

INVENTORY OF **SHARED WATER RESOURCES** IN WESTERN ASIA





Introduction I



The Inventory is...

the first UN-led effort in Western Asia to take stock of shared surface and groundwater resources in that region in a comprehensive, systematic and standardized manner.

Key Themes:

- Hydrology and hydrogeology,
- Water resources development and use,
- Agreements and cross-border management efforts.

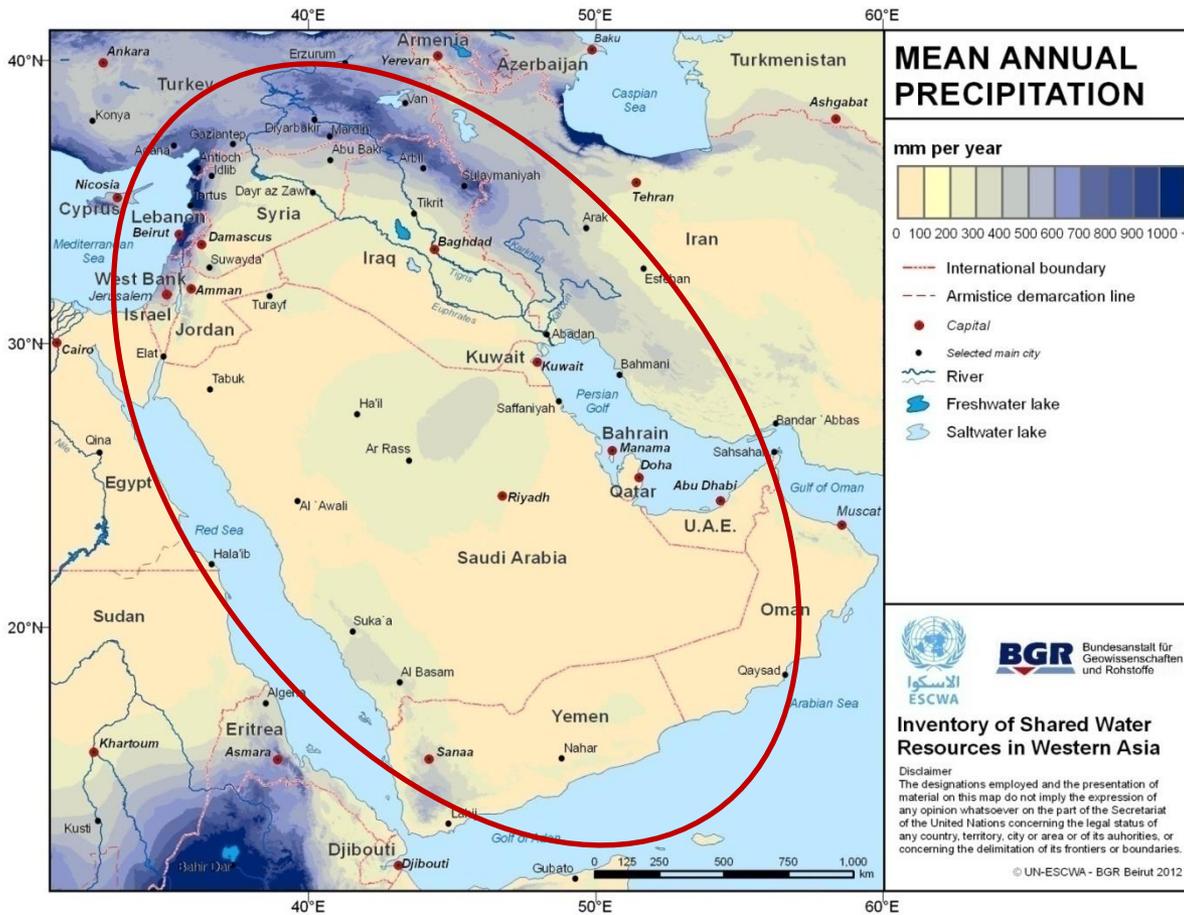
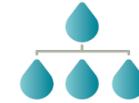
Objectives:

- **Identify**, and document the state of, shared water resources and their use
- Improve the **knowledge base** and facilitate information access
- Create awareness and stimulate **informed dialogue** within and between riparian countries
- Support **regional processes** towards improved dialogue and cooperation over shared water resources

Euphrates River – Syrian Arab Republic



Introduction II

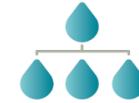


Geographical Scope:
covers all identified surface and groundwater resources shared between Arab Countries of Western Asia. Also covers water resources shared with Iran, Israel and Turkey.

- Arabian Peninsula
- Mashrek
- Mesopotamia



Work Process



WORK IN PROGRESS: Mapping the research and production process

COMPILATION OF
INFORMATION

CONSOLIDATION

REVIEW &
CONSULTATION

PUBLICATION

SOURCES

- ESCWA reports
- Regional literature
- Scientific publications
- Country papers
- Media
- National statistics
- Maps
- Satellite data

Identification of
Shared Basins in
Western Asia

CORE INFORMATION/
BASIN CHAPTER

- Table** of basin/aquifer facts
- Executive summary**
- Overview map**
- Basin description**
 - Introduction
 - Hydro(geo)logy
 - Water use
 - Agreements, cooperation & outlook

REVIEW PROCESS

- Internal**
- Technical experts**
- Member countries:**
- Focal points**

THE INVENTORY

- Introduction**
- Main findings**
- Methodology**
- Basin chapters**
- References**

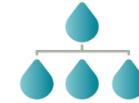
FORMATS

- Report**
- Booklet & CD**
- Website**
- Corrigendum**





Timeline and Consultation

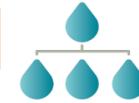


| | | |
|--------------|---|--|
| 2008 Dec | Committee on Water Resources, 8 th Session | Build national capacities on IWRM and shared waters; update assessment of legal and institutional tools for shared water management. |
| 2009 Jun | Start of Work | Literature research, pre-screening, compilation of core information, hydrogeological interpretation. |
| 2011 Mar | Committee on Water Resources, 9 th Session | Recommendation to nominate focal points to support the finalization of the Inventory, and consider its outcomes. |
| 2011 Apr-Sep | Nomination of focal points | Bahrain, Egypt, Iraq, Jordan, Kuwait, Lebanon, Oman, Palestine, Qatar, Saudi Arabia, Sudan, Syria, UAE, Yemen. |
| 2011 May | Expert Consultation | Review of concept, hydrogeological interpretation and identified shared aquifer systems by regional and international experts. |
| 2011 Oct-Nov | Circulation of Basin fact sheets and questionnaires | Information package for each shared basin/ aquifer system with overview maps, tables, available data and literature list; request to review and complement core information. |





Timeline and Consultation II

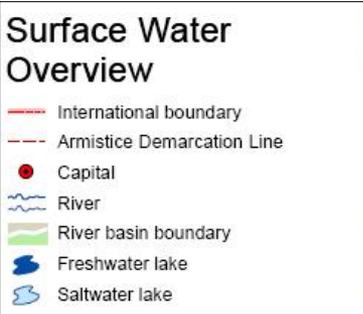
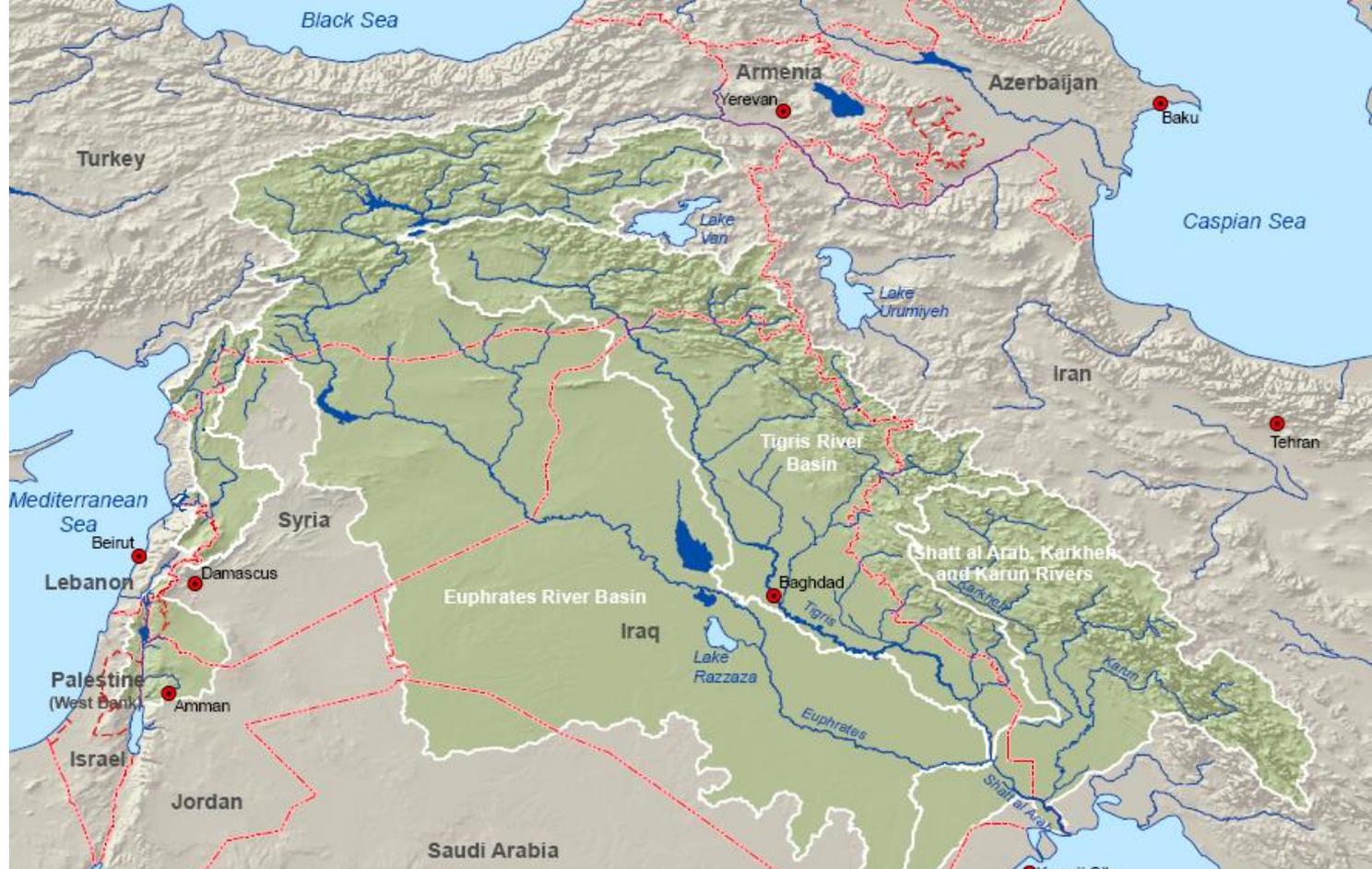


| | | |
|---------------|--|---|
| 2011 Nov-Dec | Regional Consultative Meeting | Discussion of findings and further steps, including submission of requested data. |
| 2011 Dec -Apr | Follow-up and informal consultations | Follow-up on data submission and clarification of content; via email, missions and back-to-back meetings |
| 2012 May-Dec | Chapter review | Circulation of completed draft basin chapters to focal points of riparian countries. In parallel, review of chapters by selected experts. |
| 2013 Feb-Mar | Full Review | Circulation of complete Inventory in layout for final review and comments. |
| 2013 Mar | Committee on Water Resources, 10 th session | Final report on preparation of Inventory and discussion of findings. |
| 2013 Apr-Jun | Finalization of report | Incorporation of final comments, preparation for print and web |
| 2013 Sept/Oct | Launch of Report | Global Launch at Stockholm World Water Week Regional Launch on UN Day in Beirut |



Shared River Basins

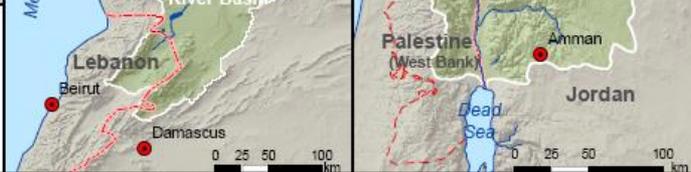
- Jordan River
- Orontes River
- Euphrates-Tigris-Shatt Al Arab
- El Kabir River
- Qweik River



Inventory of Shared Water Resources in Western Asia

Disclaimer
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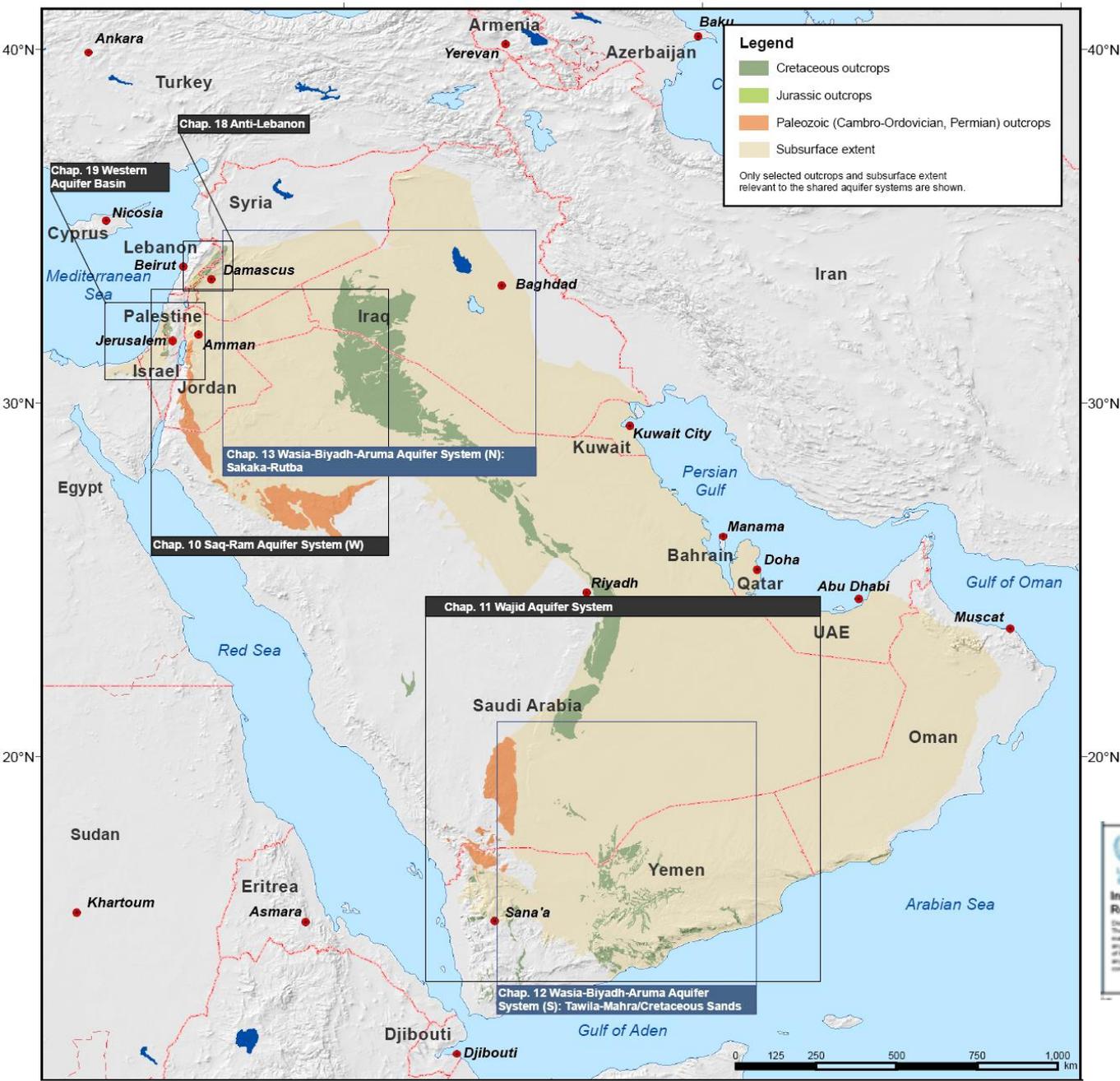


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UN-ESCWA

Shared River Basins in the Inventory

| SHARED RIVER | | COUNTRIES | MAIN SHARED TRIBUTARIES ^b |
|--------------------|------------------------------------|---|--|
| MESOPOTAMIA | Euphrates River | Iraq, Jordan, ^a Saudi Arabia, ^a Syria, Turkey | Sajur River Jallab/Balikh River Khabour River |
| | Euphrates-Tigris- Shatt al Arab | Iran, Iraq, Syria, Turkey | Feesh Khabour River Greater Zab River Lesser Zab River Diyala River |
| | Shatt al Arab River | Iran, ^c Iraq ^c | Karkheh River Karun River ^d |
| MASHREK | Jordan River | Israel, Jordan, Lebanon, Palestine, Syria | Hasbani River Banias River ----- Yarmouk River |
| | Orontes River | Lebanon, Syria, Turkey | Afrin River Karasu River |
| | Nahr el Kabir | Lebanon, Syria | - |
| | Qweik River | Syria, Turkey | - |

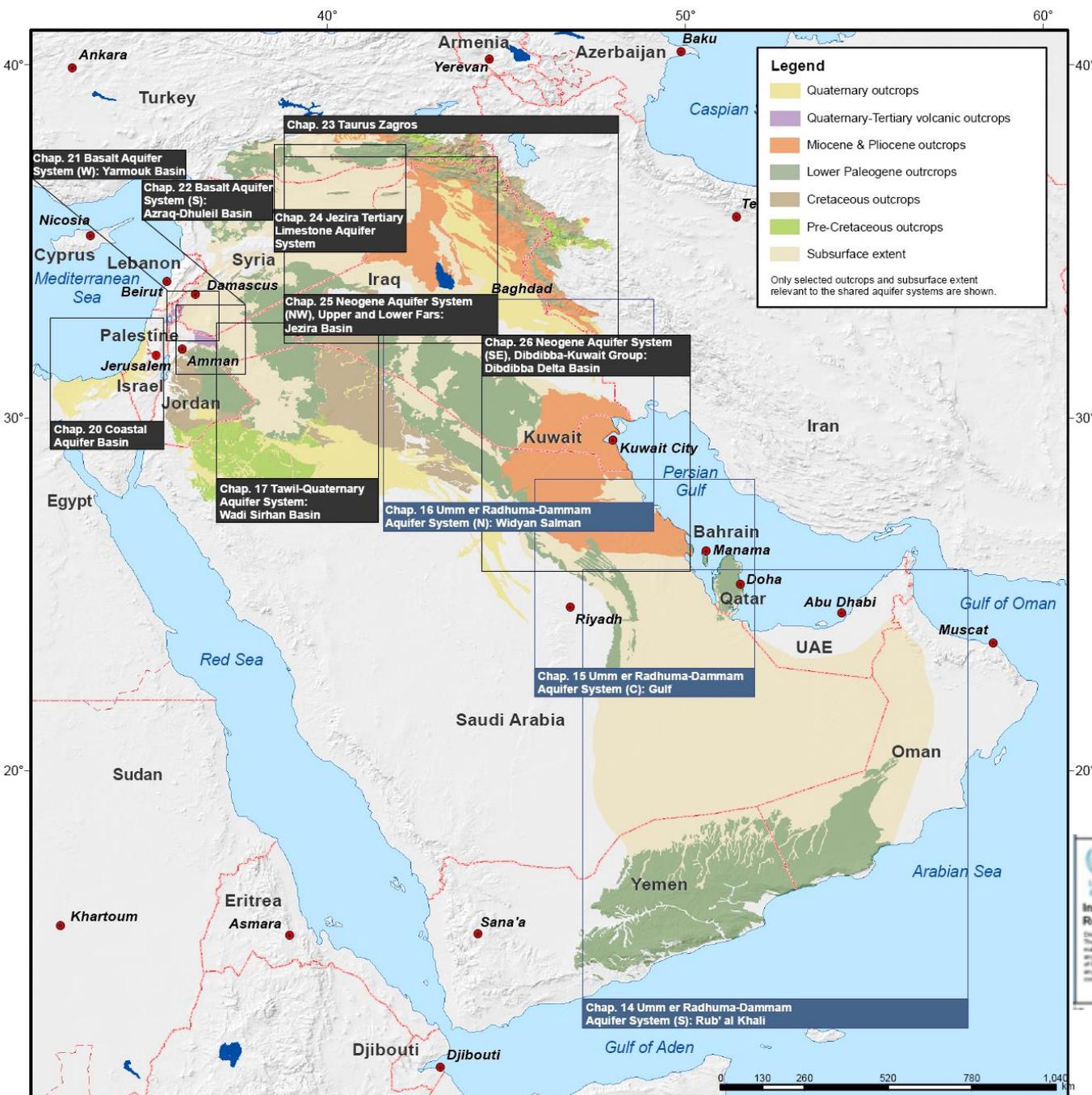
40°E 50°E 60°E



Shared Aquifer Systems (1)

Mesozoic and Paleozoic Era





Shared Aquifer Systems (2) Cenozoic Era

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ESCWA Eritrean, Sudanese, and Yemeni Countries Water Agency
Inventory of Shared Water Resources in Western Asia
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Overview: Shared Aquifer Systems in the Inventory

| Shared Aquifer Systems | | ESCWA member countries | | | | | | | | | | | | Non-ESCWA | | | |
|---------------------------------|---|------------------------|----|----|----|----|----|----|----|----|----|----|-----|-----------|----|----|----|
| | | BH | EG | IQ | JO | KW | LB | OM | PS | QA | SA | SY | UAE | YE | IR | IL | TR |
| ARABIAN PENINSULA | SaqRam Aquifer System (West) | | | | ● | | | | | | ● | | | | | | |
| | Wajid Aquifer System | | | | | | | | | ● | | | ● | | | | |
| | Wasia-Biyadh-Aruma Aquifer System (South) | | | | | | | | | ● | | | ● | | | | |
| | Wasia-Biyadh-Aruma Aquifer System (North) | | | ● | | | | | | ● | | | | | | | |
| | U er R' Dammam Aquifer System (South) | | | | | | | ● | | ● | | ● | ● | | | | |
| | U er R' Dammam Aquifer System (Centre) | ● | | | | | | | | ● | ● | | | | | | |
| | U er R' Dammam Aquifer System (North) | | | ● | | ● | | | | ● | | | | | | | |
| Tawil-Quaternary Aquifer System | | | | ● | | | | | | ● | | | | | | | |
| MASHREK | Anti-Lebanon | | | | | | ● | | | | | ● | | | | | |
| | Western Aquifer Basin | | ● | | | | | | ● | | | | | | | ● | |
| | Coastal Aquifer Basin | | ● | | | | | | ● | | | | | | | ● | |
| | Basalt Aquifer System (West) | | | | ● | | | | | | | ● | | | | | |
| | Basalt Aquifer System (South) | | | | ● | | | | | | | ● | | | | | |
| MESOPOTAMI | Taurus-Zagros | | | ● | | | | | | | | | | | ● | | ● |
| | Jezira Tertiary Limestone Aquifer System | | | | | | | | | | | ● | | | | | ● |
| | Neogene Aquifer System (North-West) | | | ● | | | | | | | | ● | | | | | |
| | Neogene Aquifer System (South-East) | | | ● | | ● | | | | | | ● | | | | | |

Shared aquifer systems without a basin chapter

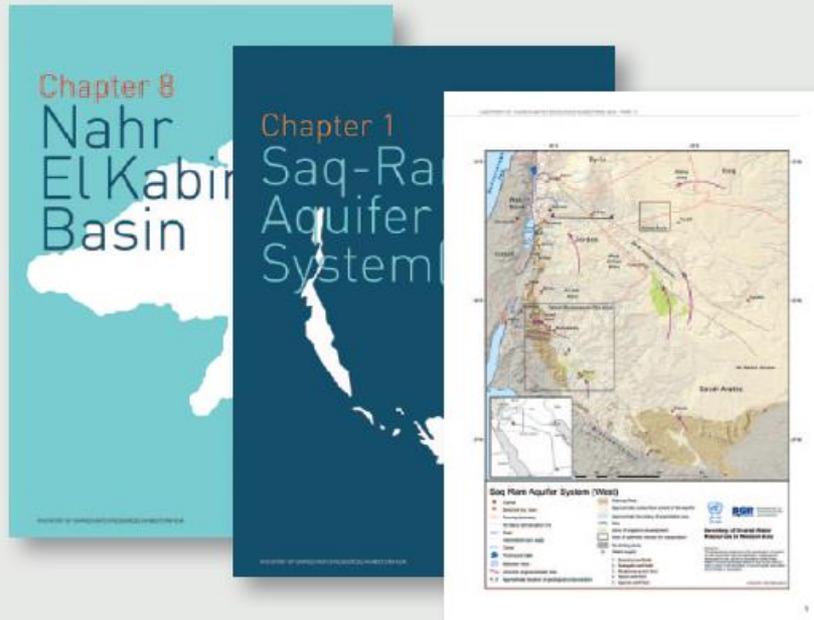
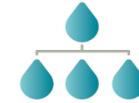
| NAME | LITHOLOGY | RIPARIAN COUNTRIES |
|-----------------------------|-----------------------------|--------------------------------------|
| Central Hammad Basin | Basalt, carbonates and marl | Jordan, Syria |
| Eastern Aquifer Basin | Limestone | Israel, Palestine |
| Ga'ara Aquifer System | Sandstones/ carbonates | Iraq, Jordan, Saudi Arabia, Syria |
| North-Eastern Aquifer Basin | Predominantly limestone | Israel, Palestine |
| Western Galilee Basin | Limestone and dolomite | Israel, Lebanon |

Criteria:

- ◆ Limited size / Scale of Inventory
- ◆ Limited shared portion
- ◆ Limited exploitability (i.e. depth, salinity, oil-bearing, facies change)



Inventory Features



- ◆ A total of **22 shared aquifer systems** and **6 shared river basins** were identified.
- ◆ **9 chapters on shared surface waters** and **17 chapters on shared aquifer systems**, each following a standardized structure and methodology.
- ◆ **624 pages of detailed information** with **60 new maps** and over **200 figures, tables and boxes**.

Chapter Features

GROUNDWATER CHAPTER

INTRODUCTION

Location
Area
Climate
Population
Other aquifers in the area
Information sources



HYDROGEOLOGY

Aquifer configuration
Stratigraphy
Aquifer thickness
Aquifer type
Aquifer parameters



Recharge
Flow regime
Storage
Discharge
Water quality
Exploitability



SURFACE WATER CHAPTER

GEOGRAPHY

River course
Climate
Population



HYDROLOGICAL CHARACTERISTICS

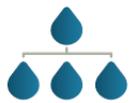
Annual discharge variability
Flow regime
Groundwater linkages



Chapter Features II

GROUNDWATER CHAPTER

GROUNDWATER USE



Abstraction and use
Quality issues
Sustainability issues

AGREEMENTS, COOPERATION & OUTLOOK



List of agreements
Cooperation between riparian countries
Outlook

NOTES



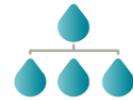
BIBLIOGRAPHY



SURFACE WATER CHAPTER

WATER RESOURCES MANAGEMENT

Development and use
Water quality &
environmental issues



AGREEMENTS, COOPERATION & OUTLOOK

List of agreements
Cooperation between riparian countries
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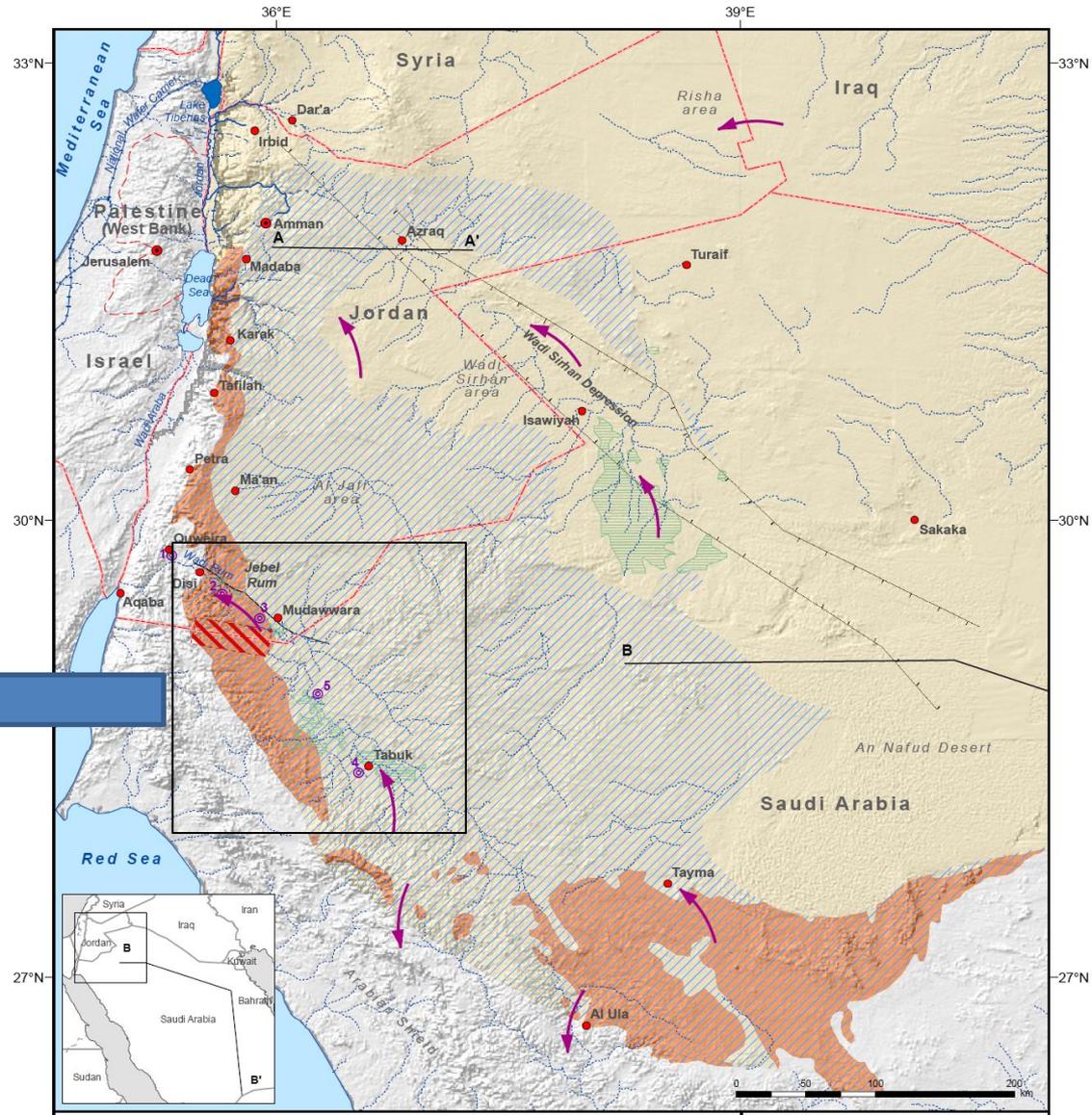
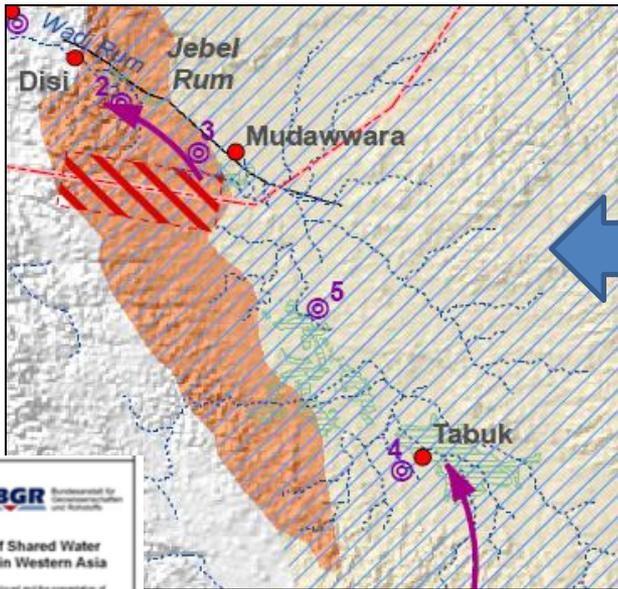




Added Value: Focus discussion on shared aquifer systems

Example: Saq-Ram Aquifer System (West) – ‘Disi’ Aquifer

- approximate exploitability
- groundwater development





Added Value: Visualization in new maps



- Example:
Map of **shared tributaries of the Tigris River**
- Sub-basin delineation
 - Infrastructure
 - agricultural development





Added Value: Hydrological baseline and trends

Example:

Discharge Variability: Orontes River
- visualize trend, drought years

Example:

Flow Regime: Euphrates River
- effect of river regulation

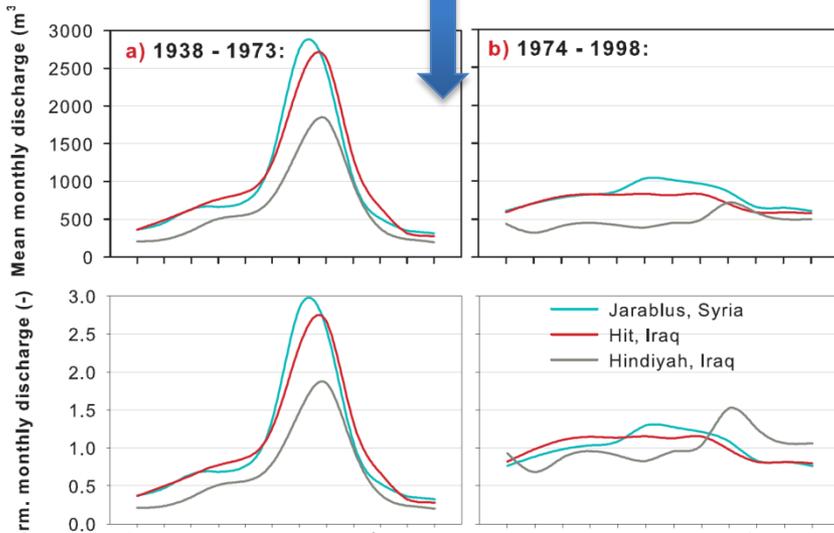


Figure 6. Mean monthly flow regime of the Euphrates River at different gauging stations for different time periods

Source: Compiled by ESCWA-BGR based on data provided by the Ministry of Irrigation in the Syrian Arab Republic in ACSAD and UNEP-ROWA, 2001; USGS, 2012; Ministry of Irrigation in the Syrian Arab Republic, 2012

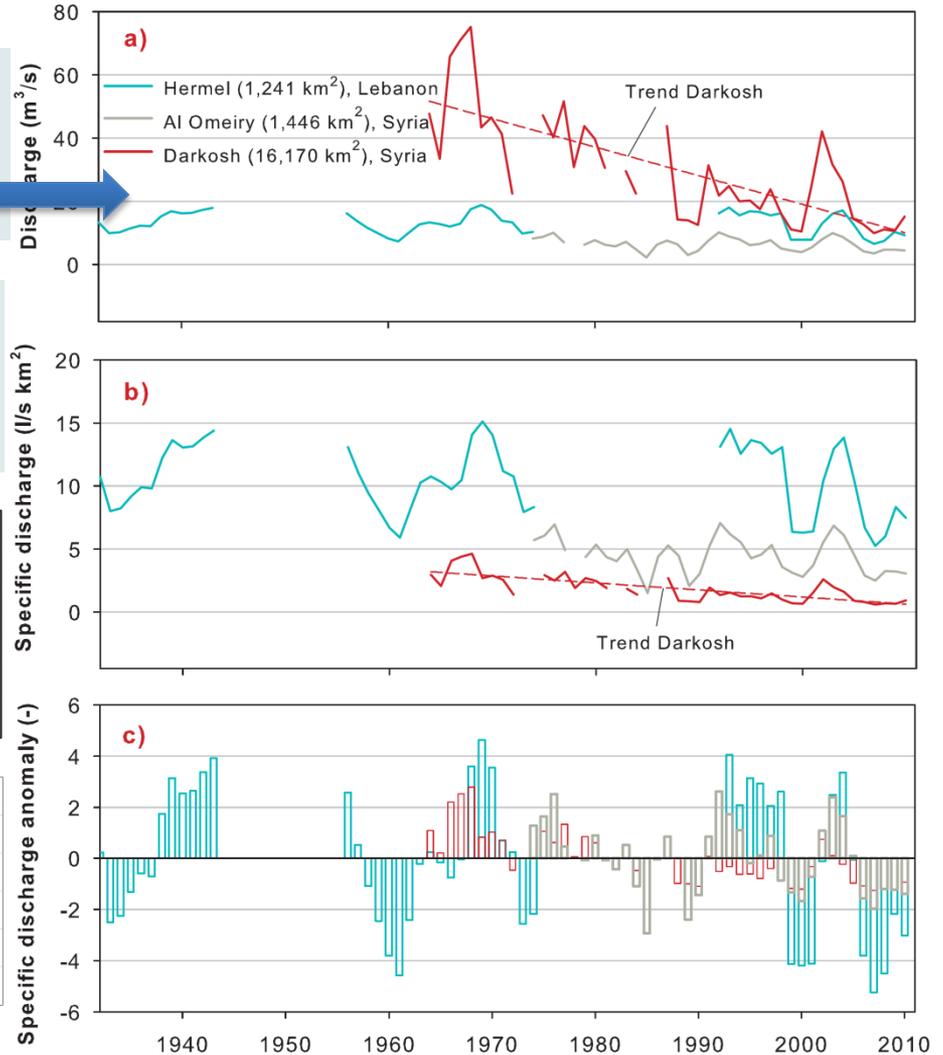
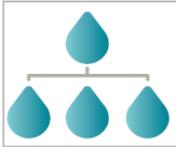


Figure 4. a) Mean annual discharge, b) specific mean annual discharge and c) discharge anomaly time series of the Orontes (1932-2010)



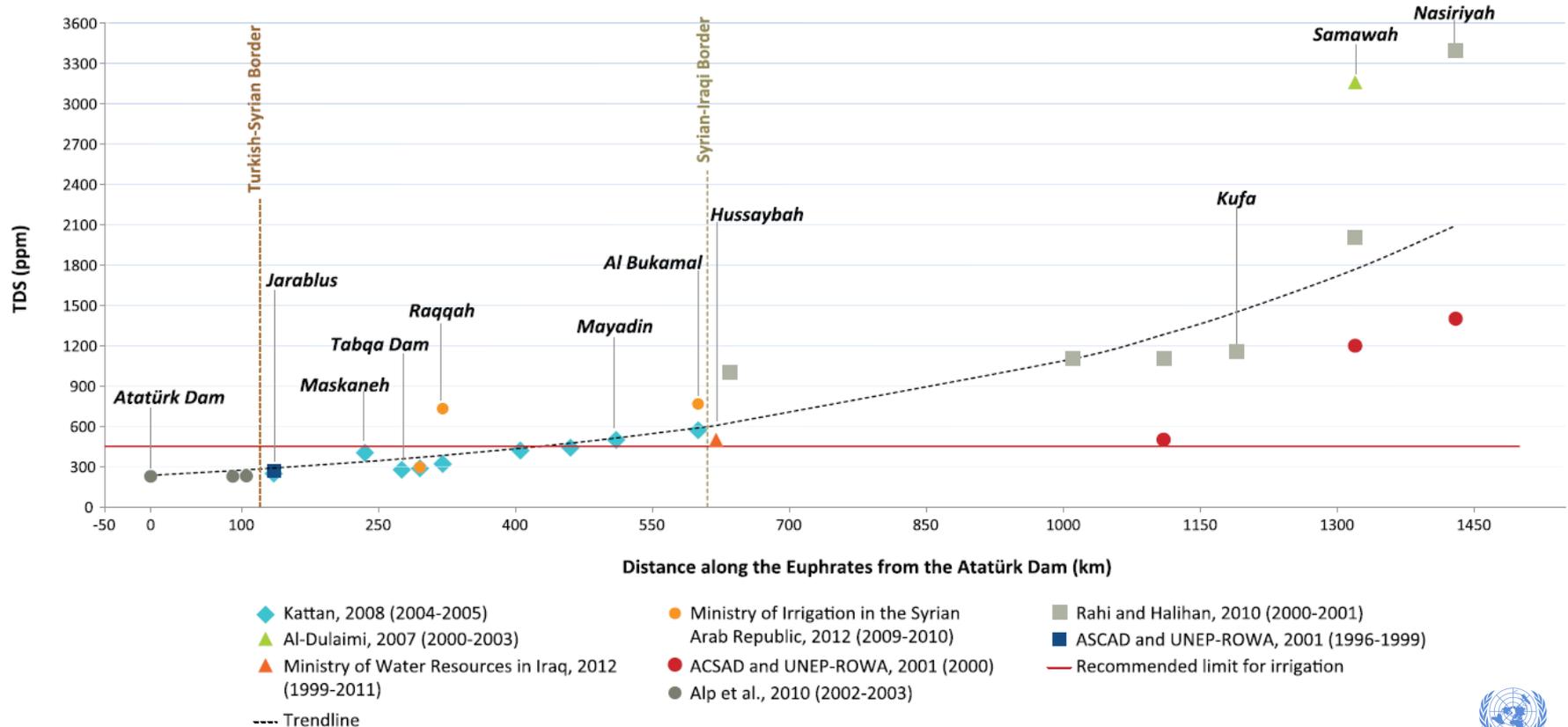
Added Value: Compilation of various data sources

Example:

Water Quality Euphrates River

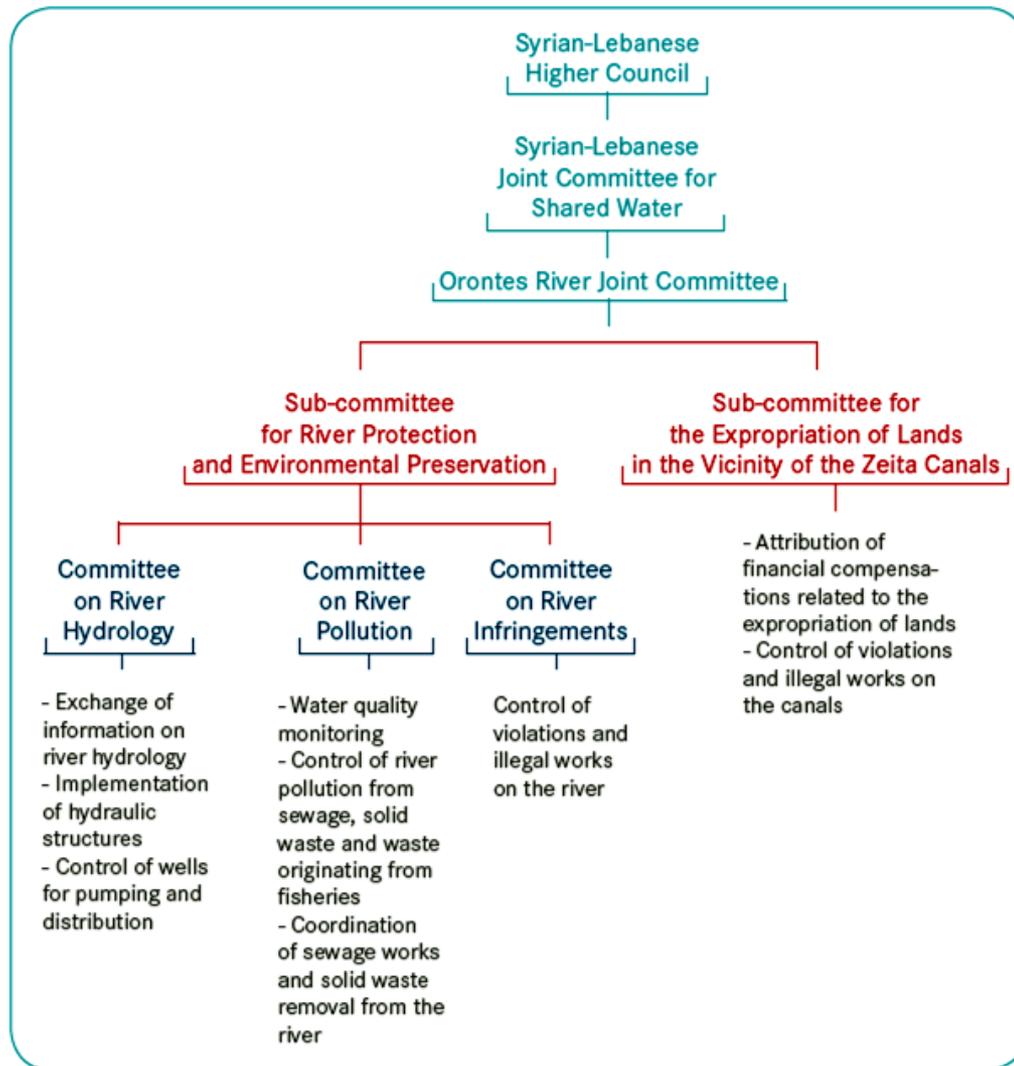
- National Data sets
- Scientific publications

Figure 9. Salinity variations along the Euphrates River since 1996





Added Value: Understanding existing cooperation



Source: Compiled by ESCWA-BGR based on data provided by Ministry of Energy and Water in Lebanon, 2011.

Example: Orontes River

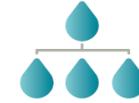
Table 8. Water agreements on the Orontes River

| YEAR | NAME | SIGNIFICANCE |
|------|---|--|
| 1939 | Final Protocol to Determine the Syria-Hatay Border Delimitation | The protocol specifies the Orontes and Afrin Rivers. Although water is to be shared, that water is to be used for irrigation. |
| 1972 | Agreement on Water Use | First bilateral agreement between Syria and Lebanon. |
| 1991 | Fraternity, Cooperation and Coordination Treaty | The treaty provides for the establishment of joint entities where necessary. A Joint Committee for Shared Water Resources was established. |
| 1994 | Agreement on the Distribution of the Orontes River Water Originating in Lebanese Territory | The agreement specifies the distribution of water resources of the Orontes River on an annual basis. Lebanon is to receive 80 MC. |
| 1997 | Annex to the Agreement on the Distribution of Orontes River Water Originating in Lebanese Territory | The annex identifies the areas to be excluded from the agreement. |
| 2001 | Amendment to the Agreement on the Distribution of Orontes River Water Originating in Lebanese Territory | This amendment clarifies the distribution of water on the river. |
| 2009 | Turkish-Syrian Strategic Cooperation Council Agreement | At the High-Level meeting, two countries agreed on cooperation with quality, the construction of infrastructure as well as the development of the meeting, Syria and Lebanon related to the cooperation. |

Source: Compiled by ESCWA-BGR based on Scheumann et al., 2011; Comair, 2009.



10 Key Findings



1. There are more shared water resources in Western Asia than generally assumed.
2. Water quantity and allocation dominate the discourse on shared water resources in this water-scarce region.
3. Water quality is rapidly deteriorating, a fact that is largely neglected.
4. The lack of accurate data hampers joint water resources management.
5. Cooperation over shared water exists, but is never basin-wide.
6. There is not a single agreement on shared groundwater resources in the region.
7. The region's groundwater is largely non-renewable and aquifers are rapidly being depleted.
8. Groundwater plays an important role in surface water basins, a link which is often overlooked.
9. A new thinking is required to deal with large regional aquifer systems from a shared perspective.
10. It is already too late to save some shared waters.

Lessons Learned

- **Consultation** – Necessary to engage Member States, identify national focal points, and ensure transparency with clear and open lines of communication.
- **Definitions** – Need to define what constitutes a basin for purpose of the review. Basins v/s sub-basins; inter-basin transfers.
- **Interconnected basins** – Need to decide how to present connected surface and groundwater basins.
- **Scale** – need to apply pre-determined criteria to determine what is included/excluded; otherwise, all basins should be presented equally, regardless of volume, area or use.
- **Coverage** – fresh and saline inland waters?
- **Maps Matter** – ensure high quality GIS work, vetting & review; schematics can cause confusion and misinterpretation.
- **Terminology** – transboundary v/s shared



Areas for Further Study & Issues for Consideration

- **Ownership** – Produce of member States? Signatories of the Water Convention? Secretariat of the Water Convention?
- **Consultation** – Need to decide if publication based on direct country input (per SDG 6.5.b questionnaires) or take a ‘no objection’ approach.
- **Cooperation** – Would 3rd Assessment Report only present cooperation initiatives that are in compliance with definition used in SDG 6.5.2 survey guidance?
- **Coverage** – better to err on more coverage than less; try to be as inclusive as possible.
- **Contradictions** – how to handle divergent data from member States? Exclude, include both sets of information, seek consensus? This presents the greatest opportunity for dialogue.
- **Conclusions** – generate key findings



Thank you!

www.waterinventory.org

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