

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





## ABOUT ESCWA

The United Nations Economic and Social Commission for Western Asia (ESCWA) is one of the five Regional Commissions of the United Nations Secretariat. It focuses on cross-sectoral approaches for achieving sustainable development and integrated natural resources management by informing regional policies, dialogue and cooperation. ESCWA comprises Arab countries in Western Asia and North Africa: Bahrain, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Palestine, Qatar, Saudi Arabia, the Sudan, the Syrian Arab Republic, Tunisia, the United Arab Emirates and Yemen.

## ABOUT BGR

Bundesanstalt für Geowissenschaften und Rohstoffe (BGR) is the German Federal Institute for Geosciences and Natural Resources. It is the central scientific authority providing advice to the Federal Government of Germany and to the private sector in all geo-related issues, such as energy and mineral resources, groundwater, soil, geo-hazards, disposal of radioactive waste, deep subsurface use and storage of CO<sub>2</sub>. BGR currently implements around 30 technical cooperation projects worldwide.

The cooperation project between ESCWA and BGR aims to enhance collaboration on shared water resources between ESCWA member countries. The project also promotes the integrated management and protection of water resources.

## ABOUT THE INVENTORY

The Inventory of Shared Water Resources in Western Asia is the first effort led by the United Nations to catalogue and characterize transboundary surface and groundwater resources in the Middle East. It is a desk study by the United Nations Economic and Social Commission for Western Asia (ESCWA) and the German Federal Institute for Geosciences and Natural Resources (BGR), which has been developed in close consultation with national, regional and international experts. Through the inter-governmental Committee on Water Resources and nominated focal points, ESCWA member countries have actively participated in the preparation of this Inventory, including the identification of shared basins, the compilation of information and the review of chapters.

The Inventory follows a standardized structure, with 9 surface water chapters and 17 groundwater chapters that systematically address hydrology, hydrogeology, water resources development and use, international water agreements and transboundary water management efforts. The chapters cover all rivers and groundwater resources shared between and by Arab countries in the Middle East. By providing an up-to-date view of the state and evolution of shared water resources in Western Asia, the Inventory makes an important contribution to the regional debate surrounding shared water resources as well as to further discussion and analysis at the basin level. It targets a wide audience of experts from water, environment and other sectors, including decision-makers, government representatives, academia, donors, specialized agencies, international and non-governmental or civil society organizations.



The Sajur River in Syria, 2009. Source: Andreas Renck.

## OVERVIEW OF SHARED WATER RESOURCES IN WESTERN ASIA

As a descriptive reference document on shared waters in the region, the main purpose of the Inventory is to provide a sound scientific basis for informing further discussion and analysis at the basin level. The main finding of this work is the identification of all the major shared surface water basins and aquifer systems in Western Asia, as listed in Tables 1 and 2.

Table 1. List of shared surface water basins in Western Asia

SHARED RIVER		COUNTRIES	MAIN SHARED TRIBUTARIES <sup>b</sup>
MESOPOTAMIA	Euphrates River	Iraq, Jordan, <sup>a</sup> Saudi Arabia, <sup>a</sup> Syria, Turkey	Sajur River Jallab/Balikh River Khabour River
	Tigris River	Iran, Iraq, Syria, Turkey	Feesh Khabour River Greater Zab River Lesser Zab River Diyala River
	Shatt al Arab River	Iran, <sup>c</sup> Iraq <sup>c</sup>	Karkheh River Karun River <sup>d</sup>
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	-

(a) Riparians that contribute surface water only under extreme climatic conditions.

(b) Not all shared tributaries listed are shared by all the displayed countries.

(c) Iran and Iraq are only riparians to the river, however all riparians to the Euphrates and Tigris Rivers are riparians to the Euphrates-Tigris-Shatt al Arab basin. See 'Overview and Methodology: Surface Water' chapter for more information.

(d) The Iranian Karun River does not cross any political boundary, but provides a significant freshwater contribution to the Shatt al Arab and forms an important part of the transboundary river system; it is thus included in the Inventory as part of the shared basin covered in the chapter related to the Shatt al Arab.

Map 1. Overview Map of shared surface water basins in Western Asia

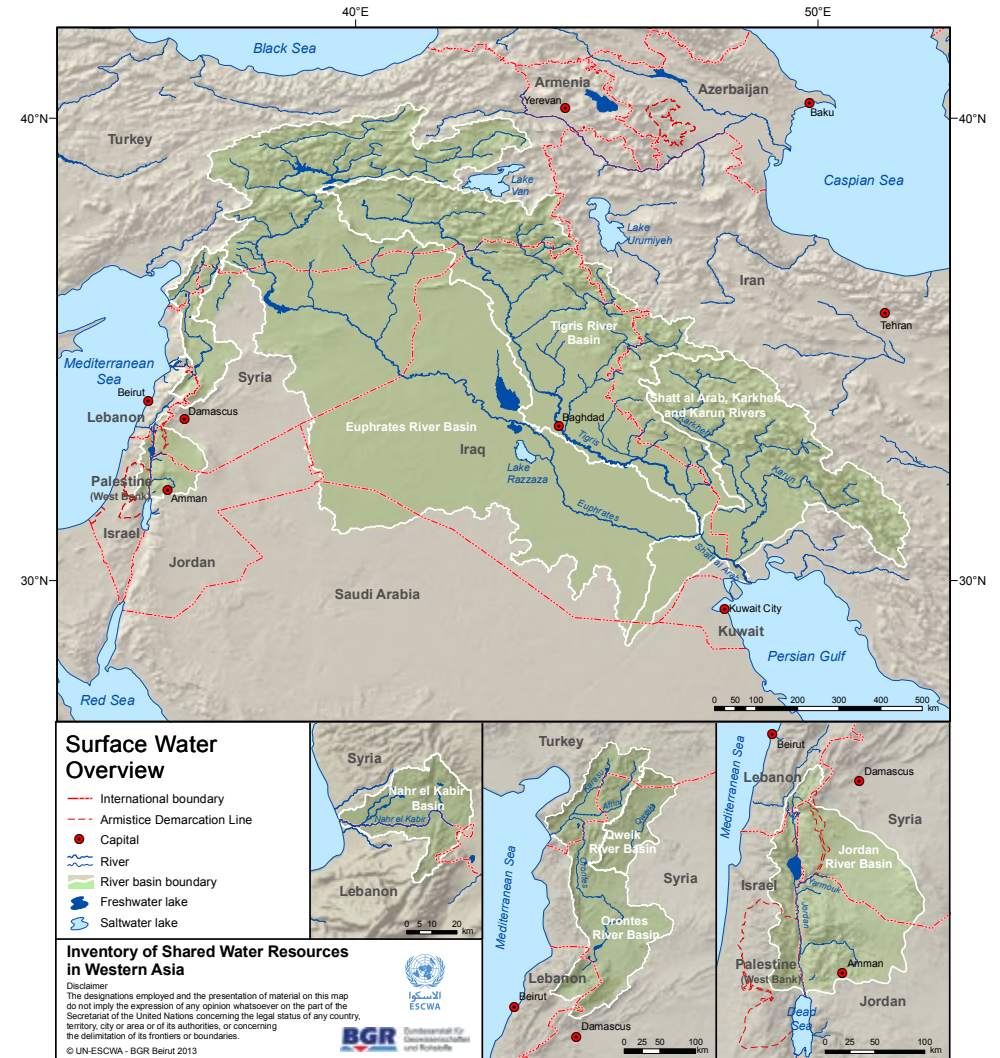


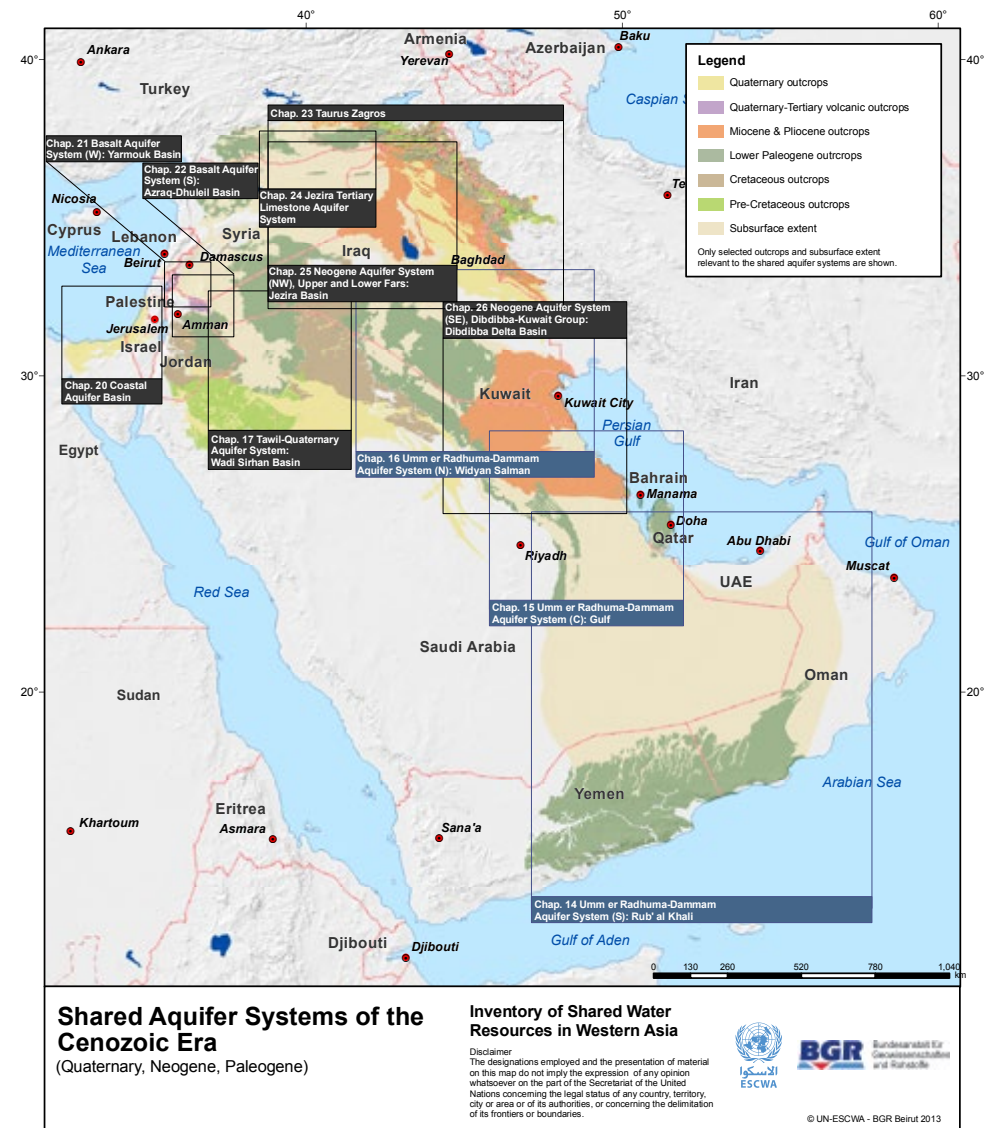


Table 2. List of shared aquifer systems in Western Asia

	SHARED AQUIFER SYSTEM	COUNTRIES
ARABIAN PENINSULA	Saq-Ram Aquifer System (West)	Jordan, Saudi Arabia
	Wajid Aquifer System	Saudi Arabia, Yemen
	Wasia-Biyadh-Aruma Aquifer System (South): Tawila-Mahra/Cretaceous Sands	Saudi Arabia, Yemen
	Wasia-Biyadh-Aruma Aquifer System (North): Sakaka-Rutba	Iraq, Saudi Arabia
	Umm er Radhuma-Dammam Aquifer System (South): Rub' al Khali	Oman, Saudi Arabia, United Arab Emirates, Yemen
	Umm er Radhuma-Dammam Aquifer System (Centre): Gulf	Bahrain, Qatar, Saudi Arabia
	Umm er Radhuma-Dammam Aquifer System (North): Widyan-Salman	Iraq, Kuwait, Saudi Arabia
	Tawil-Quaternary Aquifer System: Wadi Sirhan Basin	Jordan, Saudi Arabia
	Ga'ara Aquifer System <sup>a</sup>	Iraq, Jordan, Saudi Arabia, Syria
	Anti-Lebanon <sup>b</sup>	Lebanon, Syria
MASHREK	Western Aquifer Basin	Egypt, Israel, Palestine
	Central Hammad Basin <sup>a</sup>	Jordan, Syria
	Eastern Aquifer Basin <sup>a</sup>	Israel, Palestine
	Coastal Aquifer Basin	Egypt, Israel, Palestine
	North-Eastern Aquifer Basin <sup>a</sup>	Israel, Palestine
	Basalt Aquifer System (West): Yarmouk Basin	Jordan, Syria
	Basalt Aquifer System (South): Azraq-Dhuleil Basin	Jordan, Syria
	Western Galilee Basin <sup>a</sup>	Israel, Lebanon
	Taurus-Zagros <sup>b</sup>	Iran, Iraq, Turkey
MESOPOTAMIA	Jejira Tertiary Limestone Aquifer System	Syria, Turkey
	Neogene Aquifer System (North-West), Upper and Lower Fars: Jezira Basin	Iraq, Syria
	Neogene Aquifer System (South-East), Dibdibba-Kuwait Group: Dibdibba Delta Basin	Iraq, Kuwait, Saudi Arabia

(a) These aquifer systems are not covered in stand-alone chapters. See 'Table of Contents' and 'Overview and Methodology: Groundwater' chapter for more information.  
 (b) Aquifers in faulted and folded tectonic areas have been classified as one group. However, in practice they may represent more than one aquifer system.

Map 2. Overview Map of Cenozoic shared aquifer systems in Western Asia



Note: Only Cenozoic shared aquifer systems are displayed on this map. For Mesozoic and Paleozoic shared aquifer systems covered in the Inventory, see 'Overview and Methodology: Groundwater' chapter, Map 1.

## KEY FINDINGS

The 10 key findings below highlight important region-specific observations drawn from the Inventory. These key findings synthesize and consolidate some of the main issues regarding the identification, state, use and management of shared water resources. In doing so, they offer ideas for further research into shared water resources and provide insights into how the Inventory can inform complementary research in the other important areas such as climate change, food security, the water and energy nexus, and efforts to achieve sustainable development.

### 1. There are more shared water resources in Western Asia than generally assumed.

More than 70% of the study area is part of a shared surface or groundwater basin. A quick look at a map of the region shows that most surface water is shared and originates from outside the region. However, the Inventory also identifies a number of transboundary aquifer systems, most of which are shared between Arab countries. Many of these had not been previously delineated or recognized as shared. The groundwater reserves in these large aquifer systems far exceed the discharged volume of all rivers combined.

### 3. Water quality is rapidly deteriorating, a fact that is largely neglected.

The problem of deteriorating water quality across the region is eclipsed by concerns over quantity. However, increasing levels of pollution and salinity of both surface and groundwater resources is increasingly affecting the ability to use the scarce water resources available in the region, and is heightening tensions between riparian countries. In addition, while environmental ministries consider the need for minimal environmental flows to maintain ecosystems, this issue is rarely incorporated in national water management planning in the region.

### 2. Water quantity and allocation dominate the discourse on shared water resources in this water-scarce region.

As in other arid and semi-arid regions, water scarcity in Western Asia has led to a supply management approach that seeks to harness all available water resources and that prioritizes quantitative water allocation. Riparian countries are more intent on dividing the region's water resources than on sharing them. Both on the level of discourse and agreements, the focus lies on the quantity of available water, not on the potential benefits derived from its shared use.

### 4. The lack of accurate data hampers joint water resources management.

Water remains a sensitive topic in the Arab region and data sharing between riparian countries is limited. As a result, there is no common understanding of the state and development of water availability, use and trends. On a national level, data is often lacking, incomplete or inaccessible, particularly when it comes to water use, which is rarely measured. Regionally, data from different countries can be contradictory, often because there are no unified standards for measuring hydrological changes. The fact that cooperation between riparian countries is limited further impedes the development of a common vision on shared water resources management.

### 5. Cooperation over shared water exists, but is never basin-wide.

Long-standing political instability in the region has hampered successful basin-wide cooperation. There is not a single basin-wide agreement on shared water resources in the Middle East. Existing bilateral agreements centre on water allocation, with an emphasis on infrastructure development and use. Water quality is not addressed in these agreements. While there are no river basin associations in place, bilateral cooperation over surface water does take place through technical committees and local projects.

### 7. The region's groundwater is largely non-renewable and aquifers are rapidly being depleted.

Most aquifer systems in the Arabian Peninsula are non-renewable. Their massive development over the past 30 years has led to aquifer depletion and unprecedented hydrogeological changes, which threaten the sustainability of groundwater use. In addition, the cross-border implications of high abstraction are generally neglected. In some cases, shared aquifer systems are developed so rapidly that they may be exhausted before being recognized as a shared resource.

### 9. A new thinking is required to deal with large regional aquifer systems from a shared perspective.

Regional aquifer systems in the Arabian Peninsula are among the most extensive and productive in the world, with some stretching into eight countries. Closer cooperation over these resources will require the delineation of more manageable units where cross-border impacts can occur. This regional Inventory can stimulate this discussion among riparian countries, but cannot replace more detailed hydrogeological studies needed for this process.

### 6. There is not a single agreement on shared groundwater resources in the region.

There are no specific agreements on shared groundwater resources, though in a few cases bilateral agreements include groundwater-related provisions. Cooperation over shared groundwater is rare as resources are often not clearly delineated and may therefore not be recognized as shared by riparian countries.

### 8. Groundwater plays an important role in surface water basins, a link which is often overlooked.

The link between surface and groundwater is rarely explored. Groundwater forms the base flow of many rivers in this arid region, including the Jordan, Orontes and Nahr el Kabir. Similarly, groundwater over-abstraction has lowered water tables and led to the disappearance of freshwater springs, which has in turn affected surface water flows. Groundwater abstraction and the development of large-scale irrigation schemes also produces return flows, which contribute to the discharge of rivers. The understanding and management of shared basins may change if surface and groundwater are considered together.

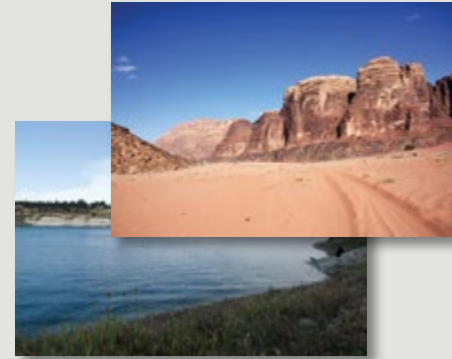
### 10. It is already too late to save some shared waters.

Man-made diversions of upstream surface waters, the over-exploitation of some groundwater resources and intensive irrigated agriculture have already led to the disappearance of intermittent streams, the drying up of wadis, and rendered some groundwater resources too polluted or saline to use. This has fuelled tensions along international borders, affected health and livelihoods in rural communities, and increased costs to industry. More cooperative action and constructive dialogue is needed to sustain the shared water resources that remain.

## FEATURES



- ◆ 9 chapters on shared surface water basins and 17 chapters on shared aquifer systems follow a standardized structure and methodology.
- ◆ More than 600 pages of detailed information with 60 new maps and around 200 figures, tables and boxes.



- ◆ Compiles information from a variety of sources and sectors.
- ◆ Comprehensive and inclusive on the regional scale; specific and detailed regarding local issues in shared sub-basins of large transboundary rivers.
- ◆ Rich in visuals, with photos from remote areas of the region.

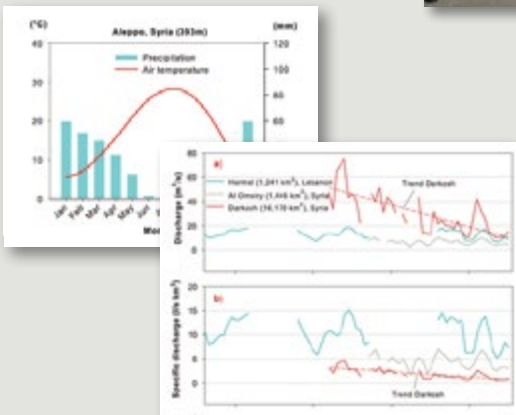
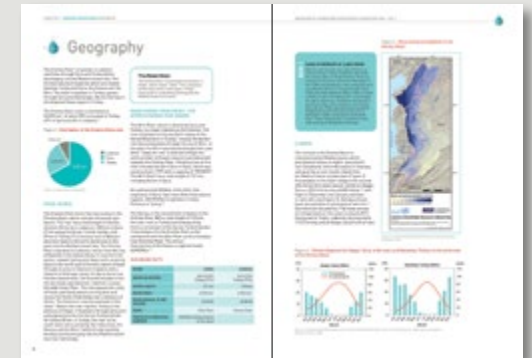
- ◆ Developed in close consultation with ministries of water in ESCWA member countries as well as international and regional experts, thereby transcending traditional approaches to report preparation and desk studies.
- ◆ Descriptive and impartial; the outcome of a scientific process.



Table 1. Main characteristics and general data in the Euphrates Basin

Parameter	Value	Unit	Comments
Basin Area	1,000,000	km <sup>2</sup>	
Population	150,000,000		
Water Resources	100,000	km <sup>3</sup>	
Water Demand	150,000	km <sup>3</sup>	

- ◆ Includes in-depth sections on water quality, emphasizing the need for integrated water resources assessment.
- ◆ Breaks new ground in identifying, delineating and describing shared aquifer systems.



- ◆ Provides an up-to-date view of the state and evolution of shared water resources with recent and comprehensive data series and solid trend analysis.



- ◆ A user-friendly icon and colour-coding scheme guides readers through each chapter.
- ◆ Comprehensive bibliographies for each chapter provide an entry point for further reading on shared river basins and aquifer systems.

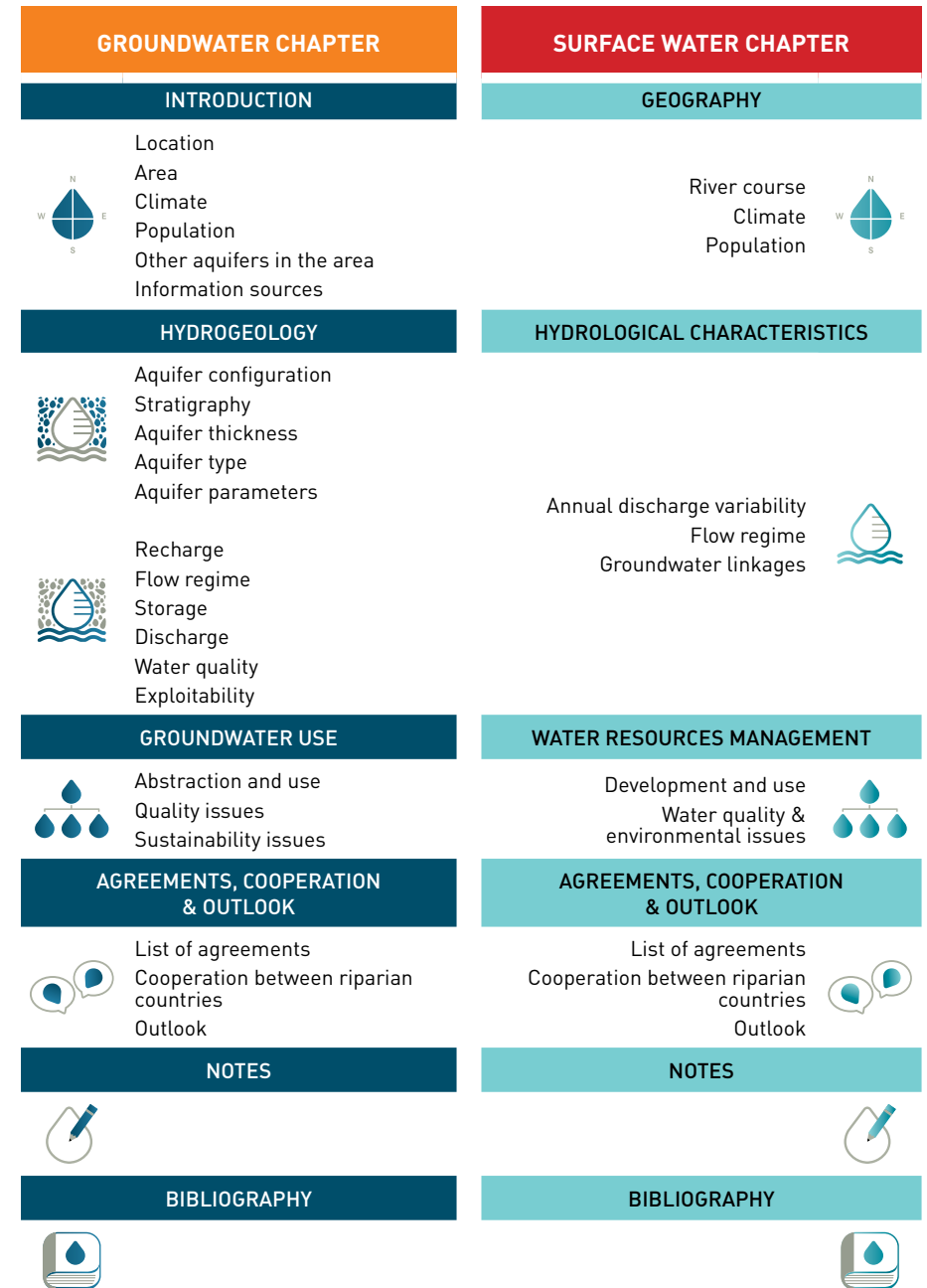
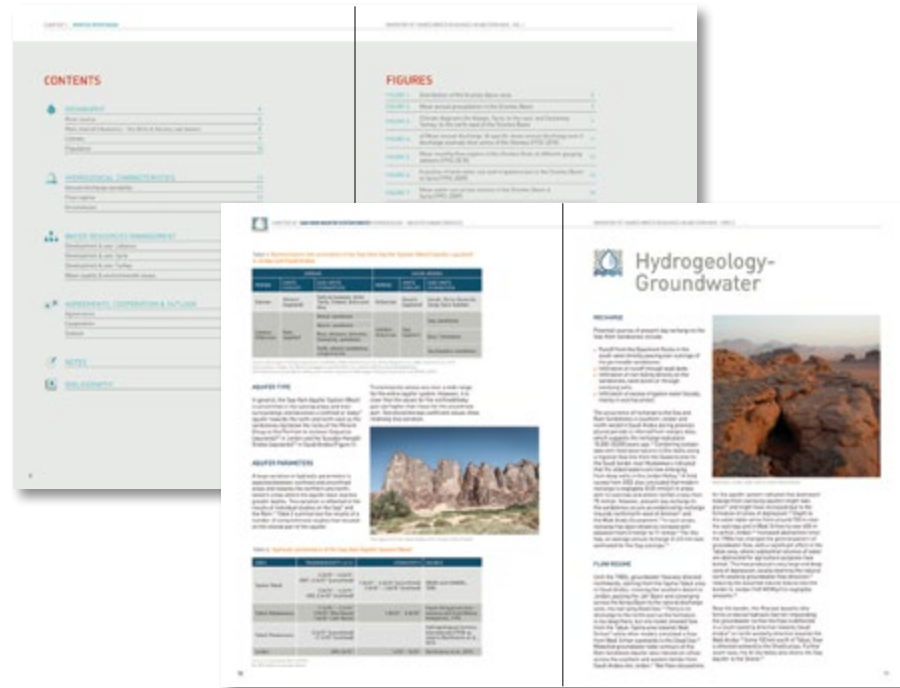


## WHAT DOES A BASIN CHAPTER LOOK LIKE?

Each basin chapter follows a set structure, which introduces the basin through a list of facts and figures, a summary of key basin features and an overview map. Information presented in the main text is clearly organized, with chapters varying in length depending on the significance of the resource and availability of information. Each basin chapter concludes with a bibliography.

Many sections, especially 'Geography/Introduction', 'Water Resources Management', and 'Agreements, Cooperation & Outlook' are written in a non-technical style that is accessible to a wide audience of interested readers. The Hydrology/Hydrogeology sub-sections contain more complex scientific information, that target a specialized audience of academics and technical experts.

A helpful series of icons allows readers to navigate between the different sections and identify passages of interest.





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The Inventory of Shared Water Resources in Western Asia is the first UN-led effort to comprehensively assess the state of transboundary surface and groundwater resources in the Middle East. The United Nations Economic and Social Commission for Western Asia (ESCWA) and the German Federal Institute for Geosciences and Natural Resources (BGR) developed the Inventory as a desk study, while working in close consultation with ESCWA member countries, as well as regional and international experts.



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