

Transboundary Groundwater in Western Asia: A Depleting Resource that Needs Immediate Attention

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Outline

- Background
- Overview of the shared aquifer systems
- Technical constraints for the systems management
- Legal constraints for the systems management
- Recent initiatives to alleviate constraints
- outlook



25-29th
September 2016

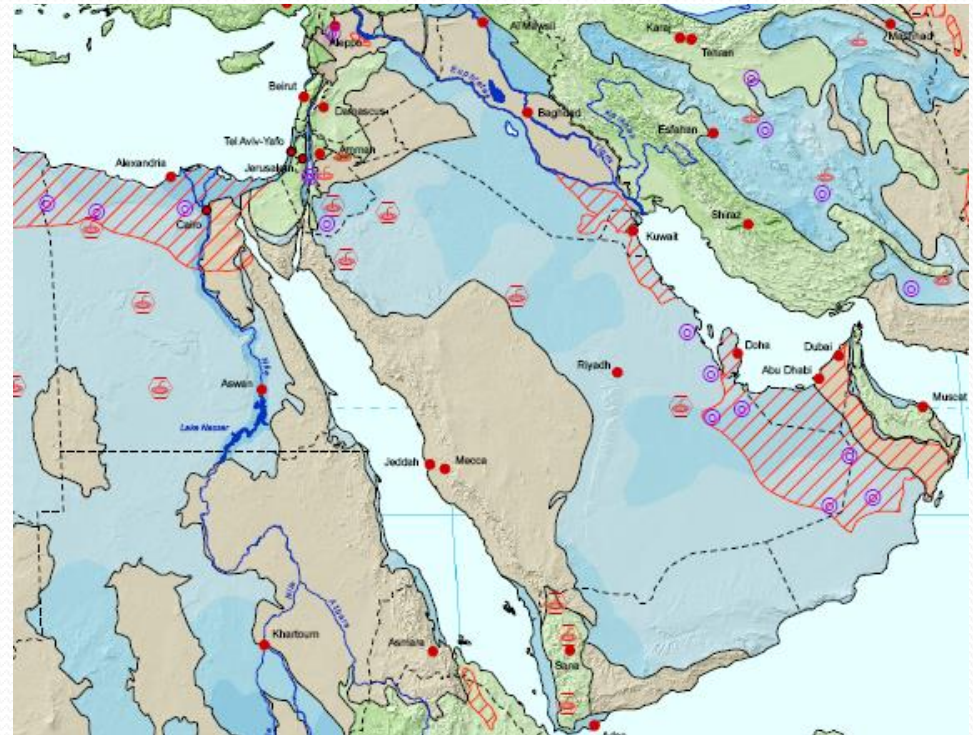
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Background

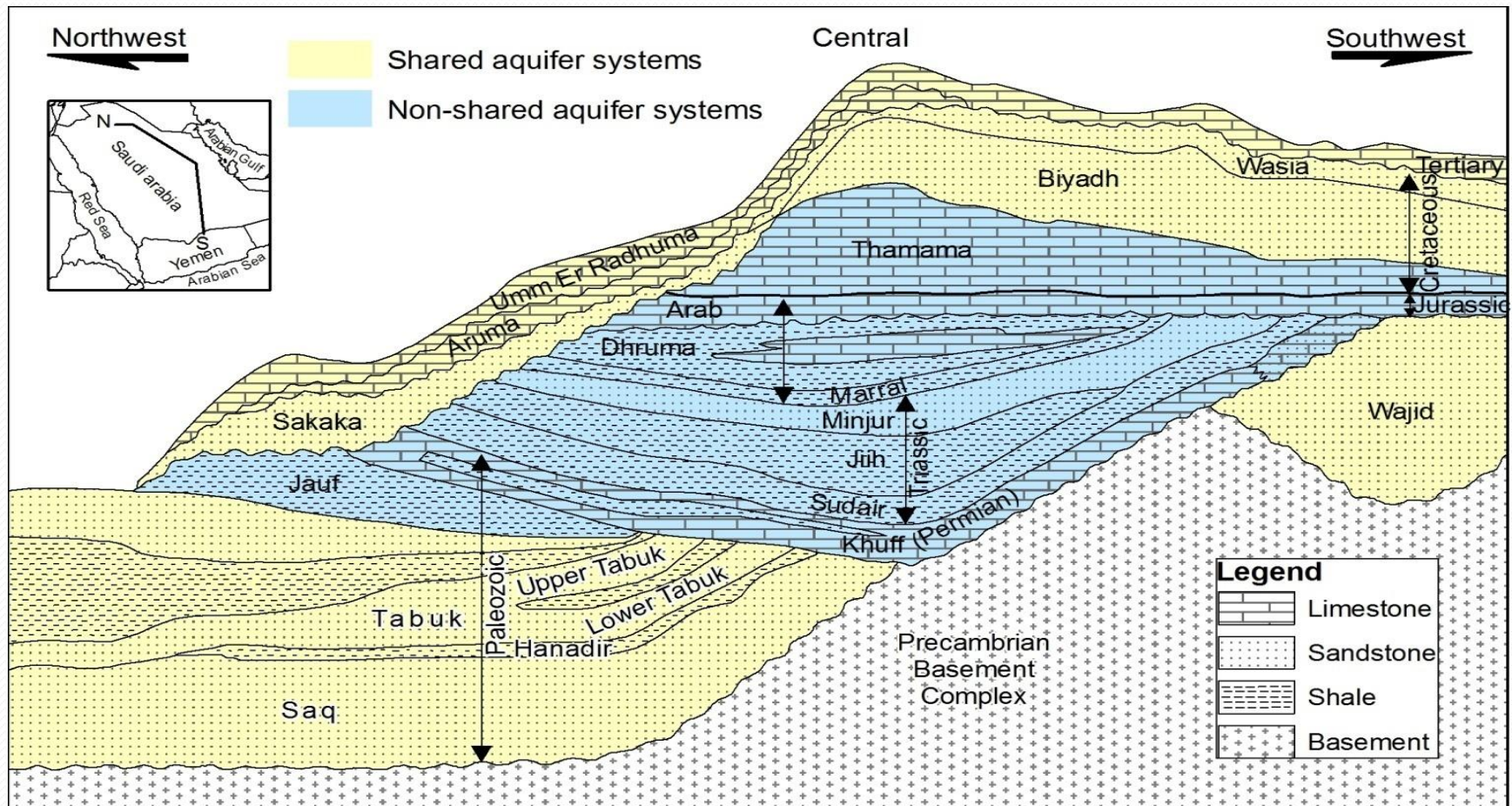
- ACSAD study 1990
- UNESCWA-BGR study 1999
- UNESCWA-BGR 2013



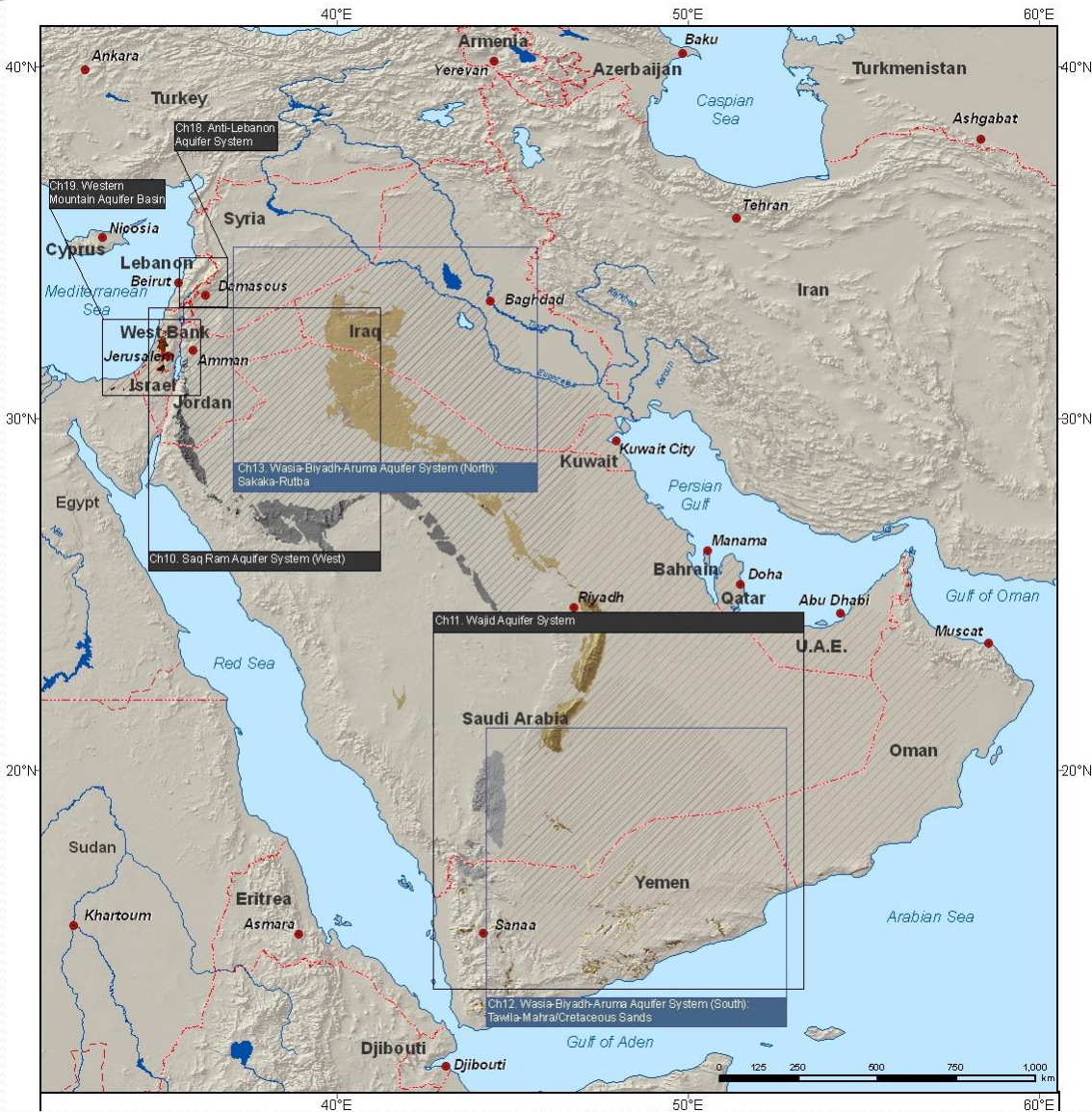
Source: WHYMAP, 2008

Shared VS Non-shared non-renewable aquifers in the Arabian Peninsula

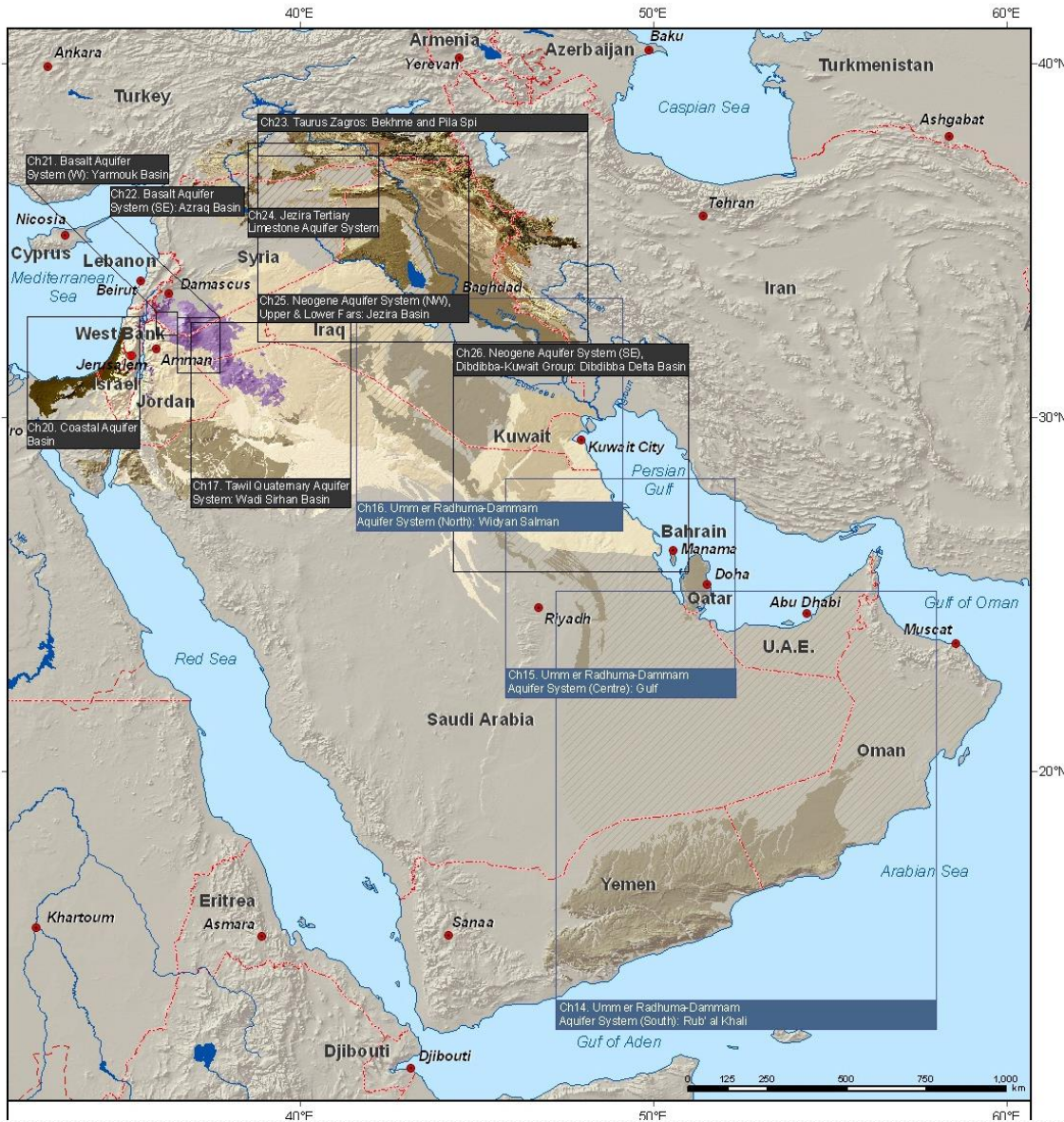
(Modified from Al Sharhan et al., 1996)



Shared Aquifer Systems Mesozoic and Paleozoic Era

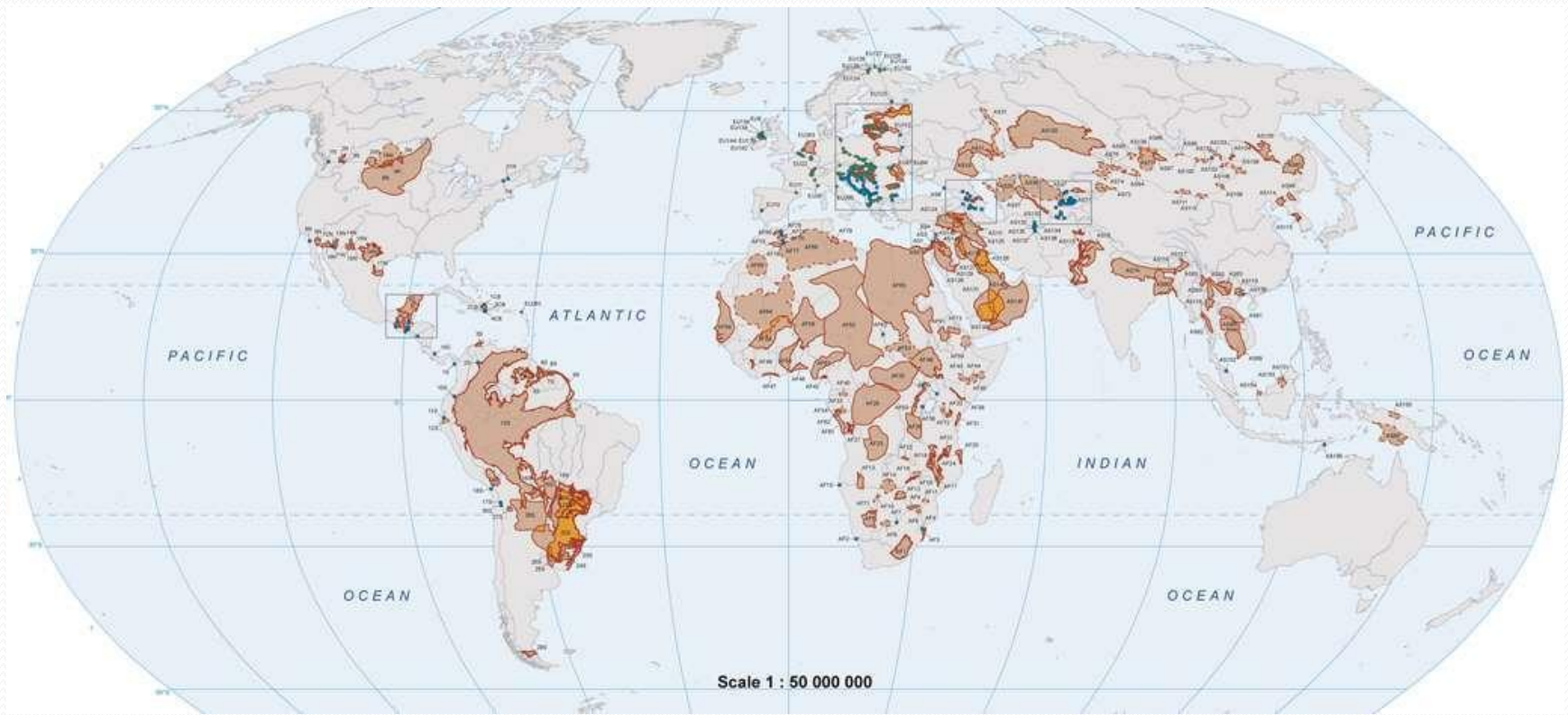


Shared Aquifer Systems Cenozoic Era



Transboundary Aquifers of the World, 2015

(Source: UNESCO-IHP Groundwater Portal)



Aquifer systems in the arid to semi-arid areas in the region (Arabian Peninsula Systems)

- Arabian Shelf provided the depositional basin (up to 7,500 m thick) for **extensive sedimentary strata**.
- Development of large regional aquifer systems subjected to minor folding and faulting along **extensive anticlines and arches**.
- Lithological character maintained over large areas.



Tectonic and Geologic Structures in the Arabian Plate



Inventory of Shared Water Resources in Western Asia

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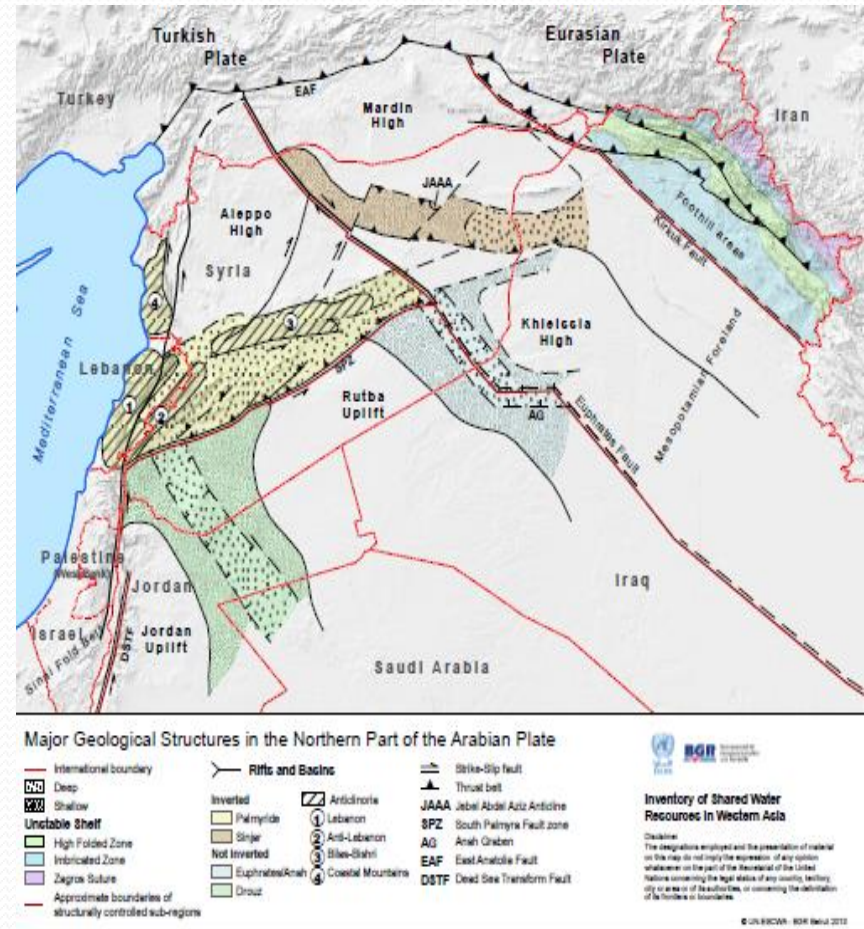
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Aquifer systems in the more humid areas (Mashrek and Mesopotamia Systems)

- A series of uplifts bounded by strike-slip faults surrounded by **highly folded and faulted mountainous regions**.
- High precipitation falling on extremely well-exposed and highly karstified carbonate rocks in the mountains.
- Characterized by numerous **springs and river systems** that sustain the supply of fresh water from small catchments.



Technical and socio-economic constraints (Arabian Peninsula Systems)

Shared Aquifer Systems	Geologic Era	Riparian countries	Area (km ²)	Storage (bcm)	Abstraction (mcm/a)	Salinity, TDS (mg/L)
Saq Ram West	Paleozoic	Saudi Arabia-Jordan	308,000	43-740 , 10	>1,000 , 90	<1,000
Wajid	Paleozoic	Saudi Arabia-Yemen	455,000	30-225, 4-6	2260, 100	700-1,000
Wasia Biyadh Aruma (S): Tawila-Mahra / Cretaceous Sands	Mesozoic	Saudi Arabia-Yemen	157,000	500	Very limited	<1,000
Wasia Biyadh Aruma (N): Sakaka-Rutba	Mesozoic	Saudi Arabia-Iraq	112,000	?	<40	400-3,000
U er R' Dammam (S): Rub' El Khali	Cenozoic	Saudi Arabia-Oman-UAE-Yemen	680,000	180-1,100 (O)	45 (O), ~8 (UAE)	<2,000-200,000
U er R' Dammam (Center): Gulf	Cenozoic	Saudi Arabia-Qatar-Bahrain	281,000	235, <3	~600, 90	<5,000-100,000
U er R' Dammam (N): Widyan-Salman	Cenozoic	Saudi Arabia-Iraq-Kuwait	246,000	?	135	<1,000-150,000
Tawil-Quaternary: Wadi Sirhan Basin	Cenozoic	Saudi Arabia-Jordan	44,000	58-22	2,264-3,500	3,000-7,000
Total			2,283,000 (88.8%)			

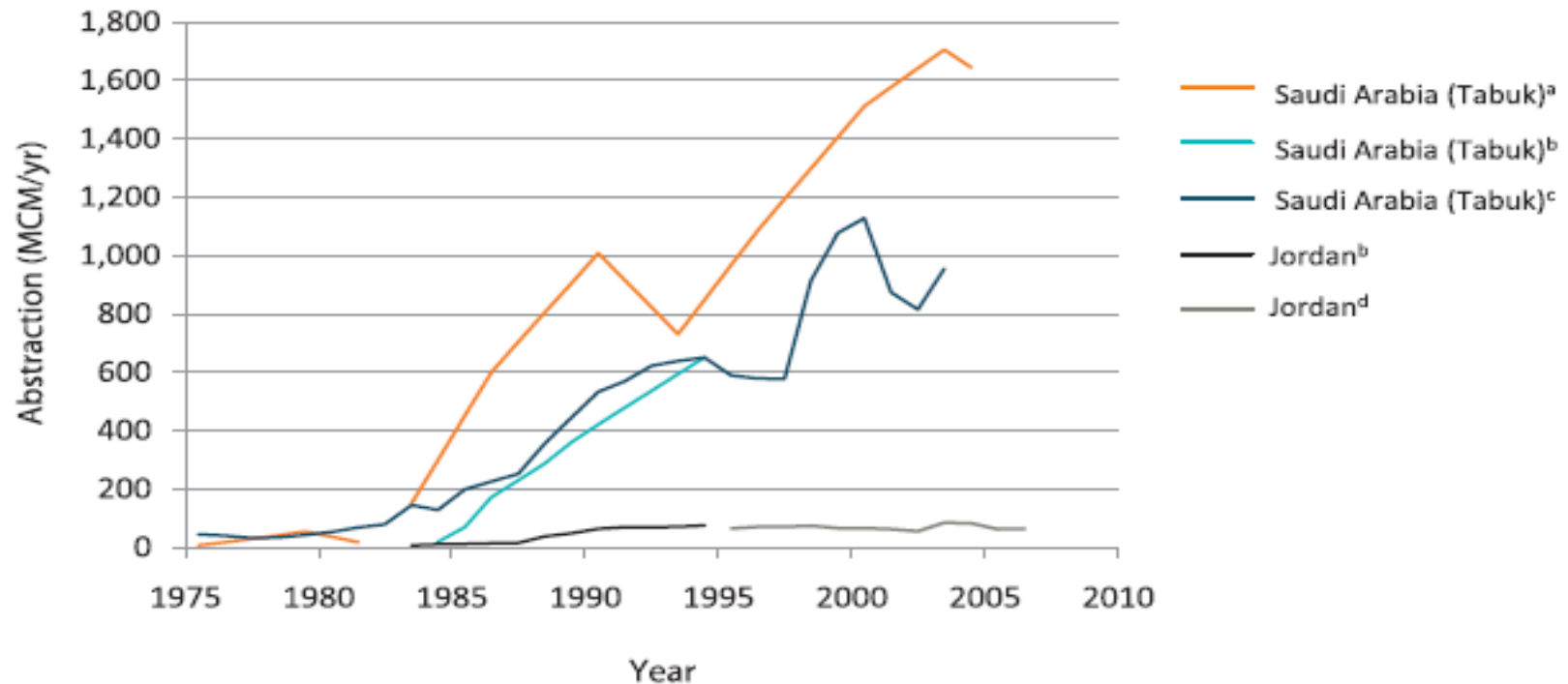
Technical and socio-economic constraints (Mashrek and Mesopotamia Systems)

Shared Aquifer Systems	Geologic Era	Riparian countries	Area (km ²)	Storage (bcm)	Abstraction (mcm/a)	Salinity, TDS (mg/L)
Anti-Lebanon	Cenozoic	Syria, Lebanon	1,055	4	430	200-600
Western Aquifer Basin	Cenozoic	Egypt, Israel , Palestine	6,035- 6,250	?	~390	250-2,000
Coastal Aquifer Basin	Cenozoic	Egypt, Israel , Palestine	18,370	1.4-2	620-740 (400-480)	<1,000-9,000
Basalt (W): Yarmouk Basin	Cenozoic	Syria,, Jordan	7,000	?	~200	<250-400
Basalt (SE): Azraq Basin	Cenozoic	Syria,, Jordan	8,500	?	~10	<250-6000
Taurus-Zagros	Cenozoic	Iran , Iraq, Turkey	14,286	?	~420-3700	<1,000
Jezira Tertiary Limestone	Cenozoic	Syria, Turkey	14,000	7,400	1590, 1380	220-4,700
Neogene (NW) - Upper and Lower Fars: Jezira Basin	Cenozoic	Syria, Iraq	65,000	?	44-63	<1,000->20,000
Neogene (SE) Dibdibba – Kuwait Group	Cenozoic	Saudi Arabia, Iraq, Kuwait	153,000	1.26 (Iraq)	~460	2,500-15,000
Total			287,461 (11.2%)			

Technical and socio-economic constraints, cont. (Arabian Peninsula Systems)

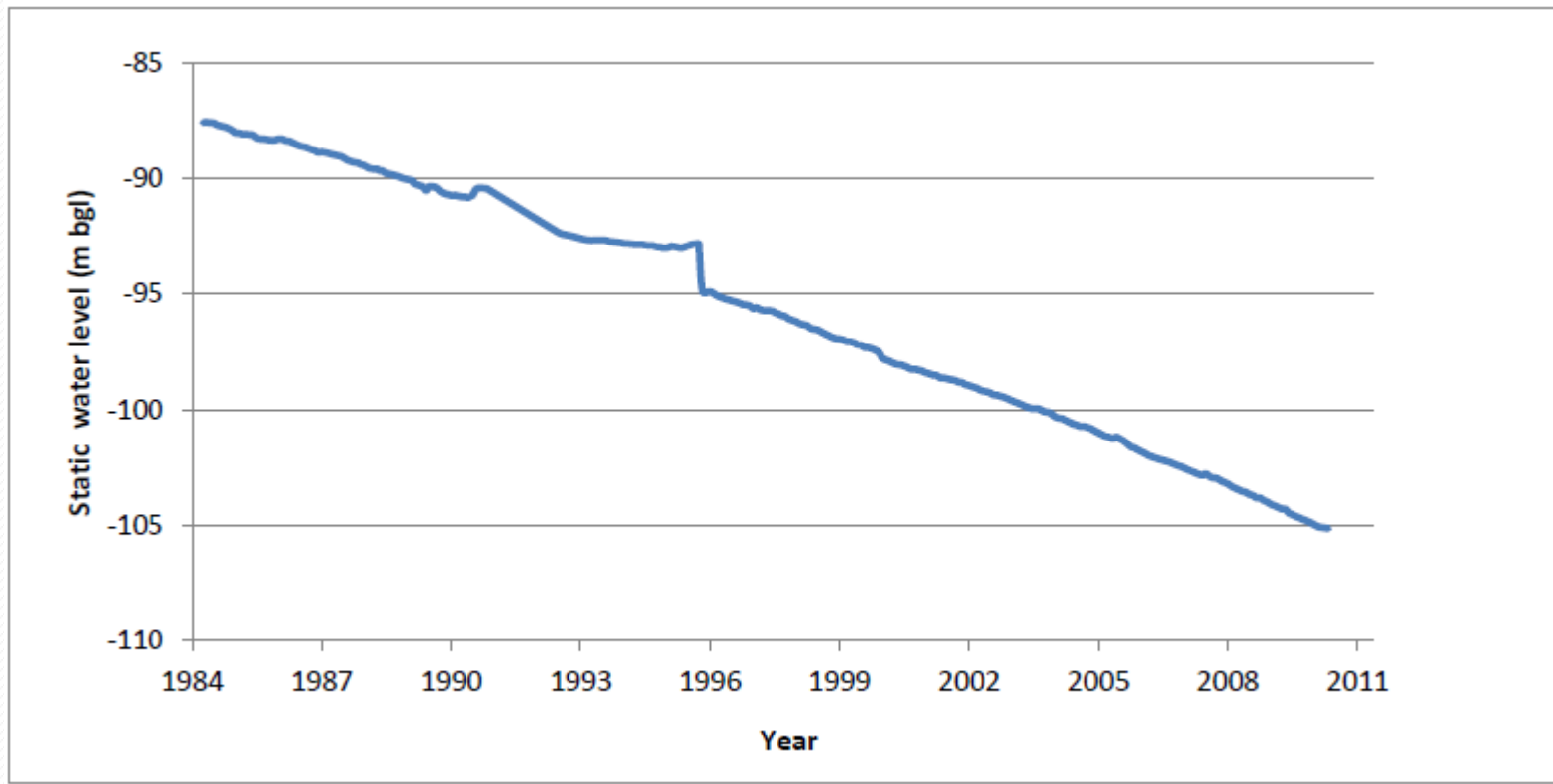
(a: Water Watch, 2006; b: Hiaste Kirkpatrick International and Scot Wilson Kirkpatrick, 1995; c: based on data from Abunayyan Trading Corporation and BRGM, 2008; d: based on data from Barthelemy et al. 2010)

Figure 2. Historical abstraction from the Saq-Ram Aquifer System (West) (1975-2007)

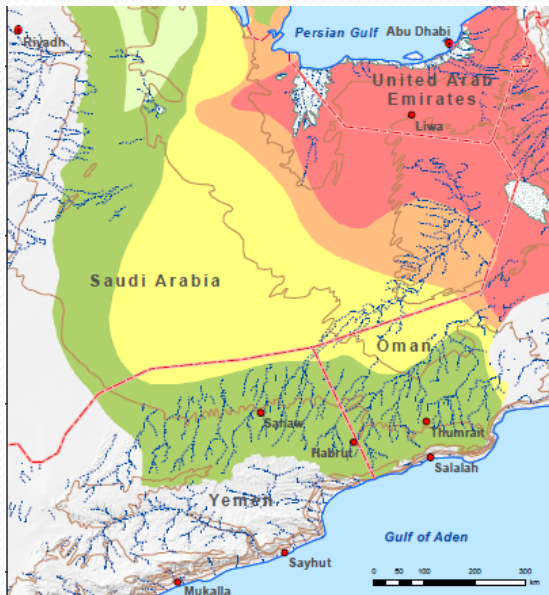


Compiled by ESCWA-BGR based on sources below.

Groundwater level decline in the Ram aquifer system, Jordan



Technical and socio-economic constraints, cont. (Arabian Peninsula Systems)

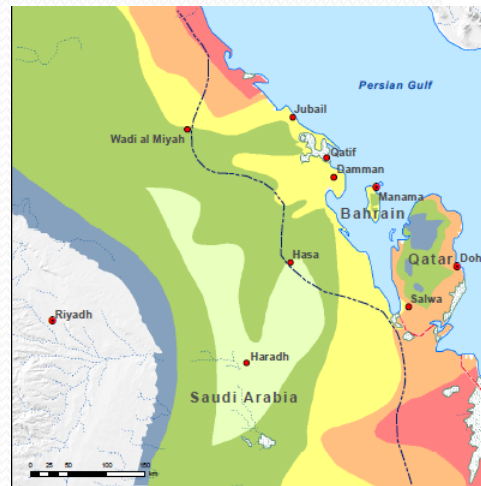


Groundwater salinity map TDS
Umm er Radhuma-Dammam Aquifer System (S)

 <1 g/L	Topographic contours
 1-3 g/L	Sabkha
 3-5 g/L	
 5-10 g/L	
 >10 g/L	

Inventory of Shared Water Resources in Western Asia
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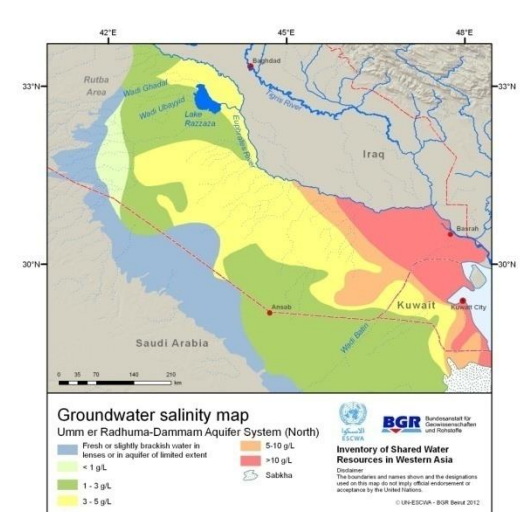


Groundwater salinity map TDS
Umm er Radhuma-Dammam Aquifer System (C)

 Fresh or slightly brackish water in lenses or in aquifers of limited extent	 >10 g/L
 <1 g/L	Sabkha
 1-3 g/L	Sabkha line
 3-5 g/L	
 5-10 g/L	

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Groundwater salinity map
Umm er Radhuma-Dammam Aquifer System (North)

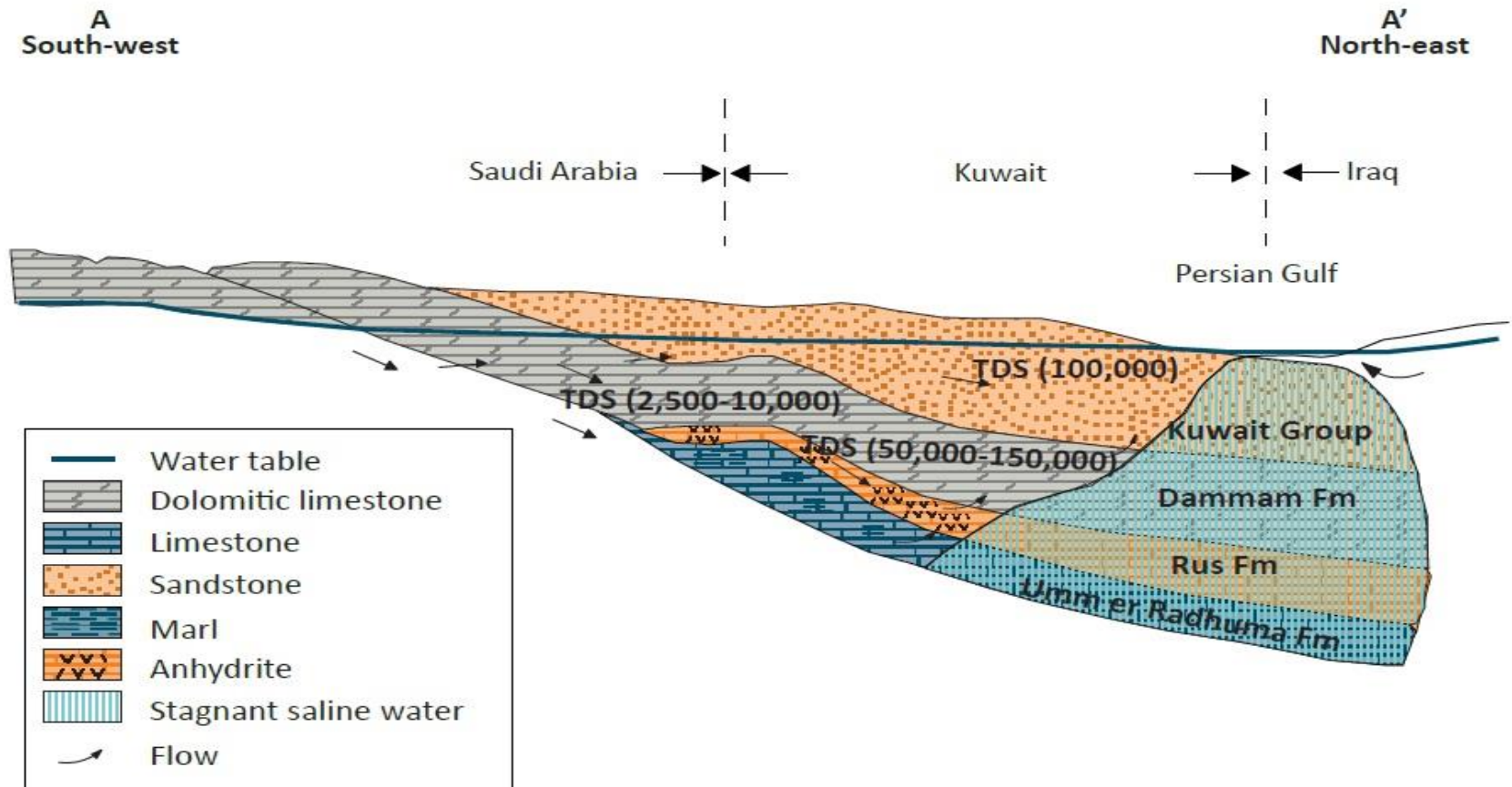
 Fresh or slightly brackish water in lenses or in aquifers of limited extent	 >10 g/L
 <1 g/L	Sabkha
 1-3 g/L	
 3-5 g/L	

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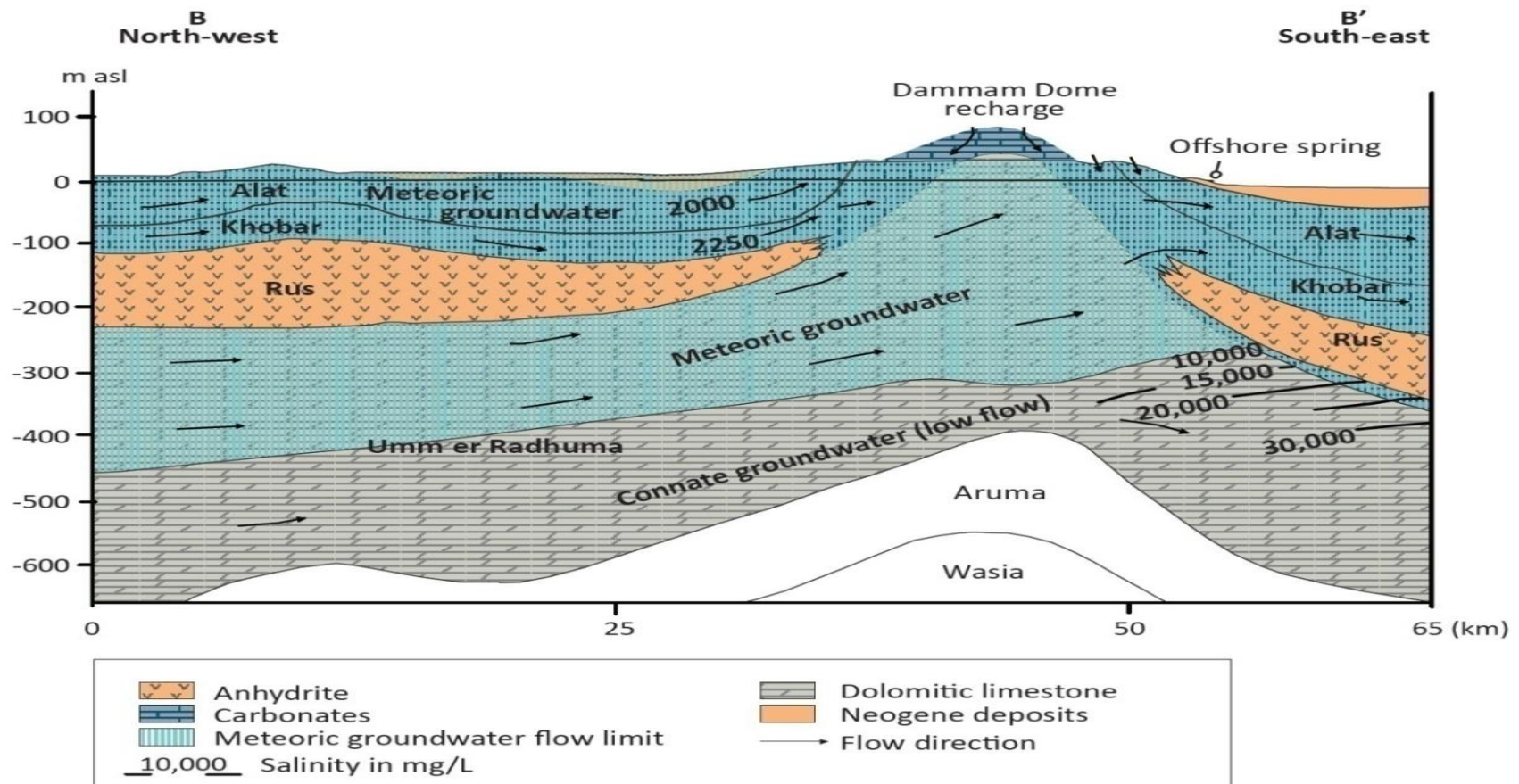
Technical and socio-economic constraints, cont. (Arabian Peninsula Systems)

(Based on ESCWA-BGR, 1999)



Technical and socio-economic constraints, cont. (Arabian Peninsula Systems)

(Based on Harhash and Yousif, 1985)



Legal constraints

- Ineffective or absence of national water legislations
- Lack of consensus over water rights
- Dilemma of water security VS food security
- Inadequate knowledge of groundwater systems
- Serious shortage of qualified legal experts to enforce water laws

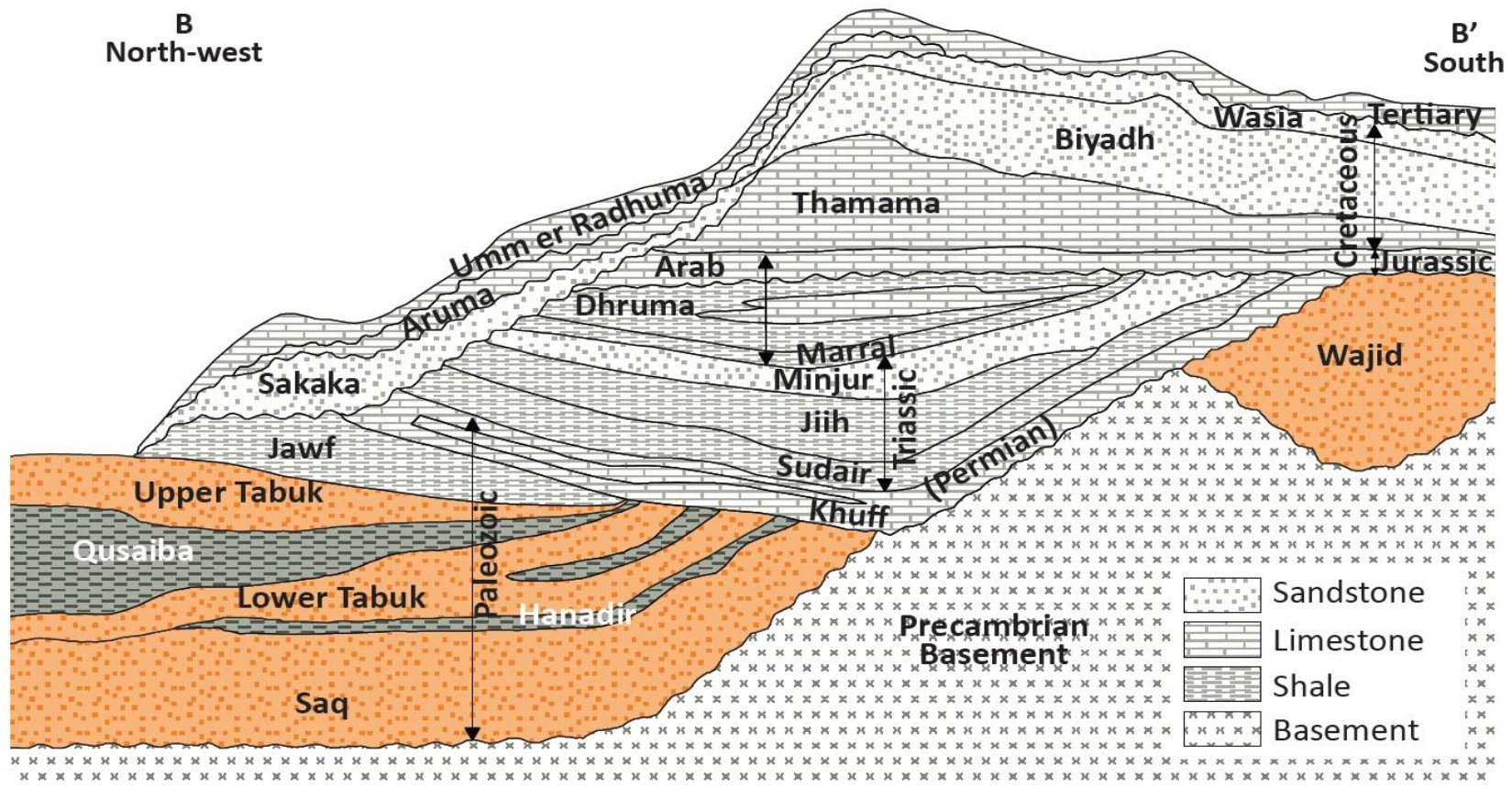
Main groundwater issues in the Western Asia region

- Prevalence of extensive non-renewable aquifers
- Storage unknown
- Heavy abstraction
- Discrepancy on abstraction figures
- Increasing salinization
- Not a single basin-wide agreement

Recent initiatives

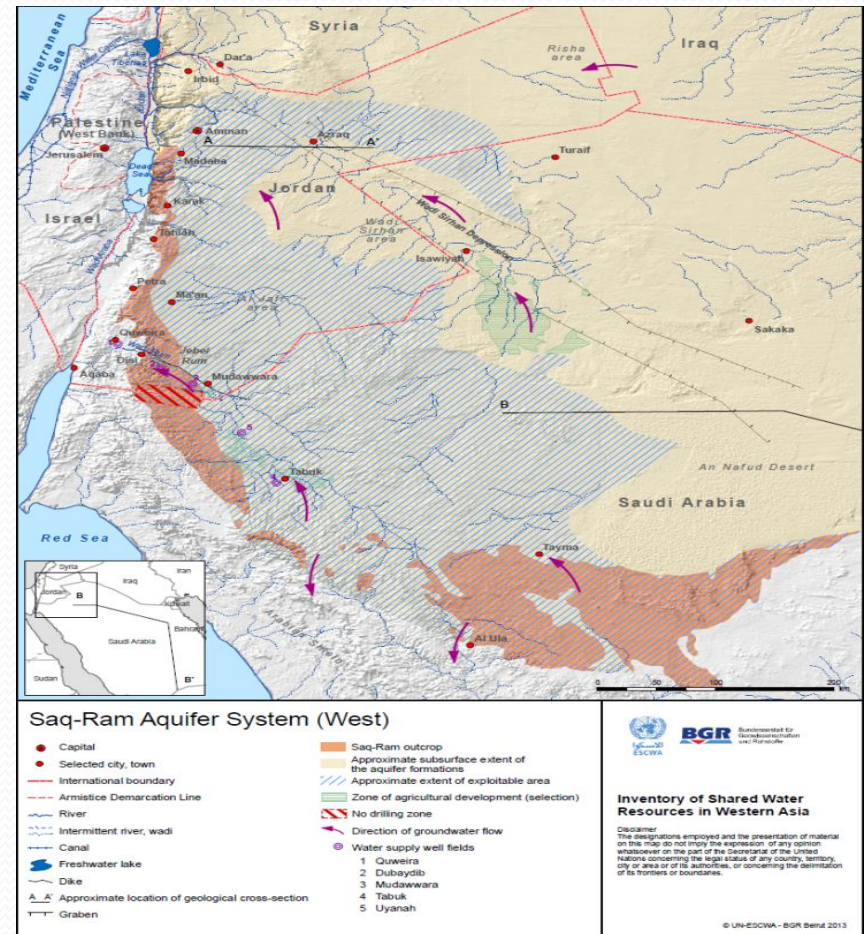
- Bilateral agreement on the Saq-Ram (West) aquifer system
- Regional initiative for cooperation among Arab States (Framework Convention for Arab Shared water Resources)

Saq-Disi Agreement



Saq-Disi Agreement (cont)

- Creation of a “protected Area” free from groundwater-related activities for domestic water supply in April 2015
- Essentially an official version of a non-binding MoU signed at the technical level in 2007



Saq-Disi Agreement (cont)

- No limitations on abstraction beyond the protected area
- No pollution control measures beyond the protected area
- No mention of basic principles of international law such as equitable and reasonable utilization, and no significant harm
- Joint technical committee with no decision-making authority

Framework Convention for Arab Shared water Resources

- Commitment for cooperation on sustainable use and effective management of shared water resources
- Exchange of information and data
- Prior notification of measures to be implemented
- Equitable and reasonable utilization but no mention of no significant harm
- Measures for protection of the environment
- Shared water resources with non-Arab countries
- Water rights in the Occupied Palestinian Territories

Framework Convention for Arab Shared water Resources (cont)

- General objective: to protect shared water resources in the Arab Region
- **Big debate on:**
- Shared groundwater only or groundwater and surface water
- Terminology of shared VS transboundary

conclusion

- Extensive shared aquifer systems that are essentially non-renewable and rapidly being depleted and/or being subjected to salinization
- Lack of adequate data coupled with the absence of official agreements on shared groundwater resources hampers joint water resources management
- It is already too late to save some shared aquifers that have become too polluted or saline to use

Outlook

- completion, validation and updating of baseline information
- Establish a regional data base
- Build trust among riparian countries
- Enhance and activate cooperation between international organizations, donors and the League of Arab States
- Initiate ISARM project in the region

Thank you



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