

International Shared Aquifers in the Arab Region

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ABSTRACT

The **Arab countries** are sharing many aquifers, which are in some countries one of the most important sources of water.

We will focus on the ground water resources in the Arab region between Arab – Arab countries and Arab countries with neighbouring countries, we will give case studies from the region, and the benefit of cooperation.

The "**Law of Transboundary Aquifers**" and the draft convention could be, in case it is amended, an international Water Law and Convention for the benefit of all the countries especially for the Arab countries.

Keywords: Arab States, Successful agreements, Occupied Territories, Legal Instruments, Water Security Strategy, Council of Arab Ministers for Water.

1. INTRODUCTION

Twenty two **Arab States**, members of the League of the Arab States, are located in an arid and semi-arid zone, in a total area of about 14 million square kilometers, out of which 87% is desert.

Renewable water resources in the Arab region are estimated at about 335 Km³/year where more than 65% of which are originating outside the region mainly conveyed through international rivers. Although extensive aquifer systems are encountered, ground water contained in such systems is almost non-renewable. Renewable groundwater on the other hand is limited to specific regions where aquifers of limited extent are prevailing.

Fossil aquifers are a particularly important but fragile resource. Vast reserves underlie the Arab countries, there are about twenty different aquifer systems, with total reserves estimated at 143,8Km³. Eight of these aquifers are shared between countries.

At present, groundwater resources in the region, in general, are in critical condition as volumes withdrawn far exceed natural recharge, resulting in a continuous decline in groundwater levels. As reserves shrink, quality deteriorates and there is often saline or sea-water intrusion. Though the overdraft of groundwater continues in many Arab countries, especially for agricultural uses, many efforts have been undertaken throughout the region to increase groundwater recharge, and to reduce the withdrawal by relying on non-conventional water resources (desalination plants and recycling wastewater) or by water conservation measures.

Still, the utilization of groundwater is subject to socio-economic, institutional, legal, cultural, ethical and political considerations however, its beneficial use is often constrained by weak social and institutional capacity and poor legal and policy frameworks.

Since groundwater systems are often the only source of fresh water in most of the Arab countries, where demand is rapidly increasing, water resources are contained in shared regional aquifers that represent a secure supply for all uses and are thus critical for national and regional water security.

The most important shared aquifers in the Arab region are:

1. the Nubian Sandstone Aquifer System
2. the North Western Sahara Aquifer system
3. Saudi Arabia and the Aquifers of the Arab Peninsula.
4. the basalt Aquifer.
5. the mountain aquifers: the source of life for the West Bank.
6. Chad basin
7. Dizi sandstone aquifer
8. groundwater resources under Israeli occupation.

Countries	Aquifer System	Extension (km ²)	Exploitable Reserves (km ³)
Egypt, Libya, Sudan, Chad	Nubian Sandstone	2 200 000	6 500
Algeria, Libya, Tunisia	North Western Sahara	1 000 000	1 280
Algeria, Libya, Niger	Murzuk Basin	450 000	60 - 80
Mauritania, Senegal, Gambia	Maastrichtian	200 000	480 - 580
Niger, Nigeria, Chad, Sudan, Cameroon, Libya	Chad Basin	600 000	170 - 350
Saudi Arabia, Bahrain, Qatar, United Arab Emirates	various including Saq Aquifer	225 000 - 250 000	500 - 2 185
Jordan (only)*	Qa Disi Aquifer	3 000	6

* extends into Saudi Arabia, where it is known as the Saq Aquifer which is included in entry above

Many Arab countries, understanding the need of the integrated management of groundwater resources, especially shared aquifers, decided to cooperate with riparian countries, toward mutually beneficial and sustainable shared aquifer development and management and they reached some form of agreement or treaty between parties sharing the aquifer system we, here, give you some examples of **successful agreements** in the Arab region between Arab – Arab countries and Arab - non-Arab countries .

2. THE NUBIAN SANDSTONE AQUIFER SYSTEM (NSAS)

It is shared by four countries, Egypt 37%, Libya 35%, Sudan %17 and Chad %11, so the total area is 2.17 million km² .

1. A monitoring network was established of Groundwater Wells .
2. Nubian Aquifer Regional Information System was developed
3. Establishment of the Joint Authority for Study and Development of the Nubian Sandstone Aquifer in 1999 among the four countries .

Challenges and constraints

1. The flow of information between relevant partners needs to be encouraged .
2. Lack of Continual monitoring of the aquifers .
3. Financial sustainability is lacking and inability to mobilize funds by the Member states.
4. Lack of a binding legal agreement among the member states .

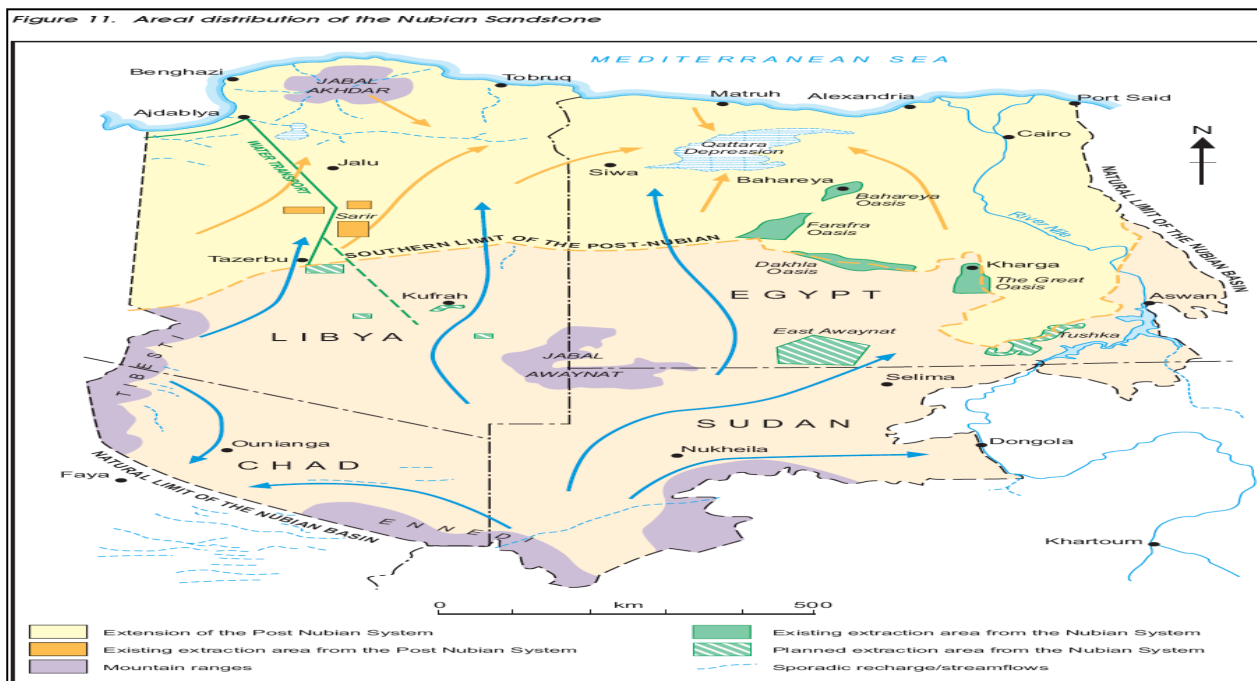


Table 3. Essential data of the Nubian Sandstone Aquifer System

Country	Nubian system (Palaeozoic and Mesozoic sandstone aquifers)		Post Nubian system (Miocene aquifers)		Total volume of fresh water in storage (km ³) ¹	Total recoverable ground- water volume (km ³) ²	Present extraction from the Post- Nubian system (km ³)	Present extraction from the Nubian system (km ³)	Total present extraction from the NSAS (km ³)
	Area (km ²)	Fresh water volume in storage (km ³)	Area (km ²)	Fresh water volume in storage (km ³)					
Egypt	815,670	154,720	426,480	97,490	252,210	5,180	0.306	0.200	0.506
Libya	754,088	136,550	494,040	71,730	208,280	5,920	0.264	0.567	0.831
Chad	232,980	47,810	–	–	47,810	1,630	–	0.000	0.000
Sudan	373,100	33,880	–	–	33,880	2,610	–	0.840 ³	0.833
Total	2,175,838	372,960	920,520	169,220	542,180	15,340	0.570	1.607	2.170

– Not applicable

1. Assuming a storativity of 10⁻⁴ for the confined part of the aquifers and 7% effective porosity for the unconfined part.

2. Assuming a maximum allowed water level decline of 100 m in the unconfined aquifer areas and 200 m in the confined aquifer areas.

3. Most of this water is extracted in the Nile Nubian Basin (833 Mm³/yr) which is not considered to be part of the Nubian Basin.

Source: CEDARE/IFAD (Programme for the development of a Regional Strategy for the Utilisation of the Nubian Sandstone Aquifer System).

3. THE NORTHWESTERN SAHARA AQUIFER SYSTEM

The Consultation Mechanism was established between the 3 Arab countries Algeria –Libya –Tunisia. This system covers 1 Million Km², the 3 countries, with 4 M inhabitants in the aquifer area in 2000 up to 8M in 2030 this aquifer contains about 25 Milliard CM per year .

The Consultation mechanism

The Consultation mechanism presents the following features :

A- Objective

To coordinate, promote and facilitate the rational management of NWSAS water resources.

Structure

- A steering committee composed of representatives of the national agencies in charge of water resources, acting as national focal points; the committee meets in an ordinary session once a year, and in extraordinary session upon the request of one of the three states; sessions are held alternatively in each country; the committee's chairmanship is held by the representative of the host country .
- A coordination unit directed by a coordinator designated by the Sahara and Sahel Observatory (OSS)
- An ad-hoc scientific committee for evaluation and scientific guidance, to be convened when the need arises

B- Legal Status

The coordination unit is administered and hosted by the OSS.

C- Functions : among them are :

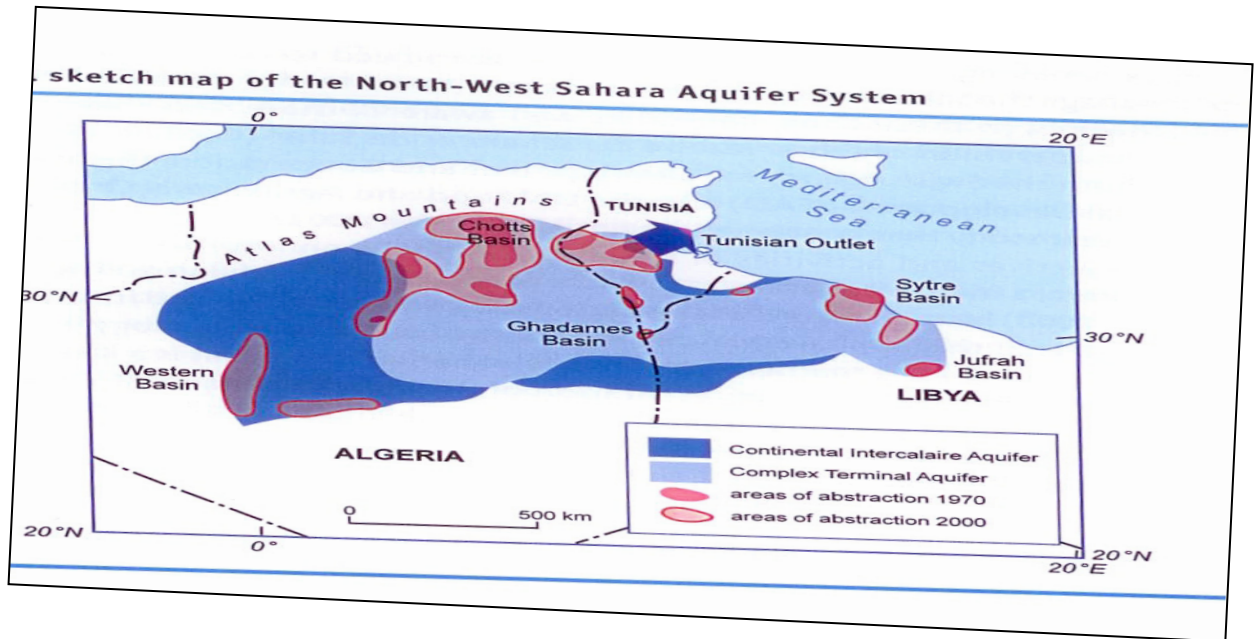
- To develop and follow-up a reference observation network ;
- To process, analyze and validate data relating to the knowledge of the resource ;
- To develop databases on socio-economic activities in the region, in relation to water uses ;
- To develop and publish indicators on the resource and its uses in three countries ;
- To promote and facilitate the conduct of joint or coordinated studies and research by experts from the three countries ;

D- Financing

Each state bears the operating costs of its own focal point . The functioning of the coordination unit is financed out of subventions and gifts granted to the OSS by the concerned states , cooperating countries, etc.

At present, The 3 countries notified an evolution and development of the aquifer resources from 0,6 Milliards CM in 1970 to 2,5 Milliards CM in 2009 per year .

complex terminal continental intercalaire



Aquifer : 1M KM2 69% Algeria 8% Tunis Libya 23%
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4. GROUND WATER RESOURCES IN PALESTINIAN OCCUPIED TERRITORIES

Water resources in the West Bank and Gaza Strip consist primarily of surface water and groundwater resources. The major and permanent surface water resources is the Jordan River and flood water in wadis . However, since the Israeli occupation of the Palestinian Territories, groundwater resources have become the major source of fresh water supply in the West Bank and Gaza Strip as the Palestinians were deprived of their rightful share in the Jordan River by the Israelis .

Groundwater

Groundwater is the major source of fresh water supply in the Palestinian Territories[In the West Bank, groundwater is formed in three major basins :

the Western Basin, the Northeastern Basin and the Eastern Basin . The West Bank receives an annual average rainfall that ranges between 500 and 600 mm. With an area of 5,856 km², this gives an average total of about 3,200 MCM of rain per year . Around[570 - 740 MCM/y as long-term annual average of this is estimated to infiltrate into the soil to replenish the aquifer. The remainder becomes surface runoff or is lost through evapotranspiration .

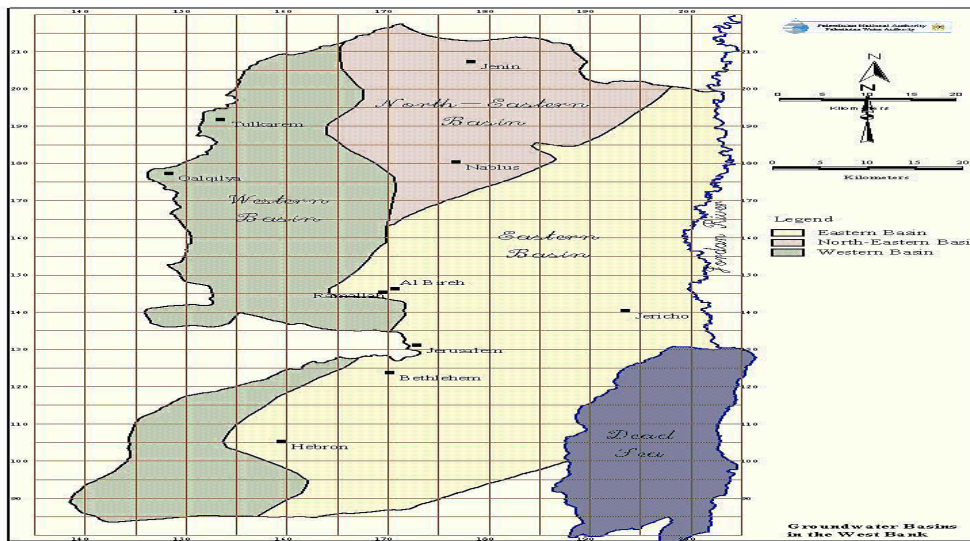
1. **the Western Basin :** it is the largest and most important basin among the West Bank Aquifer basins and has a Sustainable yield of 362 MCM/y but this basin is exploited by the Israelis at a rate of 340 MCM/y and some years it exceed 560 MCM/y which represents around 94% of its annual safe yield, while the Palestinians consume only 6% (22 MCM/y) of the sustainable yield .
2. **the Northeastern Basin :** Most of the recharge areas of this basin are located within the West Bank boundaries and it has an annual average sustainable yield of 145 MCM. In spite of this fact, the Israelis exploit the aquifer at a rate of 103 MCM/y from wells and springs , constituting around 71% of its safe yield. whereas the Palestinians allocation is only 42 MCM/y (29% of the safe yield) currently , Palestinians utilizing less than 30 MCM/y from this basin)
3. **the Eastern Basin:** The annual safe yield of this basin reaches 172 MCM. All the recharge areas of the basin are located within the West Bank area, giving the Palestinians the right to control its water and not to share it with Israel. However, Israel expanded its control over this basin and began to tap it to meet the Israeli water needs. It imposed several restrictions on the Palestinian water use from this basin and prevented them from digging new groundwater wells.

So the Israelis are currently controlling 100% of available water resources where they are utilizing about 82% of the annual safe yield of the groundwater basins to meet 25% of their water needs whereas the water consumption of Palestinians residing in the West Bank constitute around 17% of the annual safe yield . This Israeli prepotency over the Palestinian water resources is further illustrated by the infringement of the agreements signed between the Palestinian and Israeli sides. According to the Oslo II accord, it was agreed to provide the Palestinians with around 28,6 MCM of potable water However, Israel did not fulfill its obligations and provided the Palestinians with a water quantity of not more than 15 MCM .

In the Gaza Strip, groundwater is available in the shallow sandstone Coastal Aquifer that receives an annual average rainfall of about 400mm .

In spite of the annual safe yield of 60 MCM, the aquifer has been over-pumped at the rate of 110 MCM resulting in a lowering of the groundwater table below sea level and saline water intrusion in many areas .

The groundwater salinity in some wells amounts to 1,500 pp. Palestinians attribute the deterioration in the groundwater quality in Gaza Strip to the Israeli practices represented by the construction of dams on Wadi Gaza to divert the Wadi runoff to areas inside Israel resulting in the loss of a major source of water recharge to the aquifer .



Source: Palestinian Water Authority, 2004

The mountain aquifer system is made up of three different aquifers:

1. The western
2. The northeastern
3. The eastern

5. THE LEGAL INSTRUMENTS

The United Nations General Assembly has put forward two major legal instruments for managing shared surface and ground water resources .

The convention on the Law of the Non-navigational Uses of International Watercourses and the Resolution on the Law of Transboundary Aquifers, both instruments propose legal frameworks based on a number of widely accepted principles, among these principles are the equitable and reasonable utilization, the obligation not to cause significant harm, and the obligation to cooperate. Many multilateral and bilateral agreements on shared aquifer, have been signed in the Arab region that draw upon these international legal principles, considering their common socio – cultural bonds and values, and regional specificities.

Although the International Customary Rules are important, but they remain non binding and should be reviewed and adapted for the interests of the region, but regional agreements integrating the various regional factors, interests and instruments need to be agreed upon by all partners .

Most of the successful cooperation examples in the Arab region started with joint activities such as data collection, studies, monitoring programs and infrastructure projects. these activities seem to enhance communication, build trust, allow transparency and understanding of each other's interest.

Although, many regional agreements have been signed between Arab countries, and even with neighbouring non-Arab countries regarding the international shared aquifers, there is a need for regional binding legal instruments within the Arab League and especially an International law or convention within the United Nations regulating the international shared aquifers .

That's why, the League of Arab States is giving a great interest to the United Nations Law on Transboundary Aquifers and its draft convention .

The League of Arab States and especially the Center of Arab Water Security have held a meeting for representatives of the Arab concerned Ministries–high responsables and legal and water experts at the beginning of the year2010, to study the "Law on Transboundary Aquifers" and to make amendments and suggestions about the draft convention that will make it reflect and contain all the Arab interests regarding international shared aquifers .

Given the magnitude of water scarcity that the Arab region is facing, and the fact that most available renewable water resources are shared among the Arab countries or with neighbouring non-Arab countries, the League of Arab States recognized the need for an institutional development of the water sector in the Arab region and a regional cooperation framework, that's why the Arab League established the Council of Arab Ministers for Water in 2009 which is responsible for putting a **water security strategy** in the Arab region which will be adopted in September 2010, and a series of projects for surface and ground shared water resources development and management between Arab countries, still major challenges remain on dealing with neighbouring non-Arab countries, since the majority of renewable water resources of the region originate from outside its boundaries .

Having this political umbrella, the **Council of Arab Ministers for Water** and this political will is leading to a "Shared Water Vision" since the council amended the Center of Arab Water Security with the mission of establishing a legal framework within the Arab countries about the management and cooperation of Shared Water resources which will be a binding regional water legal instrument, such as a convention or a protocol ,based on International customary Laws, and which will- we hope-solve the most challenging shared water issues in the Arab region .