDP/Water Use)	$/CM	2.36	
Water and Sanitation Charges as % of the lowest Household Income Groups	%	N/A	
Subsidy (Domestic-Industrial-Agricultural)	%	N/A	
Public Expenditure on Water Related Projects	Million US$	112.57	
Foreign Development Assistance for Water (Total 2009-2012)	Million US$	354.70	
Foreign Development Assistance for Water (average yearly)	Million US$	118.23	
Virtual Water Imports related to Trade in the Agricultural Sector	BCM/Year	13.96	
Virtual Water Exports related to Trade in the Agricultural Sector	BCM/Year	1.46	
Virtual-Water net Flow Related to Trade in the Agricultural Sector	BCM/Year	12.50	
Water and Political Affairs			
IWRM Plan in Place	Yes/No	N/A	
Water Rights/year	Number	N/A	
Well Permits/year	Number	N/A	
Irrigation related complaints	Number/Year	N/A	
Water Supply and Sanitation related complaints	Number/Year	N/A	
Transboundary Water Bodies Dependency Ratio	%	0	
Standpoint in the 1997 UN Convention	Ratification/ Voting	Signed	

*All data and estimates are for 2012 unless otherwise mentioned

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Annexes

Annex A: Arab State of the Water Definitions

a. Water and Availability:

1. Annual Average Precipitation Depth: the precipitation: Average precipitation is the long-term average in depth (over space and time) of annual precipitation in the country (World Bank)
2. Annual Average Precipitation Volume: The long term average in volume (over space and time) of annual precipitation, it is the product of the Annual Average Precipitation Depth and the Effective Rainfall area.
3. Internal Renewable Surface Water (IRSW): The amount of precipitation that is neither beneficially abstracted from the atmosphere, nor infiltrated in the ground, but flows overland and routed through channels or joins bigger water bodies.
4. Internal Renewable Groundwater (IRG): Groundwater Recharge is the total volume of water entering underground sources of water (typically aquifers) within a country's borders from endogenous (internal) precipitation and surface water flow (FAO)
5. Total Internal Renewable Blue Water Resources (TIRBWR)=(IRSW+IRG): Long-term average annual flow of rivers and recharge of aquifers generated from endogenous precipitation. Double counting of surface water and groundwater resources is avoided by deducting the overlap from the sum of the surface water and groundwater resources. (FAO)
6. External Surface Water Inflow (ESWI): The part of the country's annual renewable surface water resources that are not generated in the country. It includes surface inflows from upstream countries, and part of the water of border lakes and/or rivers without human influence), it also takes into account the quantity of flow protected by formal agreements or treaties, and therefore, it may vary with time. (Modified from FAO)
7. External Surface Water Outflow (ESWO): Long-term average annual quantity of Surface water leaving the country
8. External Groundwater Inflow (EGI): Long-term average annual quantity of groundwater annually entering the country, taking into consideration treaties (FAO)
9. External Groundwater Outflow (EGO): Long-term average annual quantity of groundwater leaving the country (FAO)
10. Total External Renewable Blue Water Resources (TERBWR)=(ESWI+EGI): the portion of the country's renewable water resources which is not generated within the country (FAO).
11. Total Renewable Blue Surface Water (TRBSW)=(IRSW)+(ESWI)-(ESWO): Is the resultant of the internal produced surface water and the transboundary inflows and outflows of surface water.
12. Total Renewable Blue Groundwater (TRBG)=(IRG)+(EGI)-(EGO): Is the resultant of the internal produced groundwater and the transboundary inflows and outflows of groundwater.
13. Overlap between surface water and groundwater (OSW): Part of the renewable freshwater resources that is

common to both surface water and groundwater. It is equal to groundwater drainage into rivers (typically, base flow of rivers) minus seepage from rivers into aquifers. (FAO)

14. Total Renewable Blue Water Resources (TRBWR) = (TRBSW) + (TRBG)-(OSW): Is the sum of total renewable blue surface and groundwater excluding the overlap between them.

15. Total Non-Renewable Ground Water Resources: The annual extractable amount of non-renewable groundwater according to a pre specified safe yield that is dictated by a pre-specified sustainability period (x number of years)

16. Rainfed: The total amount of precipitation directly consumed by rain fed agriculture.

17. Pasture: The total amount of precipitation directly consumed by pasture areas.

18. Forest: The total amount of precipitation directly consumed by forests.

19. Total Renewable Green Water Resources: 16+17+18

20. Total Renewable Blue Water Resources (TRWR)=(TRBWR+TRGWR)

21. Produced Municipal and Industrial Wastewater (PMW): Annual quantity of wastewater generated in the country, in other words, the quantity of water that has been polluted by adding waste. The origin is domestic use (used water from bathing, sanitary, cooking, etc.) and industrial wastewater routed to the wastewater treatment plant. It does not include agricultural drainage water, which is the water withdrawn for agriculture but not consumed and returned to the system" (modified from FAO)

22. Treated Municipal and Industrial Wastewater: Quantity of generated municipal and industrial wastewater that is treated in a given year and discharged from treatment plants (effluent). (Modified from FAO)

23. Reused Treated Municipal and Industrial Wastewater: Quantity of trteated wastewater that is reused in a given year.

24. Produced Agricultural Drainage (PAD): Total volume of the water withdrawn for agriculture but not consumed and flows out of the system (modified from FAO).

25. Reused Agricultural Drainage: The total volume of agricultural drainage that is returned back to the system through reuse.

26. Produced Desalinated Water (PDW): Water produced annually by desalination of brackish or salt water. (Modified from FAO).

27. Total Non-Conventional Water Resources (TNCWR)= (PMW)+(PAD)+(PDW)

28. Total Non-Renewable Groundwater (TNRGR) : Total Non-Renewable Ground Water Resources: The annual extractable amount of non-renewable groundwater according to a pre specified safe yield that is dictated by a pre-specified sustainability period (x number of years)

29. Total Conventional Water Resources(TCWR)= TRWRR+TNRGR

30. Total Available Water Resources (TAWR) = TCWR+TNCWR

b. Water Withdrawals and Consumption

1. Annual Total Water Withdrawal: The gross amount of water extracted from all sources, either permanently or temporarily, for all uses. It can be either diverted towards distribution networks or directly used. It includes consumptive use, conveyance losses, and return flow" "modified from Earth Trends'
2. Withdrawals by the Domestic Sector: Total annual volume of water withdrawals used for domestic purposes.
3. Withdrawals by the Industrial Sector: Total annual volume of water withdrawals used for industrial purposes.
4. Withdrawals by the Irrigated Agriculture Sector: Total annual volume of water withdrawals used for Irrigated Agricultural purposes.
5. Agricultural Consumption from Green Water: the total volume of Green Water annually consumed by rainfed agriculture.
6. Total Agricultural Withdrawals: The total annual volume consumed by both rainfed and irrigated agriculture.
7. Withdrawals from Blue Surface Water: Annual gross amount of water extracted from rivers, lakes and reservoirs. It includes withdrawal of primary renewable surface water resources and secondary freshwater sources (water previously withdrawn and returned)." (FAO)
8. Withdrawals from Blue Groundwater: Total abstractions from groundwater sources, including nonrenewable sources per year
9. Withdrawals from Non-Renewable Groundwater: Total annual volumes abstracted from non-renewable resources, namely, fossil groundwater.
10. Withdrawals from Non-Conventional Resources: Total volumes abstracted annually from water resources other than surface and groundwater
11. Overall Water Use Efficiency: The ratio of the difference between the total withdrawals from original sources (surface water, renewable and non-renewable groundwater, and Desalinated Water) and the wastewater and Drainage flows TO the Withrawals from Original Sources Expressed as a percentage.
12. Overall water Use Efficiency= 100* ((Withdrawals from Original Sources- Wastewater and Drainage outflows) / Withdrawals from Original Sources)
13. Water Sustainability Index: The ratio of the Total Withdrawals from Original sources including Green Water consumption by rainfed agriculture TO The Total Renewable Water Resources (Blue and Green Water).
14. Wastewater and Drainage Outflows: Wastewater and Agricultural Drainage flowing out of the system.

c. Water and land Use Change

1. Total Irrigated Agricultural land Total water managed agricultural area.
2. Total Rainfed Agricultural land: The total rainfed agricultural area (ha).

d. Water and Demographics

1. Internal Renewable Water Resources per Capita: The maximum theoretical amount of water produced internally and actually available, on a per person basis (modified from FAO).

2. Total renewable Blue Water Resources per Capita: the maximum theoretical amount of water actually available, on a per person basis (FAO).
3. Total Population
4. Internal Renewable Water Resources per Capita
5. Total Renewable Blue Water Resources per Capita
6. Total Renewable Water Resources per Capita
7. Blue Water Withdrawal per Capita
8. Green Water Consumption per Capita
9. Total Available Water Resources per Capita
10. Total Water Consumption per Capita
11. Agricultural Water Withdrawal per Capita
12. Industrial Water Withdrawal per Capita
13. Domestic Water Withdrawal per Capita
14. Population Without Improved Water Supply
15. Population Without Adequate Sanitation

e. Water and Energy:

1. Electricity Generated using Hydropower: Hydropower production as percent of total electricity production (World Bank). And, the Hydropower generated per year.

f. Water and Accessibility:

1. Urban Water Supply Coverage: Percentage of population provided with piped drinking water in urban areas
2. Rural Water Supply Coverage: Percentage of population provided with piped drinking water in rural areas
3. Urban Sanitation Coverage: Percentage of population covered with sanitation in urban areas.
4. Rural Sanitation Coverage: Percentage of population covered with sanitation in rural areas.
5. % of population with improved water supply: An improved drinking-water source is defined as one that, by nature of its construction or through active intervention, is protected from outside contamination" (JMP)
6. % of population with improved sanitation: Defined looking at the following facilities as indicators: Flush or pour-flush (piped sewer system, septic tank, pit latrine), Ventilated Improved Pit (VIP) latrine, pit latrine with slab, composting toilet. (JMP)
7. Length of Networks (Water supply, Sewage, Irrigation, and Drainage)
8. Dam capacity: The total capacity of all water regulating structures installed

9. Desalination capacity: The total capacity of all desalination plants.

g. Water and Health:

1. Diarrhea prevalence (% of children under five): % of children under five suffering from Diarrhea.
2. Dracunculiasis reported cases: number of annual incidents of the disease.
3. Cholera Reported Cases: number of annual incidents of the disease.
4. Open defecation practice: Number of people who continue to practice open defecation.

h. Water and Climate:

1. Flood events in the last two decades.
2. Flood events in the period from 1989 to 2000
3. Flood events in the period from 2000 to 2011
4. Presence of a National adaptation plan (yes/no).

i. Water & Economics:

1. Industrial water productivity: Industrial GDP / (Industrial water withdrawal) , Economic value added (in US$) per cubic meter of water withdrawn by industry: The gross industrial revenue divided by the total Industrial Water consumption.
2. Industry, value added (% of GDP) (WORLD BANK): Industry corresponds to ISIC divisions 10-45 and includes manufacturing (ISIC divisions 15-37). It comprises value added in mining, manufacturing (also reported as a separate subgroup), construction, electricity, water, and gas. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3. Note: For VAB countries, gross value added at factor cost is used as the denominator.
3. Agricultural water productivity: Economic value added (in US$) per cubic meter of water withdrawn by agriculture: The gross agricultural revenue divided by the total agricultural water consumption (including irrigation withdrawals and rain fed agriculture Green Water consumption.
4. Employment in Agriculture "Job per Drop" : The ratio of total labor employed in Agriculture to the total agricultural withdrawals (including irrigation withdrawals and rain fed agriculture Green Water consumption)
5. Water and Sanitation charges as % of average household income: The monthly charge for 15 cubic metres of Water compared to the monthly household income.
6. Subsidy (Domestic-industrial-Agricultural): percentage of subsidy applied for different sectors.
7. GNI per Capita: GNI per capita (formerly GNP per capita) is the gross national income, converted to U.S. dollars using the World Bank Atlas method, divided by the midyear population. GNI is the sum of value added by all resident producers plus any product taxes (less subsidies) not included in the valuation of output plus net

receipts of primary income (compensation of employees and property income) from abroad. GNI, calculated in national currency, is usually converted to U.S. dollars at official exchange rates for comparisons across economies, although an alternative rate is used when the official exchange rate is judged to diverge by an exceptionally large margin from the rate actually applied in international transactions. To smooth fluctuations in prices and exchange rates, a special Atlas method of conversion is used by the World Bank. This applies a conversion factor that averages the exchange rate for a given year and the two preceding years, adjusted for differences in rates of inflation between the country, and through 2000, the G-5 countries (France, Germany, Japan, the United Kingdom, and the United States). From 2001, these countries include the Euro area, Japan, the United Kingdom, and the United States.

i. Water and Economics:

1. Public Expenditure on Water Related Projects: Investment in water and sanitation projects with private participation covers infrastructure projects in water and sanitation that have reached financial closure and directly or indirectly serve the public. Movable assets, incinerators, standalone solid waste projects, and small projects are excluded. The types of projects included are operations and management contracts, operations and management contracts with major capital expenditure, greenfield projects (in which a private entity or a public-private joint venture builds and operates a new facility), and divestitures. Investment commitments are the sum of investments in facilities and investments in government assets. Investments in facilities are the resources the project company commits to invest during the contract period either in new facilities or in expansion and modernization of existing facilities. Investments in government assets are the resources the project company spends on acquiring government assets such as state-owned enterprises, rights to provide services in a specific area, or the use of specific radio spectrums
2. Foreign Development assistance for Water: The sectoral distribution of bilateral Official Development Assistance commitments refers to the economic sector of destination (i.e. the specific area of the recipient's economic or social structure whose development is, or is intended to be fostered by the aid), rather than to the type of goods or services provided. These are aggregates of individual projects notified under the Creditor Reporting System, supplemented by reporting on the sectoral distribution of technical co-operation, and on actual disbursements of food and emergency aid.
3. Virtual-water flows related to trade in crop, animal, and industrial products, per country : Total inflow and outflow of virtual water
4. Virtual Water: the volume of freshwater used to produce the product, measured at the place where the product was actually produced (Hoekstra and Chapagain).

j. Water and Political Affairs:

1. IWRM plan in place (yes/no)
2. Water Rights/ Year: number of officially authorized water rights for beneficial usage by individuals or entities.
3. Well Permits/ Year : number of officially authorized shallow or deep wells for beneficial usage by individuals or entities.
4. Irrigation Related Complaints: annual number of complaints that relate directly to irrigation issues.
5. Water supply and Sanitation Related Complaints: annual number of complaints that relate directly to water supply and sanitation services.

6. Transboundary water bodies' dependency Ratio: the percent of annual volumes abstracted from transboundary water bodies to total annual renewable water resources.

7. Multilateral Agreements Status: Standpoints on UN water conventions (Ratification/ Voting)

Annex B: Arab State of the Water Data Sets

Table B-1. Green Water Assessment

Countrie	Irrigated Agriculture Area	Rainfed Agriculture Area	Natural Pasture Area	Natural Forest Area	Irrigated Agriculture Withdrawals	Unit Irrigation Abstraction Coefficient (R)	Aridity Coefficient (Alpha)	Rainy Period Coefficient (C)	Green Water Rainfed Agriculture Abstractions	Green Water Pasture Abstractions	Green Water Forest Abstractions	Total Green Water
	Km^2	Km^2	Km^2	Km^2	Km^3/y BCM/y	$m^3/Km^2/y$			BCM/Y			
Algeria	5,555	78,650	328,850	431,528	2.70	486,049	0.13	0.29	1.46	6.10	8.00	15.56
Bahrain	32	0.00	40	5	0.13	4,187,500	0.62	0.25	0.00	0.03	0.00	0.03
Comoros	0	1,400	550	550	0.00	1,180,000	0.43	0.71	0.50	0.20	0.20	0.90
Djibouti	0	645	646	646	0.00	2,000,000	0.78	0.50	0.50	0.50	0.50	1.50
Egypt	32,460	1,590	0.00	995	47.73	1,470,425	0.70	0.25	0.41	0.00	0.26	0.67
Iraq	35,250	12,250	40,000	8,303	39.38	1,117,050	0.58	0.30	2.39	7.82	1.62	11.84
Jordan	643	2,010	7,430	792	0.74	1,147,745	0.70	0.25	0.40	1.49	0.16	2.06
Kuwait	48	50	1,360	54	0.32	6,729,167	0.70	0.25	0.06	1.60	0.06	1.72
Lebanon	875	1,980	4,000	1,360	0.88	1,000,000	0.44	0.40	0.35	0.70	0.24	1.29
Libya	4,700	15,800	135,000	1,760	4.00	851,489	0.70	0.25	2.35	20.12	0.26	22.73
Mauritania	492	3,560	392,500	2,062	1.50	3,048,780	0.02	0.16	0.04	3.94	0.02	4.00
Morocco	12,582	75,980	210,000	43,708	10.16	807,582	0.58	0.30	10.74	29.68	6.18	46.59
Oman	616	770	17,000	0.00	1.15	1,866,883	0.70	0.25	0.25	5.55	0.00	5.81
Palestine	180	713	1,500	90	1.15	6,388,889	0.10	0.42	0.19	0.40	0.02	0.61
Qatar	125	20	500	0.00	0.21	1,688,000	0.00	0.25	0.00	0.00	0.00	0.00
Saudi Arabia	16,080	17,040	1,700,000	28,000	15.32	952,488	0.00	0.25	0.00	0.00	0.00	0.00
Somalia	2,000	8,280	430,000	69,597	0.79	393,000	0.78	0.45	1.14	59.14	9.57	69.86
Sudan	19,462	185,280	1,171,800	662,904	16.73	859,727	0.25	0.35	13.76	87.02	49.23	150.00
Syria	10,130	43,080	82,320	4,784	13.55	1,337,117	0.43	0.41	10.08	19.26	1.12	30.46
Tunisia	3,850	44,910	48,400	10,850	2.71	702,857	0.58	0.30	5.52	5.95	1.33	12.81
U.A.E.	667	340	3,050	3,108	1.41	2,116,942	0.70	0.25	0.13	1.13	1.15	2.41
Yemen	4,815	7,720	22,000	5,280	2.70	560,125	0.68	0.30	0.88	2.51	0.60	4.00
								Total	**51**	**253**	**81**	**385**

Total Green Water Consumption is divided into: Rain-fed areas consumption, Pasture areas consumption, and Forest Areas consumption. For the purpose of this report the following methodology will be used in estimating the total consumption for each of the three different kinds of areas that collectively represent the total Green Water Consumption:

***(R)** is a Reference value calculated as the ratio between irrigation withdrawals and the irrigated agriculture area in the country expressed as water consumption per unit area. (R) (m^3/km^2/year) is expressed as the [irrigation withdrawals (Km^3/y or BCM/y) * (10^9)] divided by the irrigated area (Km^2). If there is no irrigated area in the country, a water requirement rate per green cover area may be assumed for "R" on average around 4000 m^3/acre or 10,000 m^3/ha, or 1,000,000 m^3/km^2 .

***(Alpha)** is a coefficient (from 0-1) function of the prevailing aridity and the plant cover (e.g. 0.2 for hyper arid regions, 0.5 for arid regions, 0.7 for temperate regions, and 1.0 for tropical areas)

***(C)** The Rainy Period Coefficient for Rain-fed Agriculture which is function of the rainy months (e.g. 3 months is "0.25" of a year, a value of "1.0" for 12 rainy months)

***Green Water Abstractions (Km^3/y or BCM/y)** = **(**Area of Green Cover Vegetation (Km^2) * (R) (m^3/Km^2/year) * (Alpha) (unitless) * Rainy Period Coefficient (C) (unitless)**)** / (10^9)

Table B-2. Water Supply and Sanitation Coverage (JMP)

Population							Drinking Water without Coverage (%)	Drinking Water Coverage (%)			Drinking Water Coverage (1000 inhabitants)			MDG Achievment (% Coverage Reduction)	Population gained access to drinking water 1990 - 2012 (x1000)	Sanitation without Coverage (%)	Improved Sanitation Coverage (%)			Improved Sanitation Coverage (1000 inhabitants)			MDG Achievment (% Coverage Reduction)	Population gained access to sanitation 1990 - 2012 (x1000)
Country	Year	Total (x1000)	Urban %	Urban (x1000)	Rural %	Rural (x1000)	Total	Total	Urban	Rural	Total	Urban	Rural			Total	Total	Urban	Rural	Total	Urban	Rural		
Algeria	1990	25,299.00	52	13,155.48	48	12,143.52	9	91	100	88	23,841.78	13,155.48	10,686.30	-78	11,046.00	11	89	99	68	21,281.52	13,023.93	8,257.59	55	15,430.31
	2012	38,482.00	74	28,476.68	26	10,005.32	16	84	93	84	34,887.78	26,483.31	8,404.47			5	95	98	88	36,711.83	27,907.15	8,804.68		
Bahrain	1990	493.00	88	433.84	12	59.16	5	95	100	90	487.08	433.84	53.24	100	829.47	1	99	100	99	492.41	433.84	58.57	0	824.14
	2012	1,318.00	89	1,173.02	11	144.98	0	100	100	99	1,316.55	1,173.02	143.53			1	99	100	99	1,316.55	1,173.02	143.53		
Comoros	1990	438.00	28	122.64	72	315.36	83	17	98	83	381.94	120.19	261.75	94	306.48	83	17	34	11	76.39	41.70	34.69	23	179.22
	2012	718.00	28	201.04	72	516.96	5	95	93	97	688.42	186.97	501.45			64	36	50	30	255.61	100.52	155.09		
Djibouti	1990	562.00	76	427.12	24	134.88	34	66	82	60	431.17	350.24	80.93	76	359.60	38	62	73	45	372.49	311.80	60.70	-3	154.43
	2012	860.00	77	662.20	23	197.80	8	92	100	65	790.77	662.20	128.57			39	61	73	22	526.92	483.41	43.52		
Egypt	1990	56,843.00	43	24,442.49	57	32,400.51	28	72	96	90	52,625.25	23,464.79	29,160.46	96	27,644.71	28	72	91	57	40,710.96	22,242.67	18,468.29	86	36,588.43
	2012	80,722.00	44	35,517.68	56	45,204.32	1	99	100	99	80,269.96	35,517.68	44,752.28			4	96	98	94	77,299.39	34,807.33	42,492.06		
Iraq	1990	17,374.00	70	12,161.80	30	5,212.20	19	81	95	39	13,586.47	11,553.71	2,032.76	21	14,438.72	28	72	81	81	14,072.94	9,851.06	4,221.88	46	13,670.36
	2012	32,778.00	66	21,633.48	34	11,144.52	15	85	94	69	28,025.19	20,335.47	7,689.72			15	85	86	82	27,743.30	18,604.79	9,138.51		
Jordan	1990	3,416.00	72	2,459.52	28	956.48	3	97	99	91	3,305.32	2,434.92	870.40	-33	3,410.00	3	97	98	95	3,318.99	2,410.33	908.66	33	3,549.83
	2012	7,009.00	83	5,817.47	17	1,191.53	4	96	97	90	6,715.32	5,642.95	1,072.38			2	98	98	98	6,868.82	5,701.12	1,167.70		
Kuwait	1990	2,088.00	98	2,046.24	2	41.76	1	99	99	99	2,067.12	2,025.78	41.34	0	1,150.38	0	100	100	100	2,088.00	2,046.24	41.76	100	1,162.00
	2012	3,250.00	98	3,185.00	2	65.00	1	99	99	99	3,217.50	3,153.15	64.35			0	100	100	100	3,250.00	3,185.00	65.00		
Lebanon	1990	2,948.00	83	2,446.84	17	501.16	0	100	100	100	2,948.00	2,446.84	501.16	100	1,699.00	5	95	100	94	2,917.81	2,446.84	470.97	-220	1,618.09
	2012	4,647.00	87	4,042.89	13	604.11	0	100	100	100	4,647.00	4,042.89	604.11			16	84	100	82	4,535.90	4,042.89	493.01		
Libya	1990	4,334.00	76	3,293.84	24	1,040.16	29	71	97	96	4,193.58	3,195.02	998.55	-3	123.29	3	97	97	96	4,193.58	3,195.02	998.55	0	1,763.23
	2012	6,155.00	78	4,800.90	22	1,354.10	30	70	87	11	4,316.87	4,171.98	144.89			3	97	97	96	5,956.81	4,656.87	1,299.94		
Mauritania	1990	1,996.00	40	798.40	60	1,197.60	70	30	36	26	598.80	287.42	311.38	29	1,302.24	84	16	29	8	327.34	231.54	95.81	13	843.34
	2012	3,796.00	52	1,973.92	48	1,822.08	50	50	52	48	1,901.04	1,026.44	874.60			73	27	51	9	1,170.69	1,006.70	163.99		
Morocco	1990	24,781.00	48	11,894.88	52	12,886.12	47	53	94	53	18,010.83	11,181.19	6,829.64	66	9,105.18	48	52	81	26	12,985.24	9,634.85	3,350.39	48	11,581.12
	2012	32,521.00	57	18,536.97	43	13,984.03	16	84	98	64	27,116.01	18,166.23	8,949.78			25	75	85	63	24,566.36	15,756.42	8,809.94		
Oman	1990	1,868.00	66	1,232.88	34	635.12	21	79	96	55	1,532.88	1,183.56	349.32	67	1,419.89	18	82	95	55	1,520.55	1,171.24	349.32	83	1,676.80
	2012	3,314.00	74	2,452.36	26	861.64	7	93	93	78	2,952.77	2,280.69	672.08			3	97	97	95	3,197.35	2,378.79	818.56		
Palestine	1990	2,000.00	68	1,360.00	32	640.00	8	92	100	75	1,840.00	1,360.00	480.00	-125	1,424.42	10	90	90	90	1,800.00	1,224.00	576.00	40	1,962.05
	2012	3,981.00	75	2,985.75	25	995.25	18	82	82	82	3,264.42	2,448.32	816.11			6	94	95	93	3,762.05	2,836.46	925.58		
Qatar	1990	474.00	92	436.08	8	37.92	0	100	100	100	474.00	436.08	37.92	100	1,577.00	0	100	100	100	474.00	436.08	37.92	100	1,577.00
	2012	2,051.00	99	2,030.49	1	20.51	0	100	100	100	2,051.00	2,030.49	20.51			0	100	100	100	2,051.00	2,030.49	20.51		
Saudi Arabia	1990	16,139.00	77	12,427.03	23	3,711.97	8	92	97	63	14,392.76	12,054.22	2,338.54	63	13,046.60	8	92	100	65	14,847.89	12,427.03	2,420.86	100	13,440.11
	2012	28,288.00	83	23,479.04	17	4,808.96	3	97	97	97	27,439.36	22,774.67	4,664.69			0	100	100	100	28,288.00	23,479.04	4,808.96		
Somalia	1990	6,599.00	30	1,979.70	70	4,619.30	77	23	23	23	1,517.77	455.33	1,062.44	8	1,438.78	80	20	20	20	1,319.80	395.94	923.86	4	1,025.05
	2012	10,195.00	38	3,874.10	62	6,320.90	71	29	29	29	2,956.55	1,123.49	1,833.06			77	23	23	23	2,344.85	891.04	1,453.81		
Sudan (North)	1990	26,494.00	27	7,153.38	73	19,340.62	33	67	86	61	17,949.69	6,151.91	11,797.78	-36	2,611.71	73	27	52	18	7,201.07	3,719.76	3,481.31	-4	1,439.33
	2012	37,195.00	33	12,274.35	67	24,920.65	45	55	66	50	20,561.40	8,101.07	12,460.33			76	24	44	13	8,640.40	5,400.71	3,239.68		
Syria	1990	12,324.00	49	6,038.76	51	6,285.24	14	86	97	75	10,571.53	5,857.60	4,713.93	29	9,085.69	15	85	95	75	10,450.75	5,736.82	4,713.93	73	10,467.33
	2012	21,890.00	56	12,258.40	44	9,631.60	10	90	92	87	19,657.22	11,277.73	8,379.49			4	96	96	95	20,918.08	11,768.06	9,150.02		
Tunisia	1990	8,215.00	58	4,764.70	42	3,450.30	18	82	95	63	6,700.15	4,526.47	2,173.69	83	3,815.97	27	73	94	43	5,962.45	4,478.82	1,483.63	63	3,868.55
	2012	10,875.00	67	7,286.25	33	3,588.75	3	97	100	90	10,516.13	7,286.25	3,229.88			10	90	97	77	9,831.00	7,067.66	2,763.34		
UAE	1990	1,809.00	79	1,429.11	21	379.89	3	97	100	100	1,809.00	1,429.11	379.89	100	7,397.00	3	97	98	95	1,761.42	1,400.53	360.90	33	7,219.03
	2012	9,206.00	85	7,825.10	15	1,380.90	0	100	100	100	9,206.00	7,825.10	1,380.90			2	98	98	95	8,980.45	7,668.60	1,311.86		
Yemen	1990	11,948.00	21	2,509.08	79	9,438.92	34	66	96	59	7,977.68	2,408.72	5,568.96	-32	5,200.55	76	24	70	12	2,889.03	1,756.36	1,132.67	38	9,864.64
	2012	23,852.00	33	7,871.16	67	15,980.84	45	55	72	47	13,178.23	5,667.24	7,510.99			47	53	93	34	12,753.66	7,320.18	5,433.49		
Arab Region	1990	228,442.00	49	113,013.81	51	115,428.19	18	82	94	70	187,242.79	106,512.42	80,730.37	11	118,432.69	34	66	87	45	151,064.63	98,616.37	52,448.25	41	139,904.39
	2012	363,103.00	57	208,358.25	43	154,744.75	16	84	92	74	305,675.48	191,377.33	114,298.15			20	80	90	66	290,969.02	188,266.26	102,702.76		

*Source: 2014 JMP Report, except for the following:

* For Iraq, 1990 Rural and Urban Water Supply Coverage is taken as being the same as the Total Coverage of 81%
* For Libya, 2012 Rural and Urban Water Supply Coverage was provided by the Government Sector in charge.
* For Lebanon, 1990 and 2012 Rural Sanitation Coverage was calculated as: RISC= (TISC x TP - UISC x UP) / (RP)
* For Saudi Arabia, 1990 Rural Sanitation was calculated as: RISC= (TISC x TP - UISC x UP) / (RP)
* For Saudi Arabia, 2012 Urban and Rural Water Supply Coverage was taken as being the same as the Total Coverage of 97%
* For Saudi Arabia, 2012 Urban and Rural Sanitation Coverage was taken as being the same as the Total Coverage of 100%
* For Somalia, 1990 and 2012 Rural and Urban Water Supply Coverage was taken as being the same as the Total Coverage of 23% in 1990 and 29% in 2012
* For Somalia, 1990 and 2012 Rural and Urban Sanitation Coverage was taken as being the same as the Total Coverage of 20% in 1990 and 23% in 2012
* For Palestine, 1990 Rural Water Supply and Sanitation Coverage were calculated as: RIWC= (TIWC x TP - UIWC x UP) / (RP) & RISC= (TISC x TP - UISC x UP) / (RP)

WC: Water Supply Coverage, **SC**: Sanitation Coverage, **R**: Rural, **U**: Urban, **T**: Total, **I**: Improved, **P**: Population

Table B-3. Virtual Water Embedded in Agricultural Products

Agriculture Product	Cubic meters/ ton
WHEAT AND FLOUR	1334
MAIZE	909
RICE	2291
BARLEY	1910
POTATOES	255
PULSES (TOTAL)	1754
VEGETABLES (TOTAL)	195
FRUITS (TOTAL)	455
SUGAR(REFINED)	1929
FATS & OILS(TOTAL)	18000
RED MEAT	15497
POULTRY MEAT	2046
EGGS	2700
MILK & DAIRY PROD.	5000

Hoekestra & Chapagain, 2001 & Egypt NWRC (2009)

Table B-4. Exported Amounts of Agricultural Products in the Arab Countries

FOOD Exported (1000 MT)	Algeria	Bahrain	Djibouti	Egypt	Iraq	Jordan	Kuwait	Lebanon	Libya	Morocco	Oman	Palestine	Qatar	Saudi Arabia	Somalia	Sudan North	Syria	Tunisia	UAE	Yemen	total
WHEAT AND FLOUR	6	0.19	0.13	238.14	0.68	9.78	1.82	57.97	-	231.33	72.74	2.94	5.79	18.41	-	-	31.03	1.65	285.08	6.56	970.24
MAIZE	-	-	-	15.61	-	-	-	1.58	-	0.45	4.74	0.87	0	0.15	-	2.1	0.07	0	57.36	12.32	95.25
RICE	-	0.16	-	546	-	1.19	-	1.86	-	0.87	-	-	2.88	9.03	-	-	0.05	-	47.4	7.76	617.2
BARLEY	-	-	-	15.48	-	1.12	-	4.04	-	0.04	0.6	8.6	0.21	18.45	-	-		-	1.75	0.2	50.49
POTATOES	0	0.04	-	299.96	-	7.29	0.03	151.71	0.01	37.74	0.01	2.5	0.1	21.79	-	0	112.21	10.08	0.67	0.22	644.36
PULSES (TOTAL)	0.09		-	236	3.1	1.68	0.41	2.9	0.11	22.19	0	0.45	0.13	9.49	-	3.32	42.5	0.73	41.24	0.14	364.48
VEGETABLES (TOTAL)	5.25	11.26	-	791.22	0.02	719.12	4.32	41.29	0.18	719.24	59.6	80.08	0.24	374.24	-	3.78	1010.25	66.62	231.12	107.64	4225.47
FRUITS (TOTAL)	9.02	2.92	0.34	1220.32	37.08	79.42	17.87	331.89	0.05	712.05	10.85	46.68	1.3	124.36	14.68	6.33	587.87	143.8	557.18	134.93	4038.94
SUGAR (REFINED)	12.73	0.56	0.13	432.19	-	13.97	0.03	0.37	-	1.84	0.04	3	1.44	275.97	-	17.11	193.06	3.55	895.56	71.76	1923.31
FATS & OILS (TOTAL)	7.2	0.07	0.36	118.03	-	2.38	6.69	3.74	2.02	59.86	108.88	2.55	0.3	134.46	18.4	85.35	41.66	245.16	178.41	6.51	1022.03
RED MEAT	0.02	1.13	-	1.47	-	31.37	0.07	1.03	-	0.1	0.39	-	0.58	25.07	0.35	8.35	0.05	0.12	37.84	0.52	108.46
POULTRY MEAT	(..)	0.28	-	9.16	-	19.6	0.02	0.68	-	0.36	13.23	0.35	0.11	18.59	-	-	8.29	2.9	18.57	0	92.14
EGGS	-	0.34	-	0.04	-	3.91	-	10.33	-	1.79	2.81	-	0.05	21.98	-	-	38.05	0.1	2.65	0.19	82.24
MILK & DAIRY PROD.	16.81	16.2	-	2792.64	-	84.38	2.74	4.34	-	282.66	544.35	-	1.2	321.33	-	7.6	566.32	53.86	75.36	215.62	4985.41
Total	57.12	33.15	0.96	6716.26	40.88	975.21	34	613.73	2.37	2070.52	818.24	148.02	14.33	1373.32	33.43	133.94	2631.41	528.57	2430.19	564.37	19220.02

Table B-5. Imported Amounts of Agricultural Products in the Arab Countries

FOOD IMPORTED (1000 MT	Algeria	Bahrain	Djibouti	Egypt	Iraq	Jordan	Kuwait	Lebanon	Libya	Mauritania	Morocco	Oman	Palestine	Qatar	Saudi Arabia	Somalia	Sudan North	Syria	Tunisia	UAE	Yemen	Total
WHEAT AND FLOUR	5729.83	67.84	174.79	9651.54	72.53	503.37	315.51	427.92	1450.13	310.92	3349.09	378.19	353.5	187.35	1704.89	221.85	1863.27	1109.73	1914.89	876.64	2586.07	27452.18
MAIZE	1994.79	8.82	0.6	4960.35	0	454.65	165.96	317.42	530.01	3.69	1906.85	95.96	43	23.68	1911.12	165.1	4.31	1918.72	889.28	216.07	456.22	14062.99
RICE	75.85	55.92	22.98	13.86	201.95	133.13	182.04	47.08	104.05	15.98	12.37	155.86	111.14	169.85	1238.67	38	14.54	384.68	10.24	1292.82	370.02	4519.26
BARLEY	105.34	0.29	0	14.54	0	231.3	224.16	62.96	177.13	0.97	212.54	38.22	59	93.5	7206.72	0	0	112.8	429.33	180.31	0.71	9044.19
POTATOES	124.92	2.46	8.51	72.9	94.38	41.22	34.29	92.28	10.79	16.21	42.54	28.51	0.2	37.28	30.3	0.01	1.91	25.43	21.36	123.33	12.79	694.24

FOOD IMPORTED (1000 MT	Algeria	Bahrain	Djibouti	Egypt	Iraq	Jordan	Kuwait	Lebanon	Libya	Mauritania	Morocco	Oman	Palestine	Qatar	Saudi Arabia	Somalia	Sudan North	Syria	Tunisia	UAE	Yemen	Total
PULSES (TOTAL)	175.11	4.78	20.66	355.52	16.29	49.09	13.97	33.1	6.15	2.27	29.28	12.14	11.87	31.13	118.87	3.7	59.72	19.69	30.19	174.49	53.77	1041.9
EGETABLES (TOTAL)	30.82	50.66	12.1	3.54	20.21	92.4	106.98	77.59	31.76	50.36	20.72	171.97	21.84	236.26	360.97	11.04	1.14	216.39	20.79	1360.74	78.74	2895.54
FRUITS (TOTAL)	354.76	52.99	8.22	576.24	45.02	138.99	108.7	30.32	57.43	4.72	125.76	152.92	24.06	136.3	1023.14	7.03	74.78	345.53	37.95	1447.16	39.54	4383.81
SUGAR (REFINED)	1133.31	28.34	156.88	800.65	401.38	270.75	102.91	150.45	191.31	190.21	732.53	105.65	86	26.89	191.63	216.44	172.7	1232.2	349.81	602.8	546.68	6527.87
FATS & OILS (TOTAL)	703.35	16.04	29.55	642.72	35.84	117.03	56.62	86.75	142.83	66.6	556.81	348.87	3.24	53.4	244.5	7.32	26.02	335.16	406.9	549.32	246.01	3955.49
RED MEAT	62.30	7.51	11.24	178.61	0.76	64.93	19.65	30.49	20.46	0.01	5.7	30.7	9.5	34.37	91.29	0	4.11	12.02	5.48	476.79	6.93	1003.04
POULTRY MEAT	N/A	28.50	6.21	47.62	148.17	49.34	191.94	5.84	0.02	5.24	1.32	74.58	8.2	94.46	566.73	0	0.71	0	3.21	282.07	109.12	1594.78
EGGS	0.50	2.81	0.42	0.15	79.31	0.49	7.77	0.08	11.98	0.49	0.07	8.39	2.33	9.7	3.47	0	0.79	0.05	0.04	33.65	0.12	159.3
MILK & DAIRY PROD.	2752.26	129.97	33.38	2014.86	187.96	393.45	374.24	406.89	354.71	117.27	696.24	866.87	22.14	130.28	2053.43	6.53	305.64	403.89	127.63	404.74	661.2	9561.35
Total	13243.14	456.93	485.54	19333.1	1303.8	2540.14	1904.74	1769.17	3088.76	784.94	7691.82	2468.83	756.02	1264.45	16745.73	677.02	2529.64	6116.29	4247.1	8020.93	5167.92	86895.94

Table B-6. Imported Virtual water In Agricultural Products

Virtual Water (MCM)	Cubic meters/ ton	Algeria	Bahrain	Djibouti	Egypt	Iraq	Jordan	Kuwait	Lebanon	Libya	Mauritania	Morocco	Oman	Palestine	Qatar	Saudi Arabia	Somalia	Sudan North	Syria	Tunisia	UAE	Yemen	Total
WHEAT AND FLOU	1,334	7,643.59	90.50	233.17	12,875.15	96.76	671.50	420.89	570.85	1,934.47	414.77	4,467.69	504.51	471.57	249.92	2,274.32	295.95	2,485.60	1,480.38	2,554.46	1,169.44	3,449.82	44,355.30
MAIZE	909	1,813.26	8.02	0.55	4,508.96	-	413.28	150.86	288.53	481.78	3.35	1,733.33	87.23	39.09	21.53	1,737.21	150.08	3.92	1,744.12	808.36	196.41	414.70	14,604.54
RICE	2,291	173.77	128.11	52.65	31.75	462.67	305.00	417.05	107.86	238.38	36.61	28.34	357.08	254.62	389.13	2,837.79	87.06	33.31	881.30	23.46	2,961.85	847.72	10,655.51
BARLEY	1,910	201.20	0.55	-	27.77	-	441.78	428.15	120.25	338.32	1.85	405.95	73.00	112.69	178.59	13,764.84	-	-	215.45	820.02	344.39	1.36	17,476.16
POTATOES	255	31.85	0.63	2.17	18.59	24.07	10.51	8.74	23.53	2.75	4.13	10.85	7.27	0.05	9.51	7.73	0.00	0.49	6.48	5.45	31.45	3.26	209.51
PULSES (TOTAL)	1,754	307.14	8.38	36.24	623.58	28.57	86.10	24.50	58.06	10.79	3.98	51.36	21.29	20.82	54.60	208.50	6.49	104.75	34.54	52.95	306.06	94.31	2,143.02
VEGETABLES (TOTAL)	195	6.01	9.88	2.36	0.69	3.94	18.02	20.86	15.13	6.19	9.82	4.04	33.53	4.26	46.07	70.39	2.15	0.22	42.20	4.05	265.34	15.35	580.52
FRUITS (TOTAL)	455	161.42	24.11	3.74	262.19	20.48	63.24	49.46	13.80	26.13	2.15	57.22	69.58	10.95	62.02	465.53	3.20	34.02	157.22	17.27	658.46	17.99	2,180.16
SUGAR (REFINED)	1,929	2,186.15	54.67	302.62	1,544.45	774.26	522.28	198.51	290.22	369.04	366.92	1,413.05	203.80	165.89	51.87	369.65	417.51	333.14	2,376.91	674.78	1,162.80	1,054.55	14,833.08
FATS & OILS (TOTAL)	18,000	12,660.30	288.72	531.90	11,568.96	645.12	2,106.54	1,019.16	1,561.50	2,570.94	1,198.80	10,022.58	6,279.66	58.32	961.20	4,401.00	131.76	468.36	6,032.88	7,324.20	9,887.76	4,428.18	84,147.84
RED MEAT	15,497	965.46	116.38	174.19	2,767.92	11.78	1,006.22	304.52	472.50	317.07	0.15	88.33	475.76	147.22	532.63	1,414.72	-	63.69	186.27	84.92	7,388.81	107.39	16,625.96
POULTRY MEAT	2,046	-	58.31	12.71	97.43	303.16	100.95	392.71	11.95	0.04	10.72	2.70	152.59	16.78	193.27	1,159.53	-	1.45	-	6.57	577.12	223.26	3,321.23

Virtual Water (MCM)	Cubic meters/ ton	Algeria	Bahrain	Djibouti	Egypt	Iraq	Jordan	Kuwait	Lebanon	Libya	Mauritania	Morocco	Oman	Palestine	Qatar	Saudi Arabia	Somalia	Sudan North	Syria	Tunisia	UAE	Yemen	Total
EGGS	2,700	1.35	7.59	1.13	0.41	214.14	1.32	20.98	0.22	32.35	1.32	0.19	22.65	6.29	26.19	9.37	-	2.13	0.14	0.11	90.86	0.32	439.05
MILK & DAIRY PROD.	5,000	13,761.30	649.85	166.90	10,074.30	939.80	1,967.25	1,871.20	2,034.45	1,773.55	586.35	3,481.20	4,334.35	110.70	651.40	10,267.15	32.65	1,528.20	2,019.45	638.15	2,023.70	3,306.00	62,217.90
	Total in MCM	39,912.82	1,445.70	1,520.32	44,402.16	3,524.74	7,713.99	5,327.59	5,568.84	8,101.79	2,640.93	21,766.82	12,622.30	1,419.25	3,427.91	38,987.73	1,126.85	5,059.29	15,177.33	13,014.75	27,064.44	13,964.22	273,789.78
	Total in BCM	39.91	1.45	1.52	44.40	3.52	7.71	5.33	5.57	8.10	2.64	21.77	12.62	1.42	3.43	38.99	1.13	5.06	15.18	13.01	27.06	13.96	273.79

Table B-7. Exported Virtual Water In Agricultural Products

Virtual Water (MCM)	Cubic meters/ ton	Algeria	Bahrain	Djibouti	Egypt	Iraq	Jordan	Kuwait	Lebanon	Libya	Morocco	Oman	Palestine	Qatar	Saudi Arabia	Somalia	Sudan North	Syria	Tunisia	UAE	Yemen	
WHEAT AND FLOUR	1,334	8.00	0.25	0.17	317.68	0.91	13.05	2.43	77.33	-	308.59	97.04	3.92	7.72	24.56	-	-	41.39	2.20	380.30	8.75	1,294.30
MAIZE	909	-	-	-	14.19	-	-	-	1.44	-	0.41	4.31	0.79	-	0.14	-	1.91	0.06	-	52.14	11.20	86.58
RICE	2,291	-	0.37	-	1,250.89	-	2.73	-	4.26	-	1.99	-	-	6.60	20.69	-	-	0.11	-	108.59	17.78	1,414.01
BARLEY	1,910	-	-	-	29.57	-	2.14	-	7.72	-	0.08	1.15	16.43	0.40	35.24	-	-	-	-	3.34	0.38	96.44
POTATOES	255	-	0.01	-	76.49	-	1.86	0.01	38.69	0.00	9.62	0.00	0.64	0.03	5.56	-	-	28.61	2.57	0.17	0.06	164.31
PULSES (TOTAL)	1,754	0.16	-	-	413.94	5.44	2.95	0.72	5.09	0.19	38.92	-	0.79	0.23	16.65	-	5.82	74.55	1.28	72.33	0.25	639.30
VEGETABLES (TOTAL)	195	1.02	2.20	-	154.29	0.00	140.23	0.84	8.05	0.04	140.25	11.62	15.62	0.05	72.98	-	0.74	197.00	12.99	45.07	20.99	823.97
FRUITS (TOTAL)	455	4.10	1.33	0.15	555.25	16.87	36.14	8.13	151.01	0.02	323.98	4.94	21.24	0.59	56.58	6.68	2.88	267.48	65.43	253.52	61.39	1,837.72
SUGAR (REFINED)	1,929	24.56	1.08	0.25	833.69	-	26.95	0.06	0.71	-	3.55	0.08	5.79	2.78	532.35	-	33.01	372.41	6.85	1,727.54	138.43	3,710.06
FATS & OILS (TOTAL)	18,000	129.60	1.26	6.48	2,124.54	-	42.84	120.42	67.32	36.36	1,077.48	1,959.84	45.90	5.40	2,420.28	331.20	1,536.30	749.88	4,412.88	3,211.38	117.18	18,396.54
RED MEAT	15,497	0.31	17.51	-	22.78	-	486.14	1.08	15.96	-	1.55	6.04	-	8.99	388.51	5.42	129.40	0.77	1.86	586.41	8.06	1,680.80
POULTRY MEAT	2,046	-	0.57	-	18.74	-	40.10	0.04	1.39	-	0.74	27.07	0.72	0.23	38.04	-	-	16.96	5.93	37.99	-	188.52
EGGS	2,700	-	0.92	-	0.11	-	10.56	-	27.89	-	4.83	7.59	-	0.14	59.35	-	-	102.74	0.27	7.16	0.51	222.05
MILK & DAIRY PROD.	5,000	84.05	81.00	-	13,963.20	-	421.90	13.70	21.70	-	1,413.30	2,721.75	-	6.00	1,606.65	-	38.00	2,831.60	269.30	376.80	1,078.10	24,927.05
	Total	251.81	106.50	7.06	19,775.35	23.22	1,227.57	147.43	428.56	36.61	3,325.30	4,841.42	111.82	39.14	5,277.55	343.30	1,748.05	4,683.57	4,781.56	6,862.73	1,463.07	55,481.64
	Total in BCM	0.25	0.11	0.01	19.78	0.02	1.23	0.15	0.43	0.04	3.33	4.84	0.11	0.04	5.28	0.34	1.75	4.68	4.78	6.86	1.46	55.48

Table B-8. Agricultural and Total Labour

Country	agricultural labour (1000)	total labour (1000)
Algeria	2,358.3	10,544
Bahrain	9.1	379.3
Djibouti	280.1	375.1
Jordan	1,250	1,710.5
Saudi Arabia	492.6	7,887.2
Syria	721	5,055
Tunisia	749.4	3,886.2
Emirates	170.3	3,277.5

(LAS, 2010)

Table B-9. Industrial GDP (LAS, GCC)

Year	Country	Value of industry % GDP	GDP in (Billion US$)
2010	Algeria	62.1	189
2011	Bahrain	63.7	32
2009	Comoros	12.1	610
2009	Djibouti	N/A	1,049
2011	Egypt	36.7	220
2010	Iraq	60.5	144
2011	Jordan	31.1	29
2007	Kuwait	52.2	177
2011	Lebanon	21.4	40
2008	Libya	78.2	62
2011	Mauritania	46.2	4
2011	Morocco	29.9	100
2004	Oman	55.1	72
2011	Qatar	67	173
2010	Saudi Arabia	59.8	577
2011	Sudan_North	39.8	N/A
2009	Syria	30.6	59
2011	Tunisia	33.3	46
2010	UAE	55.5	360
2010	Yemen	29.4	34

Table B-10. Estimated Industrial and Agricultural GDP

	Agricultural GDP Million USD$	Industrial GDP Million USD$
Algeria	13,644	117,171
Bahrain	93	20,464.89
Comores	N/A	73.86
Djibouti	36	0

	Agricultural GDP Million USD$	Industrial GDP Million USD$
Egypt	29,135	84,237.72
Iraq	2,611	86,923
Jordan	7,294	8,969
Kuwait	791	92,180
Lebanon	207	8,580
Libya	1,963	48,765
Mauritania	1,631	1,882
Morocco	575	29,966
Oman	12,641	39551
Palestine	857	N/A
QATAR	314.16	115,898
Saudi Arabia	92	344,941
Somalia	820	0
Sudan_North	22,754	0
Syria	12,015	18,098
Tunisia	3,175	15272
UAE	3,492	200,008
Yemen	11,204	9,924

Table B-11. Aid Directed to the Water Sector in Arab Countries

(US MILLION $)					
Country	Project Name	Mode of Financing	Total project cost (Million USD)	IDB Financing	Approval date
Bahrain	Expansion of water transmission network	Istisna'a (Exception)	273	191	26/06/2011
Kuwait	Design of national groundwater monitoring network	grant	0.62	0.26	Unknown
Mauritania	Upgrading of Nouakchott water distribution network	loan and istisna'a	29.77	27.44	26/02/2011
Sudan	Upper Atbara Dam project	Istisna'a (Exception)	1505.35	150	31/07/2011
Yemen	Sana'a water supply enhancement	loan	26.25	21.0	28/02/2011

(Islamic Development Bank (IDB), 2009)

Table B-12. Public Spending on Water

Year	Country	In Million US dollars
2011-12	Bahrain	662.9
2011-2012	Jordan	1,400
2011	jordan	191.4
2010	jordan	188.5
2010-2011	Kuwait	12,044
2012	Lebanon	7,154
2012	Lebanon	45.7
2012	Lebanon	57.9
2012	Morocco	87.07
2012	Oman	8.16
2012	Oman	263
2012	Oman	1,814
2012	Oman	1,438
2012	Oman	1,582
2012	Oman	1,835
2011	Saudi Arabia	13,545
2007-2011	Tunisia	1,863
2008	Yemen	112.57

(LAS, 2012)

Table B-13. Foreign Aid to the Water Sector in The Arab Region in 2009 (Million US$)

Foreign Aid to the Water Sector in The Arab Region (Million US$)	
Algeria	91.63
Comoros	16.96
Djibouti	9.09
Egypt	542.93
Iraq	6,546.04
Jordan	1,055.14
Lebanon	93.68
Libya	0.06
Mauritania	38.13
Morocco	954.54
Saudi Arabia	0.57
Somalia	7.13
Sudan	203.49
Syria	32.08
Tunisia	318.94
Yemen	333.7

(LAS, 2009)

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